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RECOVERY PLAN

Volume II: Results & Recovery Actions

for the Evolutionarily Significant Unit

of Central California Coast Coho Salmon

Photo courtesy: Morgan Bond, SWFSC

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LITERATURE CITATION SHOULD READ AS FOLLOWS:

National Marine Fisheries Service. 2012. Final Recovery Plan for Central California Coast coho salmon (*Oncorhynchus kisutch*) Evolutionarily Significant Unit. National Marine Fisheries Service, Southwest Region, Santa Rosa, California.

ADDITIONAL COPIES MAY BE OBTAINED FROM:

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http://www.nmfs.noaa.gov/pr/recovery/plans.htm

First page photo courtesy of CCC coho salmon juvenile, Scott Creek, Santa Cruz County, Morgan Bond, Southwest Fisheries Science Center.

ESU, DIVERSITY STRATA AND POPULATION LEVEL RECOVERY ACTIONS

Many factors have resulted in the degradation of streams, declines in populations and diminishment of the historical distribution of coho salmon across the Central California Coast (CCC) Evolutionarily Significant Unit (ESU). These factors have been systemic and persistent involving both environmental and political issues; they are outlined in Federal Register Notices, the Recovery Strategy for California Coho Salmon (CDFG 2004), and this Recovery Plan (Volume I). To effectively address these factors recovery actions must promote: (1) effective implementation and enforcement of current laws, policies and regulations or development of new policies and regulations; (2) adequate funding for recovery implementation; (3) development of strategic partnerships; (4) prioritization and implementation of recovery actions; and (5) education and outreach.

In 1988, Congress amended the Endangered Species Act (ESA) (S. Rep. No. 240, 100th Cong., 2d. Sess. 111-32 (1988) adding that: "*Section 4(f) of the Act is amended to require that each recovery plan incorporate descriptions of site-specific management actions to achieve recovery, criteria by which to judge success of the plan, and time frames and estimates of cost to carry out the planned recovery…(i)ncorporation of this information will ensure that plans are explicit as possible in describing the steps to be taken in the recovery of a species…and provide a means by which to judge the progress being made toward recovery.*" Case law has affirmed that an increase in population numbers is insufficient to delist a species. Recovery plans are required to ensure threats to the species' persistence and well-being are sufficiently controlled such that the species no longer requires the protections of the ESA.

For CCC coho salmon, achieving recovery depends on two things: individuals must survive across their life stages and populations must persist across a large geographic area over a long

time frame. Recovery actions attempt to provide the site-specificity needed for life stage survival while also addressing landscape level impacts. They are organized in two ways: (1) hierarchically into ESU, diversity strata and population levels and (2) assigned to one of the five statutory Section 4(a)(1) listing factors. Site specific recovery actions discussed in this plan apply to the 28 focus populations. General recovery actions apply to the 11 supplemental populations. NMFS reviewed a wide range of resources to develop and prioritize recovery actions including the Recovery Strategy for California Coho Salmon (CDFG 2004), state and local watershed assessment reports, total maximum daily loads (TMDLS) plans, environmental impact reports (EIRs), strategic management plans from cities and counties, coordination with other divisions of NOAA, outreach to knowledgeable constituents, staff expertise, and many other sources.

CCC coho salmon cannot wait for habitats to improve naturally and their populations to rebound. Immediate and focused action is needed to improve the probability of survival of each individual across life stages for all remaining populations. Preventing extinction will require expanding broodstock programs, monitoring and conducting instream restoration that can quickly improve their likelihood of survival (*e.g.*, inputting wood structures to improve habitat complexity and capacity). Furthermore, extinction prevention and recovery efforts must occur in each of the four diversity stratum. Progress of actions for each strata will be evaluated. If recovery actions are implemented disproportionately, the result will undermine overall ESU viability.

Volume II provides ESU and Diversity Strata recovery actions along with the population CAP results and site specific actions, which are organized alphabetically. The information on each population includes: (1) a summary of current conditions and threats; (2) maps delineating Core, Phase I, and Phase II Areas; (3) Conservation Action Planning (CAP) analysis result tables for Viability and Threats analyses; (4) recovery actions to improve current conditions and abate threats to the species; and (5) associated information for site specific actions (*e.g.*, priority, duration, cost, recovery partners, *etc*.).

Central CA Coast Coho Salmon ~ ESU Level

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

1.1. **Objective:** Address the present of threatened destruction, modification or curtailment of habitat or range

1.1.1. **Recovery Action:** Increase quality and extent of estuarine habitat

1.1.1.1. **Action Step:** Work with landowners/stakeholders to remove dikes and levees limiting the current extent of estuary systems.

1.1.1.2. **Action Step:** Work with landowners/stakeholders to preserve or restore primary processes in support of a properly functioning estuary/lagoon ecosystem.

1.1.1.3. **Action Step:** Prevent development of surface water diversions that, independently or cumulatively, will reduce inflow or impair estuarine water quality conditions during spring/summer/fall months.

1.1.1.4. **Action Step:** Prevent future alterations (e.g., jetties, tide gates, roads, bridge abutments, dredging, artificial breaching, etc.) to river mouth, inner estuary or lagoon dynamics that change estuary opening patterns.

1.1.1.5. **Action Step:** For restoration/rehabilitation estuary projects, identify physical (hydrology, water quality, substrate, tidal circulation, freshwater input, inundation period, habitat complexity, etc.) and functional (productivity/growth, staging, migration, refuge, etc.) attributes needed for coho salmon.

1.1.1.6. **Action Step:** Promote the historical seasonal formation and timing of estuary/lagoon barrier beach through removal of problematic infrastructure and fill materials.

1.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

1.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.2.1. **Recovery Action:** Increase quality and extent of estuarine habitat

1.2.1.1. **Action Step:** Develop and implement Estuary Inflow Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.

1.2.1.2. **Action Step:** Work with local county/city and state organizations to develop alternative methods of flood control to reduce artificial breaching frequency.

1.2.1.3. **Action Step:** Implement patrols by citizens groups, city employees, and law enforcement to ensure seasonal sandbars are not illegally breached.

1.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

2.1.1. **Recovery Action:** Improve floodplain connectivity with the main channel

2.1.1.1. **Action Step:** Undeveloped and active floodplains should be protected from channelization, development, forest conversion, and other disturbances.

2.1.1.2. **Action Step:** Protect and promote restoration or enhancement projects in critical over-wintering habitats (e.g., floodplains, alcoves, backchannels, off channel areas, estuaries and lagoons).

2.1.1.3. **Action Step:** Evaluate opportunities and implement restoration actions to re-establish main channel function (e.g., meandering, substrate deposition, seasonal patterns of overbank flows) and its connection with historical floodplains and off-channel habitats.

2.1.1.4. **Action Step:** Evaluate opportunities for planned retreat of urban development or other incompatible land uses from floodplains (similar to the City of Napa, Napa County, CA) and alluvial valley streams to recreate natural floodplain processes and complex off-channel habitat.

2.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

2.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.2.1. **Recovery Action:** Improve floodplain connectivity with the main channel

2.2.1.1. **Action Step:** Prevent impacts from new development through enforcing land use zoning appropriate to the site to protect floodplain and riparian processes.

2.2.1.2. **Action Step:** County zoning should consider the 20-year and 100-year floodprone areas and design protective ordinances and compatible land use designations in these locations.

2.2.1.3. **Action Step:** Undeveloped and active floodplains should be protected from channelization, development, forest conversion, and other disturbances by

conservation easements, county zoning, grading ordinances and other mechanisms.

2.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

3.1.1. **Recovery Action:** Improve habitat complexity

3.1.1.1. **Action Step:** Conduct outreach to potential applicants of FRGP to develop projects addressing high-priority areas and issues identified in the recovery plan for all four diversity strata.

3.1.1.2. **Action Step:** Restoration actions should focus on increasing freshwater survival probability of coho salmon in Core areas in the next four years (e.g., input wood structures) and improving nearby expansion habitats (e.g. Phase I), followed by habitat improvements to Phase II areas thereafter.

3.1.1.3. **Action Step:** Identify historical CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first, followed by Phase I and Phase II areas.

3.1.1.4. **Action Step:** In stream reaches where large wood is lacking, encourage landowners to implement wood and riparian restoration as part of their ongoing operations.

3.1.1.5. **Action Step:** Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.1.6. **Action Step:** Habitat restoration and enhancement activities should emphasize rehabilitation of ecological processes and functions, not artificial creation of habitat. Placement of permanent of semi-permanent habitat structures in streams should be discouraged unless it can be clearly demonstrated no other reasonable alternative is available. Existing artificial structures that impede the trajectory of watershed recovery towards properly functioning conditions should be removed or remediated.

3.1.1.7. **Action Step:** Utilize non-lethal methods to manage beaver depredation issues (e.g. flooding, crop damage) within the range of CCC salmonids such as flow devices, fencing, and beaver re-location and enhance habitat complexity.

3.1.1.8. **Action Step:** Where non-lethal methods prove unfeasible to resolve depredation issues, relocate beaver populations to remote CCC coho streams where habitat enhancement is needed and resource conflict is low.

3.1.1.9. **Action Step:** Restoration projects that introduce woody debris into any of the 28 focus, or 11 supplemental, populations should be considered an extremely high priority.

3.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

3.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

3.2.1. **Recovery Action:** Improve watershed conditions

3.2.1.1. **Action Step:** The continuation of FRGP and PCSRF contributions is a very high priority.

3.2.1.2. **Action Step:** Immediately initiate with Federal and State agencies creation of a programmatic permit for restoration work not funded by FRGP. The objectives of the programmatic should be to reduce costs and fast-track the implementation of high priority recovery actions.

3.2.1.3. **Action Step:** Work with California BOF, CDFG, RWQCB and others to modify the timber harvest permitting process (including CDFG Lake and Streambed Alteration Agreement process) and provide opportunities and incentives for the implementation of LWD placement and other restoration priorities during timber harvest operations.

3.2.1.4. **Action Step:** Develop and update a Beaver Management Plan for California to benefit salmonids.

3.2.1.5. **Action Step:** Work with CDFG and the CDFG Commission to reclassify beavers from a "non-native nuisance" animal within the CDFG code and literature to a "native non-nuisance" animal.

3.2.1.6. **Action Step:** Work with CDFG and the CDFG Commission to modify Title 14 of the California code of Regulations to prohibit recreational hunting/trapping of beavers within all counties within the NCCC Recovery Domain.

3.2.1.7. **Action Step:** Work with CDFG and the CDFG Commission to remove beavers from CDFG's list of depredated animals, and/or authorize only non-lethal management and relocation methods within the NCCC Recovery Domain.

3.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

4.1.1. **Recovery Action:** Improve flow conditions throughout the watershed

4.1.1.1. **Action Step:** Expand number of stream flow gauging stations for priority watersheds within the CCC coho salmon ESU and improve the network of those gauges by coordinating monitoring activities with the SWRCB, landowners, and other partnerships with ongoing monitoring programs. Work with other entities to develop a long-term source of funding that provides for monitoring, equipment, personnel, databases, analyses to develop bypass flows, public interface, and other necessities for stream flow information.

4.1.1.2. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match to the greatest extent possible the natural hydrologic pattern for the region in both quantity and quality. Effects of consumptive water uses on both the timing and quantity of flow should be minimized. Water-management technologies promoting restoration of natural runoff patterns and water quality should be encouraged.

4.1.1.3. **Action Step:** Work with the RWQCBs to encourage landowners to increase groundwater recharge, permeable surfaces, and percolation through swales and recharge basins in an effort to reduce the flashiness of hydrographs and increase summer baseflow.

4.1.1.4. **Action Step:** Water conservation projects should be instituted that shift reliance from on-stream storage to offstream storage, resolve frost protection issues, and ensure necessary flows for all freshwater lifestages in all water years.

4.1.1.5. **Action Step:** Prioritize projects to support and expand existing efforts to increase off-stream storage capacity (e.g., ponds) as a method to offset summer diversions.

4.1.1.6. **Action Step:** Evaluate geological patterns in the ESU to identify areas with karst formations or similar geology. These sites may provide sources of cool water and serve as locations to buffer populations against climate change and on-going water diversions.

4.1.1.7. **Action Step:** Work with the agricultural community to develop water conservation strategies protective of all freshwater life stages.

4.1.1.8. **Action Step:** Develop incentives for instream water right dedications. Support financing and expedited permitting for water users willing to shift the timing

and manner of diversion from less protective practices (e.g., direct diversion during low-flow periods) to more protective practices (e.g., properly conditioned diversions to off-stream storage during the rainy season, etc.).

4.1.1.9. **Action Step:** Work with rural residential communities to develop water conservation strategies protective of salmonids while allowing for domestic water use.

4.1.1.10. **Action Step:** Work to ensure that road drainages are disconnected from the stream network to dampen the effects of discharge peaks during intense rain events.

4.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

4.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.2.1. **Recovery Action:** Improve flow conditions throughout the watershed

4.2.1.1. **Action Step:** Participate in water use planning with local, county, and State agencies with direct control and responsibilities over non-Federal practices.

4.2.1.2. **Action Step:** Encourage local governments to condition new development to reduce or eliminate human water demand (e.g., new homes should have drought-tolerant landscaping, rainwater catchment systems, and permeable surfaces; new vineyards should demonstrate that their water supply development would have no adverse impacts of fisheries resources).

4.2.1.3. **Action Step:** Protect spring and large groundwater seeps from development and water removal; subterranean water sources will be increasingly important when surface flows are altered by climate change.

4.2.1.4. **Action Step:** Collaborate and support the SWRCB and local agencies to increase oversight and responsibility for regulating groundwater extraction from aquifers hydrologically connected to surface flows.

4.2.1.5. **Action Step:** Encourage local governments to integrate meaningful groundwater regulation for land use planning and to increase coordination with State agencies to ensure applicants secure necessary State permits (e.g., water rights) as part of local permitting processes.

4.2.1.6. **Action Step:** Improve coordination between the agencies, particularly the SWRCB, to effectively identify and address illegal water diverters and out-of-compliance diverters, seasons of diversion, off-stream reservoirs, and bypass flows fully protective of CCC coho salmon.

4.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

5.1.1. **Recovery Action:** Reduce adverse impact to landscape patterns

5.1.1.1. **Action Step:** Aggressively promote implementation of restoration projects that can serve immediate or near-term benefits to the freshwater survival of current CCC coho salmon populations. Develop a programmatic and seek efficiencies and pathways to reduce burdens on project applicants proposing such projects.

5.1.1.2. **Action Step:** Restoration actions should be considered in context to overall recovery priorities for the watershed and be coordinated across a watershed and coho salmon life stages.

5.1.1.3. **Action Step:** Promote programs that purchase land or develop conservation easements encouraging the protection, re-establishment and/or enhancement of natural riparian communities.

5.1.1.4. **Action Step:** The continuation of groups such as FishNet4C and the 5 Counties Salmon Protection Conservation Program that educate, coordinate and facilitate priority restoration by the counties are a high priority.

5.1.1.5. **Action Step:** Residential landowners should utilize the Stewardship Guide for the Russian River (Sotoyome Resource Conservation District, 2011), and Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California (MRCD, 2007), and Management Tips to Enhance Land & Water Quality for Small Acreage Properties (Sotoyome Resource Conservation District, 2007).

5.1.1.6. **Action Step:** Where local watershed restoration coalitions and coordinators exist, NMFS will work to coordinate coho recovery efforts. Where such groups do not exist, NMFS will work with CDFG to facilitate the creation of watershed restoration coalitions.

5.1.1.7. **Action Step:** Establish recovery plan implementation groups across each Recovery Unit (e.g., diversity strata) and secure funding (e.g., Pacific Coast Salmon Restoration Fund) for four designated representatives to act as liaisons and coordinators for each implementation group. Liaisons should work with grassroots watershed groups to implement recovery efforts.

5.1.1.8. **Action Step:** Conduct extensive outreach to improve education and awareness for agencies, professional organizations, landowners, and the public regarding the importance for adopting measures to minimize the likelihood of harm from their actions to listed coho salmon.

5.1.1.9. **Action Step:** Coordinate with NRCS, RCDs, and watershed groups to provide information to legal cannabis producers regarding water conservation, beneficial rural road maintenance practices and proper use and disposal of toxic materials.

5.1.1.10. **Action Step:** Conduct an outreach campaign to educate the public on the status of CCC coho salmon and associated laws, policies, ordinances, etc. related to water and uses.

5.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

5.1.2.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), and Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources.

5.1.3. **Recovery Action:** Increase density, abundance, spatial structure and diversity

5.1.3.1. **Action Step:** All work adjacent to, or within, waterways occupied by coho salmon should be conducted during the summer low flow period (June 15th - October 15th).

5.1.3.2. **Action Step:** Prioritize ESA section 7 consultations including important recovery actions, and include recovery actions in section 7 Reasonable and Prudent Alternatives and Conservation Recommendations.

5.1.4. **Recovery Action:** NMFS staff will facilitate discussions with the outlined entities on those items found inadequate for Listing Factor A as outlined in the Federal Register Notice Chapter in Volume I

5.1.5. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

5.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.2.1. **Recovery Action:** Reduce adverse impacts to landscape patterns

5.2.1.1. **Action Step:** Provide information to the appropriate regulatory bodies regarding the current status of CCC coho salmon, priority watershed processes needing consideration, and recommendations that provide no take or incidental take assurances. Encourage increased regulatory oversight for actions impairing salmonid habitat or result in direct harm to coho salmon.

5.2.1.2. **Action Step:** Use Mitigation and Conservation Banking as a means for public participation in CCC coho salmon recovery and remove barriers to development and implementation. Banks offer large scale and long-term restoration opportunities and monitoring tailored to site specific needs. Over

85% of the CCC coho salmon range is privately owned and without public/private partnerships recovery will not be possible.

5.2.1.3. **Action Step:** Work with Federal and State agencies to streamline and prioritize permitting for a core set of conservation actions contributing to the recovery of salmonids and their habitats. Coordinate on development of comprehensive programmatic permits for such actions, particularly streamlined permitting for non-FRGP funded restoration projects.

5.2.1.4. **Action Step:** Encourage appropriate agencies to minimize use of exemptions and engage in full enforcement of relevant laws, codes, regulations and ordinances protective of CCC coho salmon and their habitats.

5.2.1.5. **Action Step:** Evaluate possible funding assistance or waivers where counties are deemed economically disadvantaged and restoration work is a high priority (Priority 1) as outlined in the recovery plan.

5.2.1.6. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

5.2.1.7. **Action Step:** Participate in land and water use planning with local, county, and State agencies that have direct control and responsibilities over non-Federal practices.

5.2.1.8. **Action Step:** Work with law enforcement agencies to abate illegal cannabis operations. Stream reaches with high quality salmonid habitat that may be affected by cannabis operations should be prioritized for abatement actions.

5.2.1.9. **Action Step:** Fully implement the Programmatic Section 7 consultation for restoration projects administered by the NOAA Restoration Center that permits placement of instream woody debris and other work.

5.2.1.10. **Action Step:** Consider developing No-Take guidance to assist NMFS staff and stakeholders in avoiding and minimizing potential take or harm to CCC coho salmon or their habitats when evaluating or planning land use practices (e.g., livestock grazing, agriculture, road construction and maintenance, channel modification, etc.).

5.2.1.11. **Action Step:** Create a forum that coordinates agencies with enforcement capabilities (e.g., CalFire, SWRB, RWQCB, counties).

5.2.1.12. **Action Step:** Encourage counties to better integrate water and land use planning efforts, and ensure their permitting staff and applicants are informed about required water and endangered species permits (and encourage applicants to consult with SWRCB and/or CDFG about water rights and

Streambed Alteration Agreement requirements prior to issuance of local permits).

5.2.2. **Recovery Action:** NMFS staff will facilitate discussions with the outlined entities on those items found inadequate for Listing Factor D as outlined in the Federal Register Notice Chapter in Volume I

5.2.3. **Recovery Action:** NMFS will initiate actions outlined in the Implementation Chapter of Volume I

5.2.4. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

6.1.1. **Recovery Action:** Improve passage conditions across the ESU

6.1.1.1. **Action Step:** Creating safe passage to and from the ocean for all life freshwater life stages of CCC coho salmon is a high priority.

6.1.1.2. **Action Step:** Identify and address high priority road related barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

6.1.1.3. **Action Step:** All new crossings and upgrades to existing crossings (bridge, culverts, fills, and other crossings) must accommodate 100-year flood flows and associated bedload and debris.

6.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

6.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

6.2.1. **Recovery Action:** Prevent impairment to passage

6.2.1.1. **Action Step:** Monitor and maintain the Coastal Conservancy database of barriers to fish passage (CDFG 2004).

6.2.1.2. **Action Step:** Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and review appropriate barrier databases when developing new or retrofitting existing road crossings.

6.2.1.3. **Action Step:** Consider statutory changes to prevent certain projects through the LSAA agreement process.

6.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

7. Restoration- Pool Habitat

7.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

7.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

8.1.1. **Recovery Action:** Improve riparian condition

8.1.1.1. **Action Step:** Promote growth of larger diameter trees and adequately sized buffers across the range of CCC coho salmon.

8.1.1.2. **Action Step:** Protect and manage existing riparian areas for site potential composition and structure such that trees are allowed to mature, provide canopy, die and recruit to streams naturally.

8.1.1.3. **Action Step:** A comprehensive evaluation and monitoring program should be implemented to determine areas where poor canopy conditions are producing water temperatures limiting salmonid survival.

8.1.1.4. **Action Step:** Forestry, agricultural, and grazing practices should allow riparian zones to maintain a full range of natural vegetative characteristics, i.e., characteristics occurring in watersheds with natural disturbance regimes. Riparian zones should ideally be wide enough to fulfill all functions necessary for maintaining aquatic productivity.

8.1.1.5. **Action Step:** Upstream cool water sources should be protected from riparian disturbance to buffer stream temperatures over the long term.

8.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

8.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

8.2.1. **Recovery Action:** Improve riparian condition

8.2.1.1. **Action Step:** Develop adequately sized riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do.

8.2.1.2. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Work cooperatively with land trusts, etc.

8.2.1.3. **Action Step:** Counties should develop a riparian strategy to grow older larger diameter trees for improved canopy and appropriate natural recruitment to the stream.

8.2.1.4. **Action Step:** Enforce requirements of local regulations and riparian/setbacks.

8.2.1.5. **Action Step:** Discourage encroachment into riparian zones from road widening projects, residential and commercial development, or other infrastructure expansion.

8.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Sediment from all land uses should be reduced to magnitudes appropriate to the geologic setting of the watershed.

9.1.1.2. **Action Step:** Restoration work should consider re-establishment of natural instream sediment processes (e.g., sorting and distribution) through wood placement, bank protections, tree plantings, etc.

9.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

9.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

9.2.1. **Recovery Action:** Improve instream gravel quality

9.2.1.1. **Action Step:** Fund and implement sediment TMDL recommendations within the CCC ESU.

9.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

9.3. **Objective:** See also recommendations under Threat - Roads/Railroads

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

10.1.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.1.1.1. **Action Step:** To prevent extinction of CCC coho salmon, all mechanisms and opportunities to improve survival probability of the 28 focus populations should be considered and implemented (e.g., intervention, broodstock

development, outplanting opportunities, research on coho salmon response to restoration, etc.).

10.1.1.2. **Action Step:** Conduct outreach to key entities and prioritize restoration funds, that increase viability and probability of freshwater survival in Core areas, or areas meeting the definition of Core (e.g. occupied) first. High profile projects that increase public awareness should be strongly encouraged.

10.1.1.3. **Action Step:** Conduct watershed and ESU level monitoring and develop a centralized database and analysis process that can provide information on population and habitat trends overtime.

10.1.1.4. **Action Step:** Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods.

10.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

10.2. **Objective:** Address the overutilization for commercial, recreational, scientific or educational purposes

10.2.1. **Recovery Action:** NMFS staff will facilitate discussions with the outlined entities on those items found inadequate for Listing Factor B as outlined in the Federal Register Notice Chapter in Volume I

10.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

10.3. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.3.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.3.1.1. **Action Step:** Coordinate with the U.S. Department of Justice and the District Attorney's environmental prosecutors in all counties across the ESU to outline the dire status of CCC coho salmon and discuss coordination on potential enforcement actions (NOAA's Office of Law Enforcement can refer cases to District Attorneys on behalf of CDFG for 1600 and 5650 violations).

10.3.1.2. **Action Step:** Initiate a comprehensive effort to educate CDFG Wardens and NOAA OLE Special Agents on; (1) the status of CCC coho salmon, (2) important habitat requirements, (3) key issues limiting their survival, and (4) potential vulnerability to various human-caused activities (particularly water diversion related impacts). Education efforts should be initiated immediately and consist of a series of yearly one-day workshops, at a minimum, for the next three years for all enforcement staff. One module of the workshop would consist of a primer on water law.

10.3.1.3. **Action Step:** Collaborate with CDFG and others to finalize and implement the Statewide Coastal Monitoring Plan. The plan is essential to informing recovery criteria and factors limiting CCC coho salmon survival and abundance.

10.3.1.4. **Action Step:** NMFS should provide information to the appropriate regulatory bodies regarding the current status of CCC coho salmon, priority watershed processes needing consideration, and recommendations that provide no take or incidental take assurances.

10.3.1.5. **Action Step:** Consider establishing a multiagency task force to address high priority issues limiting coho salmon fishery in focus watersheds.

10.3.1.6. **Action Step:** Conduct population research and monitoring focusing on life stage survival (e.g., life cycle stations) within each diversity stratum including survival and fitness in wetland, estuaries and lagoons.

10.3.1.7. **Action Step:** Implement monitoring programs to assess spawner abundance and population viability and key habitat attributes. These programs will require consistent methods, reporting, databasing and adaptive management across the ESU to evaluate population and habitat responses to recovery actions. Long-term funding, for the continuation of current programs and their expansion, should be secured.

10.3.1.8. **Action Step:** Evaluate the efficacy and potential benefits of legislative creation of salmon refuges across the ESU. This legislation could be similar to the protections afforded to fish in Scott Creek by the California Legislature from 1915 until 1943. Some public lands are currently protected as wildlife refuges by local, State, or Federal entities. Potential watersheds include, but are not limited to, Waddell Creek, lower Scott Creek, San Vicente Creek, lower Big River, Garcia River, Usal Creek and Caspar Creek.

10.3.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

10.4. **Objective:** Address other natural or manmade factors affecting the species' continued existence

10.4.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.4.1.1. **Action Step:** Establish mechanisms to maintain existing genetic diversity through intervention and augmentation. This may include (1) juvenile capture from the wild and rearing in an established conservation hatchery for release as adults and (2) developing comprehensive broodstock programs similar to the Russian River Coho Salmon Captive Broodstock program.

10.4.1.2. **Action Step:** Evaluate expansion of the Warm Springs Hatchery broodstock program to include coho from other strata in the CCC ESU. Expansion of this

facility may be the most feasible and expeditious alternative for to conserve ESU broodstock.

10.4.1.3. **Action Step:** Utilize population models, recovery plan information and genetic information for each watershed and associated diversity strata to identify minimum redd or adult counts that would trigger augmentation or intervention for CCC coho salmon.

10.4.1.4. **Action Step:** Perform a feasibility study for new coho recovery conservation hatcheries.

10.4.1.5. **Action Step:** Provide logistical and financial support to ensure maximum productivity and effectiveness of current captive broodstock programs to include program improvement and expansion.

10.4.1.6. **Action Step:** Re-assess marking protocol of broodstock versus hatchery fish to minimize possible misidentification by recreational fishermen.

10.4.1.7. **Action Step:** Habitat protection, restoration, research and development of Conservation Banks and other private/public partnerships should work in concert with broodstock outplanting efforts and planning.

10.4.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

11.1.1. **Recovery Action:** Prevent impairment to water quality

11.1.1.1. **Action Step:** Conduct outreach to increase awareness of the effects of pesticides and contaminants that impact the continued existence and habitat of CCC coho salmon.

11.1.1.2. **Action Step:** Toxic waste products from industrial, mining, agricultural, and urban activities should receive the appropriate treatment before being discharged into any body of water.

11.1.1.3. **Action Step:** Support the development and implementation of stormwater BMPs in cities, towns and rural areas.

11.1.1.4. **Action Step:** Work with pesticide users to educate and advocate for an "integrative pest management framework (IPM)" for pesticide control. Best management practices within the IPM include biological control, pesticide choices, removal of pest habitat and resources, barriers, optimal fertilization

and irrigation, trap plants, intercropping, and cover crops, and synthetic mulches.

11.1.1.5. **Action Step:** Work with the academic, local, government and non-profit entities (Natural Resource Conservation District, San Francisco Estuary Institute, etc.) to support funding of research and use of pesticide alternatives. These alternatives may include technologies that reduce the amount of pesticides that need to be applied or pest management strategies (listed above) that require very little pesticide use.

11.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

11.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

11.2.1. **Recovery Action:** Incorporate appropriate elements of the Recovery Plan into the state-sponsored and funded Integrated Regional Water Management Plan (IRWMP)

11.2.1.1. **Action Step:** Work with EPA, RWQCBs, and CDFG to identify and prioritize potential contaminants of concern and develop protective standards and programs in the CCC coho salmon ESU.

11.2.1.2. **Action Step:** Work with EPA, RWQCBs, and local stakeholders to implement actions under section 303(d)(1)(C) and (D) of the Clean Water Act requiring States to prepare TMDLs for all water bodies targeted in this recovery plan not currently meeting State of California water quality standards.

11.2.1.3. **Action Step:** Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.

11.2.1.4. **Action Step:** Work with the California Pesticides Regulation Department (CPRD) to support changes to professional pesticide application methodologies and timing (e.g., change building infrastructure applications of pyrethorids on monthly schedules throughout the entire year including the rainy season to seasons of interest) to limit the potential exposure of watercourses to pesticide runoff.

11.2.1.5. **Action Step:** Work with the Regional Water Quality Control Board to support and fast track promulgation of methods to detect impacts from pesticides and other CECs) under 40 C.F.R. Part 136, followed by adoption of water quality criteria for pollutants cover by these methods.

11.2.1.6. **Action Step:** Work with agencies to advocate for refinement of the State adopted CWA general pesticide permit.

11.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

11.3. **Objective:** See also recommendations under Restoration - Sediment and Threat - Roads/Railroads

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification or curtailment of habitat or range

12.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

12.1.1.1. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing practices in priority stream reaches and where riparian habitat is in poor or fair condition.

12.1.1.2. **Action Step:** Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

12.1.1.3. **Action Step:** Develop and implement riparian setbacks/buffers that protect existing native riparian species composition and structure.

12.1.1.4. **Action Step:** Ensure that mature trees within the steam riparian corridor are not disturbed or lost due to agricultural activities.

12.1.2. **Recovery Action:** Prevent impairment to hydrology

12.1.2.1. **Action Step:** If water is used for frost protection measures, flow metering should accompany water management to ensure flows are maintained for other beneficial uses.

12.1.2.2. **Action Step:** Maintain properly functioning conditions, and do not allow further degradation, of flow conditions.

12.1.2.3. **Action Step:** Utilize BMP's for irrigation (cover crop, drip) and frost protection (wind machines, cold air drains, heaters, or micro-sprayers) which eliminate or minimize water use.

12.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

12.1.3.1. **Action Step:** Continue the use of cover crops in agriculture fields to reduce sediment runoff.

12.1.3.2. **Action Step:** Encourage and assist the NRCS and RCDs to increase the number of landowners participating in sediment reduction planning and implementation.

12.1.3.3. **Action Step:** Work with landowners to assess and address erosion control measures throughout the winter period.

12.1.4. **Recovery Action:** Prevent increased landscape disturbance

12.1.4.1. **Action Step:** Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to address sediment source reduction, riparian habitat, forest health, and restoration.

12.1.5. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

12.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.2.1. **Recovery Action:** Prevent impairment to riparian species composition and structure

12.2.1.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do.

12.2.1.2. **Action Step:** Work with EPA and CDFG to identify and prioritize potential contaminants of concern and develop protective standards and programs for issues that directly or indirectly adversely affect the continued existence of CCC coho salmon.

12.2.1.3. **Action Step:** Reduce water pollutants such as fine sediments, pesticides, and other non-point sources, and point source waste discharges to protect habitat and life-history requirements.

12.2.1.4. **Action Step:** Utilize HCPs, Safe Harbor or other regulatory authorities to protect coho salmon and their habitat.

12.2.1.5. **Action Step:** Strongly encourage the counties, cities and local jurisdictions to take a greater leadership role to reduce ongoing impacts of agriculture to salmon and their habitats by working with their various departments on permitting, road maintenance, ordinances, etc.

12.2.1.6. **Action Step:** Encourage amendments to Army Corps 404 Clean Water Act exemptions for farming, logging, and ranching activities to terminate Section

404(f) exemptions for discharges of dredged or fill material into US waters (channelization) associated with agriculture, logging, ranching and farming.

12.2.2. **Recovery Action:** Prevent increased landscape disturbance

12.2.2.1. **Action Step:** Prevent impacts from new vineyard development by enforcement of land use zoning appropriate to the site to protect floodplain and riparian processes.

12.2.2.2. **Action Step:** Incentive programs and incentive-based approaches should be explored for landowners who conduct operations in a manner compatible with salmonid recovery requirements.

12.2.2.3. **Action Step:** NMFS staff should provide technical support to encourage that county general plan updates and ordinances incorporate recovery goals of preventing impairment of, and restoring, coho salmon habitats.

12.2.3. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

13.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity

13.1.1.1. **Action Step:** Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.

13.1.1.2. **Action Step:** Beneficial long-term effects of natural disturbances, such as flooding and stream bank erosion, should be preserved or restored whenever possible.

13.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

13.1.2.1. **Action Step:** Channel modifying projects should be designed to ensure potential effects to CCC coho habitat are fully minimized or mitigated, and where possible, existing poor conditions are remediated.

13.1.2.2. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.1.2.3. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.

13.1.2.4. **Action Step:** Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.

13.1.3. **Recovery Action:** Prevent impairment to passage

13.1.3.1. **Action Step:** Ensure that all future and existing channel designed for flood conveyance incorporate features enhance coho salmon migration under high and low flow conditions.

13.1.4. **Recovery Action:** Reduce adverse impacts to watershed processes

13.1.4.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).

13.1.4.2. **Action Step:** Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Focus on ensuring minimal disruption to watershed processes.

13.1.5. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

13.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.2.1. **Recovery Action:** Reduce adverse impacts to watershed processes

13.2.1.1. **Action Step:** Modify city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historical CCC coho watersheds.

13.2.1.2. **Action Step:** Encourage FEMA to set regulatory standards in its Flood Insurance Program to explicitly address the protection of natural fluvial processes essential for the maintenance of naturally functioning riverine and riparian habitats.

13.2.1.3. **Action Step:** Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

13.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address disease or predation

14.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.1.1.1. **Action Step:** Provide funding to investigate and remediate impacts of disease and predation to overall ESU viability.

14.1.1.2. **Action Step:** Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolt coho salmon and implement abatement strategies where appropriate.

14.1.2. **Recovery Action:** NMFS staff will facilitate discussions with the outlined entities on those items found inadequate for Listing Factor C as outlined in the Federal Register Notice Chapter in Volume I

14.1.3. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

14.2. **Objective:** Address the present of threatened destruction, modification or curtailment of habitat or range

14.2.1. **Recovery Action:** Reduce the threat of invasive species to aquatic habitat across the NCCC domain

14.2.1.1. **Action Step:** Support CDFG, and other resource agencies to control and contain invasive species in California.

14.2.1.2. **Action Step:** Provide support to the Invasive Species Council of California (ISCC), and the California Invasive Species Advisory Committee (CISAC) in their efforts to effectively control invasive species.

14.2.1.3. **Action Step:** Promote the practice of Clean, Drain, and Dry for watercraft and equipment used in aquatic environments. Additional information can be found at www.dfg.ca.gov/invasives.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

15.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

15.1.1.1. **Action Step:** Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.

15.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.2.1. **Action Step:** Collaborate with CalFire to coordinate firefighting and post fire response with the resource agencies.

15.1.3. **Recovery Action:** Prevent impairment to water quality

15.1.3.1. **Action Step:** Locate chemicals, petroleum products, latrines, camp sites, etc., as far from fish bearing streams and tributary watercourses as possible. Place on flat ground.

15.1.4. **Recovery Action:** Prevent impairment to watershed processes

15.1.4.1. **Action Step:** Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.

15.1.4.2. **Action Step:** Include CDFG and NMFS participation on rehabilitation planning teams. During rehabilitation, consider leaving felled trees in streams as LWD source. Re-contour massively modified areas. Storm-proof roads immediately after use. Dispose of suitable organic materials by dispersing them on disturbed soils on the contour. Where larger organic material is available, place in severely burned-out watercourses (assure CDFG/NMFS is a part of this design and decision). Seeding, preferably with local seed-stock, at high hazard/risk areas should be done whenever feasible.

15.1.5. **Recovery Action:** Prevent impairment to hydrology

15.1.5.1. **Action Step:** Obtain water from lakes and reservoirs not occupied by listed salmonids when possible. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.

15.1.6. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

15.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to watershed processes

15.2.1.1. **Action Step:** Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.

15.2.1.2. **Action Step:** Establish fire contingency plans that involve CalFire, local fire districts and regulatory agencies with expertise in fisheries issues.

15.2.1.3. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.

15.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the overutilization for commercial, recreational, scientific or educational purposes

16.1.1. **Recovery Action:** Prevent reduced density, abundance and diversity

16.1.1.1. **Action Step:** Fisheries managers should use recovery criteria explained in this recovery plan to manage fisheries consistent with recovery of CCC coho salmon. The assessment of fishery impacts requires data to inform management, and if those data are not currently collected a system to do so should be established. Fishery managers should work with NMFS to develop Fishery Management and Evaluation Plans to prevent extinction and ensure fishery management is consistent with recovery of the species, and cover incidental take of federally listed salmonids.

16.1.1.2. **Action Step:** Work with CDFG and Fish and Game Commission to refine freshwater sport fishing regulations to minimize unintentional and unauthorized take, and incidental mortality, of CCC coho salmon by anglers during the CCC coho salmon migration period. This effort could include development of specific emergency regulations during adult migration periods between September and January, low-flow closures (much like Washington State) and angler outreach programs specifically for the 28 focus watersheds identified for coho recovery. This effort should include close coordination with CDFG Wardens and development of outreach programs.

16.1.1.3. **Action Step:** Work with CDFG to develop protective regulations and seek funds for additional Game Wardens to minimize impacts from fishing during the migratory period for CCC coho salmon (e.g., until sandbars open naturally) within one mile of the river mouths of the 28 focus watersheds.

16.1.1.4. **Action Step:** The streams of Albion, Big River, Cottaneva, Garcia, Gualala, Navarro, Noyo, and Ten Mile do not have hatchery trout or steelhead, yet the California Freshwater Sport Fishing Regulations sets forth bag limits for these watersheds. Resources such as the Northern California Atlas & Gazetteer (DeLorme 2011) use the Regulations to provide anglers a list of watersheds where fishing is allowed. The Regulations should be amended to reflect current fisheries conditions.

16.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

17. Threat- Hatcheries

17.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

17.1.1. **Recovery Action:** Improve density, abundance and diversity of CCC coho salmon populations

17.1.1.1. **Action Step:** Work with hatchery managers to implement the recommendations in the California Hatchery Scientific Review Group report (California HSRG 2012), where appropriate.

17.1.1.2. **Action Step:** Ensure the threat of hatcheries remains low for the CCC coho salmon for current, and all future, hatchery programs. Develop a HGMP under section 10 (a) (1) that comports with the hatchery criteria identified in Spence et al. (2008).

17.1.2. **Recovery Action:** NMFS staff will facilitate discussions with the outlined entities on those items found inadequate for Listing Factor E as outlined in the Federal Register Notice Chapter in Volume I

17.1.3. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

17.2. **Objective:** See Restoration-Viability for specific recommendations regarding hatchery practices.

18. Threat- Livestock

18.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

18.1.1. **Recovery Action:** Improve watershed conditions

18.1.1.1. **Action Step:** Aid willing landowners to fence livestock from the stream channel and riparian zones and develop offstream alternative water sources.

18.1.1.2. **Action Step:** Livestock and Ranch Managers should utilize Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California (MRCD, 2007), and Management Tips to Enhance Land & Water Quality for Small Acreage Properties (Sotoyome RCD, 2007), and The Grazing Handbook (Sotoyome RCD, 2007).

18.1.1.3. **Action Step:** Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff, improve soil conditions, minimize noxious weeds, and encourage native revegetation.

18.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

18.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

18.2.1. **Recovery Action:** Prevent impairment to water quality (e.g. turbidity, suspended sediment)

18.2.1.1. **Action Step:** Establish conservative residual dry matter (RDM) target per acre to ensure areas are not overgrazed by leaving 1000 lbs RDM (residual dry matter)/acre left end of grazing season. Remove cattle from pasture before soils dry out.

18.2.1.2. **Action Step:** Implement water quality standards as outlined in the University of California guidelines for water quality protection (Ristow 2006).

18.2.1.3. **Action Step:** Implement recommendations of the California Rangeland Water Quality Management Program.

18.2.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

19.1.1. **Recovery Action:** Prevent conversions and improve forest conditions throughout the ESU

19.1.1.1. **Action Step:** California BOF could consider requiring (1) EIRs for all conversions, (2) adopting a Conversion THP, (3) elimination of the subdivision exemption, (4) raising conversion permit fees, (5) developing requirements to offset loss of timberland, (6) incentivize restoration of unproductive timberlands, (7) investigate conservation banking programs and (8) coordinate with the other agencies involved for more CalFire oversight on forest conversions.

19.1.1.2. **Action Step:** Work with California BOF, CalFire, CDFG, professional organizations and landowners to protect forest lands from conversion, promote sustainable forestry practices and provide landowner incentives for growing late seral forests in riparian areas and conducting restoration actions.

19.1.1.3. **Action Step:** Support the Monitoring Study Group and encourage coordination with other state programs and monitoring.

19.1.2. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent impairment to watershed processes

19.2.1.1. **Action Step:** Discourage Counties from rezoning forestlands or identified TPZ areas to rural residential or other land uses (e.g., vineyards).

19.2.1.2. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within high value habitat areas in focus watersheds.

19.2.1.3. **Action Step:** Increase THP inspections by CalFire especially during winter months.

19.2.1.4. **Action Step:** Partner in the development of a framework similar to Washington State that establishes a scientific framework for monitoring the effectiveness of practices in meeting watershed process goals and a decision-making process that is adaptive to the new information.

19.2.1.5. **Action Step:** Work with CalFire and BOF to explore no-take rules and/or apply for a statewide Forestry HCP (similar to that developed in Washington State), GCP, safe harbor agreements, and seek funding opportunities to support the effort.

19.2.1.6. **Action Step:** Encourage development of a GCP/HCP/Natural Community Conservation Plan (NCCP), conservation easements, conservation banks, or safe harbor agreements with industrial or non-industrial forestland owners.

19.2.1.7. **Action Step:** Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through Section 10(a)(1)(B).

19.2.1.8. **Action Step:** NMFS and CDFG should continue to provide information and recommendations to the BOF regarding salmonid priorities and needed revisions to forest practices that are in compliance with the ESA.

19.2.1.9. **Action Step:** Work with the BOF, CalFire, CDFG, professional organizations and landowners to modify the timber harvest permitting process to provide opportunities and incentives for LWD recruitment during timber harvest operations.

19.2.1.10. **Action Step:** Consider assigning NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).

19.2.1.11. **Action Step:** The State should consider a Salmonid Watershed Database (similar to the CDFG Northern Spotted Owl database) for RPFs to acquire standardized information on populations and habitat conditions in the watersheds associated with their harvest plan.

19.2.2. **Recovery Action:** Prevent reduced density, abundance, and diversity

19.2.2.1. **Action Step:** The BOF should consider designating CCC coho salmon as a sensitive species. The majority of CCC coho salmon populations persist on forestlands and a sensitive species designation could provide increased protection from potential timber harvest impacts.

19.2.3. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

20. Threat- Mining

20.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

20.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

20.1.1.1. **Action Step:** Ensure protection of natural in-channel, floodplain, and riparian habitats from, in-river sand and gravel mining practices.

20.1.2. **Recovery Action:** Prevent impairment to watershed processes

20.1.2.1. **Action Step:** NMFS gravel mining guidelines (Sediment Removal Guidelines) should be strictly adhered to for all existing and proposed projects.

20.1.3. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

21. Threat- Recreation

21.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

21.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Recreation, Restoration-Sediment and Threat-Roads

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

22.1.1. **Recovery Action:** Prevent impairment to watershed processes

22.1.1.1. **Action Step:** Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

22.1.2. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

22.1.2.1. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.

22.1.2.2. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.

22.1.2.3. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

22.1.2.4. **Action Step:** Toxic waste products from urban activities should receive the appropriate treatment before being discharged into any body of water that may enter any historic CCC coho salmon stream.

22.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.3.1. **Action Step:** Restore patterns of sediment and water runoff, including surface and subsurface drainage, to the greatest extent possible to the natural hydrologic pattern for the watershed in timing, quantity, and quality.

22.1.4. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

22.2.1.1. **Action Step:** Implement performance standards in Stormwater Management Plans.

22.2.1.2. **Action Step:** New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.

22.2.1.3. **Action Step:** Address impacts from failing septic systems in rural areas.

22.2.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.2.2.1. **Action Step:** As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.

22.2.2.2. **Action Step:** Support the development and implementation of regulations for activities that intercept groundwater recharge.

22.2.2.3. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.2.4. **Action Step:** Develop legislation that will fund county planning for environmentally sound growth water supply development and work in coordination with California Dept. of Housing, Association of Bay Area Governments and other government associations (CDFG 2004).

22.2.3. **Recovery Action:** Prevent impairment to watershed processes

22.2.3.1. **Action Step:** Enforce existing building permit programs to minimize unpermitted construction.

22.2.3.2. **Action Step:** Modify Federal, State, city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historic CCC coho salmon watersheds.

22.2.3.3. **Action Step:** Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining a mature and properly functioning riparian zone.

22.2.3.4. **Action Step:** Identify forestlands or oak woodland areas at high risk of conversion, and develop incentives and alternatives for landowners to discourage conversion.

22.2.3.5. **Action Step:** Standards and recommendations regarding local development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.3.6. **Action Step:** Encourage infill and high density developments over dispersal of low density rural residential development.

22.2.3.7. **Action Step:** Develop legislation that will fund county planning for environmentally sound growth and water supply and work in coordination with California Dept. of Housing, Association of Bay Area Governments, and other government associations (CDFG 2004).

22.2.4. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification or curtailment of habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Hydrologically disconnect roads and ensure road use, maintenance, and construction are not resulting in riparian losses and sediment discharge to streams.

23.1.1.2. **Action Step:** Restoration projects that upgrade or decommission high risk roads adjacent to streams supporting coho salmon should be considered an extremely high priority for funding (e.g., PCSRF).

23.1.1.3. **Action Step:** Conduct road and sediment reduction assessments to identify sediment related and runoff related problems and determine level of hydrologic connectivity.

23.1.1.4. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.1.5. **Action Step:** Conduct outreach and continual education regarding the adverse effects of roads and the types of best management practices protective of salmonids. Education should address watershed process and the adverse effects of improper road construction and maintenance on salmonids and their habitats.

23.1.1.6. **Action Step:** Design new roadways to avoid unstable slopes, wetland, floodplains and other areas of high habitat value.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity

23.1.2.1. **Action Step:** Implement strategies to decommission and/or upgrade high risk roads (and skid trails on forestlands), maintain existing roads and construct new roads.

23.1.2.2. **Action Step:** Design and implement a program of BMPs for road maintenance on private roads similar to programs for public roads (Sommarstrom, 2002).

23.1.2.3. **Action Step:** Use best management practices for road construction, maintenance on private roads similar to programs for public roads (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).

23.1.3. **Recovery Action:** Prevent impairment to passage and migration

23.1.3.1. **Action Step:** Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and review appropriate barrier databases when developing new or retrofitting existing road crossings.

23.1.3.2. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents (i.e., pilings) feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.3.3. **Action Step:** Update the California Fish Passage Assessment Database with road related barriers to fish passage on an annual basis.

23.1.3.4. **Action Step:** All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.

23.1.3.5. **Action Step:** For impact pile driving develop and implement sound attenuation methods that ensure sound levels are (1) below thresholds for onset of physical injury to fish (see NMFS' 2008 Interim Criteria for Injury to Fish from Pile Driving), (2) avoiding adverse behavioral effects (e.g., during adult migration, etc.), and (3) minimized by a reduction in the sound field (e.g., reduce the size of the area impacted). In situations where sound attenuation is not able to keep sound pressure at sub-injurious levels (i.e., sound levels that will not harm or injure fish), work should be conducted during seasonal work windows outlined in NMFS 2008 to avoid CCC coho.

23.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.4.1. **Action Step:** Educate county and city public works departments, flood control districts and planning departments, etc., on the critical importance of maintaining a mature riparian and healthy riparian zone for salmonids.

23.1.5. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

23.2. **Objective:** Address the inadequacy of regulatory mechanisms

23.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.2.1.1. **Action Step:** Minimize new road construction within riparian corridors. Limit construction of new road crossings.

23.2.1.2. **Action Step:** Encourage implementation of Vegetation Management Plans for the roadside maintenance activities to discourage or eliminate unwanted

vegetation and promote desirable (native) vegetation (County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS, 2011)).

23.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.2.1. **Action Step:** Support and engage CalTrans, counties and others with oversight on road practices to reduce sediment delivery to streams from road networks and channelization from poorly situated roads.

23.2.2.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the most recent version of the California Forest Practice Rules.

23.2.2.3. **Action Step:** Evaluate and mitigate (where appropriate) the effects of transportation corridors and infrastructure on estuarine and stream fluvial processes. Mitigating measures may include, elevating existing approach, fill and maximizing clear spanning of upstream active channel(s), floodways, and floodplains to accommodate natural riverine and estuarine fluvial processes.

23.2.2.4. **Action Step:** Conduct annual inspections of roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.2.5. **Action Step:** Encourage enforcement of existing regulations regarding grading, riparian and building violations and sediment release from county roads.

23.2.2.6. **Action Step:** Reduce sediment sources from road networks, maintenance activities and other actions that deliver sediment to stream channels through improved or new laws and policies, and/or enforcement of existing laws and policies.

23.2.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.3.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.4. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address other natural or manmade factors affecting the species continued existence

24.1.1. **Recovery Action:** Prevent impairment to watershed processes due to climate change

24.1.1.1. **Action Step:** Actively conduct outreach to stakeholders and the public regarding anticipated effects of climate change to salmonids and increase awareness that human actions can offset these effects. The public, local, state and federal agencies should become familiar with, and implement as necessary through lifestyle and policy changes, recommendations of the Intergovernmental Panel on Climate Change (IPCC). See the website http://www.ipcc.ch to view a summary of climate change issues for North America and the suite of actions from the IPCC to be considered for ecosystem (and human health) due to climate change.

24.1.1.2. **Action Step:** Promote and support policies that explicitly maintain instream flow by limiting water withdrawals, enhancing floodplain connectivity by opening historically flooded areas where possible, removing anthropogenic barriers for fish passage, and riparian forest to increase habitat resilience.

24.1.1.3. **Action Step:** Develop a climate strategy that addresses simultaneously the reduction of fossil fuels and the protection of forestlands. For example, promote biological carbon sequestration best management practices (BMPs), where feasible, that are consistent with NMFS policies and guidelines. Develop incentives to maintain and rehabilitate forestlands, manage for older forests, discourage conversions or forest changes. Forestlands store carbon and reduce greenhouse gases.

24.1.1.4. **Action Step:** Expand research and monitoring to improve predictions of climate change and its effects on salmon recovery. Tools such as the Regional Climate System Model, Sea Level Rise and Coastal Flooding Impacts Viewer, etc. should be used to improve ecological forecasting of the threat of climate change, human population growth, and their impacts to salmonids and their habitats.

24.1.1.5. **Action Step:** Minimize anthropogenic increases in water temperatures by maintaining well-shaded riparian areas. Work to encourage and incorporate climate change vulnerability assessments and climate change scenarios in consultations, permitting, and restoration projects to access the impacts on coho salmon.

24.1.1.6. **Action Step:** Maintain headwater areas in an undisturbed state to ensure a continuous source of cool water downstream.

24.1.1.7. **Action Step:** Maximize connectivity, and increase diversity, of instream habitats to allow a full range of opportunities for salmon to exploit as environmental conditions shift.

24.1.2. **Recovery Action:** Prevent impairment to watershed processes due to droughts and flooding events

24.1.2.1. **Action Step:** Evaluate feasibility and benefits of establishing an Emergency Drought Operations Center (similar to the Emergency Drought Operations Center developed in Washington State), comprised of the SWRCB, CDFG, NMFS, and others to develop emergency rules for augmenting water supplies and mitigating the effects of drought and extreme climate on CCC coho salmon and their habitats.

24.1.2.2. **Action Step:** Institute water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

24.1.2.3. **Action Step:** Coordinate protection measures and develop rules for augmenting water supplies and mitigating the effects of drought on salmonids.

24.1.2.4. **Action Step:** Design habitat restoration projects to account for long-term changes including sea level rise, flooding frequency and loss of sediment, by increasing resiliency of existing habitat types and facilitating upstream passage (California State Coastal Conservancy et al. 2010).

24.1.3. **Recovery Action:** NMFS staff will facilitate discussions with the outlined entities on those items found inadequate for Listing Factor E as outlined in the Federal Register Notice Chapter in Volume I

24.1.4. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the inadequacy of regulatory mechanisms

25.1.1. **Recovery Action:** Improve flow conditions

25.1.1.1. **Action Step:** Establish comprehensive stream flow evaluation programs to determine instream flow needs for coho salmon.

25.1.1.2. **Action Step:** Determine and monitor 1600 program compliance related to water diversions (CDFG 2004).

25.1.1.3. **Action Step:** Counties should consider forbearance agreements that eliminate withdrawals during low-flow conditions.

25.1.1.4. **Action Step:** Develop water conservation measures at local and State levels to include a drought management plan for each watershed that is triggered by minimum flow requirements.

25.1.1.5. **Action Step:** CDFG staff should conduct compliance audits of Lake and Streambed Alteration Agreements (LSAA) in priority watersheds. Audits would be conducted using a two tiered approach in all focus CCC coho salmon watersheds – compliance checks on existing agreements and compliance review to identify unpermitted activities impacting coho. Mitigation measures for LSAA agreements should be standardized per specific life history impacts.

25.1.1.6. **Action Step:** For those streams known to support CCC coho salmon, including those with ongoing diversions, consider petitioning SWRCB to declare the stream as fully appropriated during the summer months. Encourage existing water rights holders and new applicants to shift the timing or manner, of diversion, from a less protective to a more protective practice.

25.1.1.7. **Action Step:** Collaborate and support the SWRCB and local agencies to increase oversight and responsibility for regulating groundwater extraction from aquifers hydrologically connected to surface flows.

25.1.1.8. **Action Step:** Local governments should integrate meaningful groundwater regulation for land use planning and increase their coordination with State agencies to ensure applicants secure the necessary State permits (e.g., water rights) as part of the local permitting processes.

25.1.1.9. **Action Step:** Collaborate and support the SWRCB to prioritize review and processing of water right projects within the 28 focus populations and 11 supplemental populations, enforce existing bypass flow requirements and reduce the impacts of authorized surface water diversions for populations where water flow is identified as a limiting factor.

25.1.1.10. **Action Step:** Improve coordination between the agencies, particularly the SWRCB and county District Attorneys, to effectively identify and address illegal water diverters and out-of-compliance diverters, seasons of diversion, off-stream reservoirs, and bypass flows so they are fully protective of CCC coho salmon.

25.1.1.11. **Action Step:** Until site specific studies are conducted, implement and enforce the North Coast Instream Flow Policy developed and adopted pursuant to AB2121 for the 28 focus populations and 11 supplemental population. AB2121 codified (in sections 1259.2 and 1259.4 of the California Water Code) portions of CDFG and NMFS Water Diversion Guidelines to ensure protective flows for all life stages of coho salmon.

25.1.1.12. **Action Step:** Work with CDFG and SWRCB to develop specific regulatory mechanisms to fully and effectively implement CDFG Code Section 5937 requirements.

25.1.1.13. **Action Step:** Evaluate benefits of requiring State and Federal Incidental Take Permits for all new water diversions in watersheds with extant populations of CCC coho salmon.

25.1.1.14. **Action Step:** The State Water Resources Control Board should implement the new frost protection regulations for the Russian River as soon as possible to protect CCC coho salmon.

25.1.1.15. **Action Step:** The State Water Resources Control Board should be encouraged to exercise greater regulatory authority over summer water diversions. Water rights held under a claim of pre-1914 rights, riparian rights or older appropriative rights could be divested to protect instream uses.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.2.2. **Action Step:** Promote conjunctive use of water with water projects whenever possible.

25.1.2.3. **Action Step:** Require the SWRCB to conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.

25.1.2.4. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

25.1.2.5. **Action Step:** Site and compliance visits by CDFG should be instituted for Lake and Streambed Alteration Agreements that relate to Appropriative and Riparian diversions. Consideration should be made to dedicate wardens to conduct these visits in Core areas.

25.1.3. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.3.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** During five-year status reviews update, if necessary, recovery actions

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

26.1.1. **Recovery Action:** Implement ESU level recovery actions for Landscape Patterns

Central CA Coast Coho Salmon ~ Lost Coast Diversity Stratum

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**
   1.1. **Objective:** Address the present of threatened destruction, modification, or curtailment of habitat or range

      1.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Estuaries

2. **Restoration- Floodplain Connectivity**
   2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

      2.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Floodplain Connectivity

3. **Restoration- Habitat Complexity**
   3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

      3.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity

4. **Restoration- Hydrology**
   4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

      4.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Hydrology

5. **Restoration- Landscape Patterns**
   5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

      5.1.1. **Recovery Action:** Reduce adverse impact to landscape patterns

         5.1.1.1. **Action Step:** Strongly encourage Mendocino County (including cities and local jurisdictions) to take a leadership role and work with their various departments on permitting, road maintenance, ordinances, etc., to reduce the ongoing impacts of urbanization, agriculture, road building, grading activities, timber conversions, etc., to salmon and their habitats. Mendocino County supports over 85% of remaining populations of CCC coho salmon.

5.1.1.2. **Action Step:** Facilitate as soon as possible mechanisms to promote sustainable forestry practices and reduce forest conversions including development of protective county ordinances.

5.1.1.3. **Action Step:** Continue discussions between agencies, non-profits, landowners and others in the Wood for Salmon forum to implement wood enhancement projects and seek permit streamlining solutions.

5.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.2.1. **Recovery Action:** Reduce adverse impact to landscape patterns

5.2.1.1. **Action Step:** Evaluate benefits of designating watersheds, or sections thereof, as Wild and Scenic Rivers pursuant to The National Wild and Scenic rivers systems (16 U.S.C. 1271 et seq). Watersheds for potential inclusion could include, but are not limited to: lower Ten Mile River and lower Big River.

5.2.1.2. **Action Step:** Work with Mendocino County District Attorney to address environmental crimes that adversely impact coho salmon and/or their habitat.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

6.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Passage

7. Restoration- Pool Habitat

7.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

7.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

8.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Riparian Vegetation

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

9.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Sediment

10. Restoration- Viability

10.1. **Objective:** Address other natural or manmade factors affecting the species continued existence

10.1.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.1.1.1. **Action Step:** Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods (e.g. salmon analogs).

10.1.1.2. **Action Step:** Salmonid monitoring in this Stratum is a high priority and long-term funding, for the continuation of current programs and their expansion, should be secured.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

11.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Water Quality

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present of threatened destruction, modification, or curtailment of habitat or range

12.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Agriculture

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

13.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Channel Modification

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

14.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Disease, Predation and Competition

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

15.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Fire and Fuel Management

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Fishing and Collecting

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

18.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Livestock

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent forest conversions to other landuses and improve forest conditions throughout the watershed

19.1.1.1. **Action Step:** Finalize Mendocino Redwood Company HCP.

19.1.1.2. **Action Step:** Encourage development of a HCP/NCCP/GCP or Safe Harbor with forestland owners with Jackson Demonstration State Forest, State Parks, The Conservation Fund, Coastal Ridges, Redwood Forest Foundation, and Hawthorne Timber Company.

19.1.1.3. **Action Step:** Work with California BOF, CalFire, CDFG, professional organizations and landowners to protect forest lands from conversion, promote sustainable forestry practices and provide landowner incentives for growing late seral forests in riparian areas and conducting restoration actions.

19.1.1.4. **Action Step:** Work with the BOF, CalFire, CDFG, professional organizations and landowners to modify the timber harvest permitting process to provide

opportunities and incentives for LWD recruitment during timber harvest operations.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

21.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

21.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Recreation

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.1.1.1. **Action Step:** Encourage Mendocino County to develop and implement ordinances (e.g. Santa Cruz County Code 2008) to restrict subdivisions by requiring a minimum acreage limit for parcels in concert with limits on water supply and groundwater recharge areas.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

23.1.1.1. **Action Step:** The threat of roads rated the highest for this Stratum. Road effects to salmon and their habitats must be controlled by county-wide road management planning for mainline transportation, rural residential and other road corridors.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

24.1.1. **Recovery Action:** The threat of severe weather was found high across 5 populations. A regional severe weather plan should be developed that addresses proactive measures for climate change and a drought/flooding management and response plan.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.1.1. **Recovery Action:** Improve flow conditions

25.1.1.1. **Action Step:** Petition SWRCB to declare CCC coho salmon watersheds with existing populations and ongoing diversions in the Lost Coast Diversity Stratum declared as fully appropriated during the summer months. Encourage water right applications for existing rights holders who seek to shift the timing or manner of diversion from a less protective to more protective practice.

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

26.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Watershed Processes

Central CA Coast Coho Salmon ~ Navarro Pt. – Gualala Pt.

Diversity Stratum

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**
   - 1.1. **Objective:** Address the present of threatened destruction, modification, or curtailment of habitat or range
     - 1.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Estuaries
2. **Restoration- Floodplain Connectivity**
   - 2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range
     - 2.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Floodplain Connectivity
3. **Restoration- Habitat Complexity**
   - 3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 3.1.1. **Recovery Action:** Reduce adverse impacts to landscape patterns
       - 3.1.1.1. **Action Step:** Continue discussions between agencies, non-profits, landowners and others in the Wood for Salmon forum to implement wood enhancement projects and seek permit streamlining solutions.
     - 3.1.2. **Recovery Action:** Improve habitat complexity
       - 3.1.2.1. **Action Step:** Investigate the feasibility of beaver re-location and re-introduction to the Navarro River, Gualala River and Garcia River populations to promote channel complexity, improve baseflows and provide rearing habitat.
4. **Restoration- Hydrology**
   - 4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range
     - 4.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Hydrology
5. **Restoration- Landscape Patterns**
   - 5.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.1.1. **Recovery Action:** Reduce adverse impact to landscape patterns

5.1.1.1. **Action Step:** Strongly encourage Mendocino County (including cities and local jurisdictions) to take a greater leadership role and work with their various departments on permitting, road maintenance, ordinances, etc. to reduce the ongoing impacts of urbanization, agriculture, road building, grading activities, timber conversions, etc. to salmon and their habitats. Mendocino County currently supports over 85% of remaining populations of CCC coho salmon.

5.1.1.2. **Action Step:** Evaluate benefits of designating watersheds, or sections thereof, as Wild and Scenic Rivers pursuant to The National Wild and Scenic rivers systems (16 U.S.C. 1271 et seq). Watersheds for potential inclusion could include, but are not limited to the Garcia River.

5.1.1.3. **Action Step:** Seek innovative funding solutions for matching funds when counties are deemed economically disadvantaged to afford restoration project development and work.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

6.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Passage

7. Restoration- Pool Habitat

7.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

7.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

8.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Riparian Vegetation

8.1.2. **Recovery Action:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Discourage conversions.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Sediment

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

10.1.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.1.1.1. **Action Step:** Evaluate the need and feasibility of developing a Captive Broodstock Program.

10.1.1.2. **Action Step:** Salmonid monitoring in this Stratum is a high priority and long-term funding, for the continuation of current programs and their expansion, should be secured.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Work with Mendocino county district attorney to address environmental crimes that adversely impact coho salmon and/or their habitat.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

11.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Water Quality

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

12.1.1. **Recovery Action:** Prevent impairment to riparian composition and structure

12.1.1.1. **Action Step:** Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with salmon recovery priorities.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

13.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Channel Modification

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

14.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Disease, Predation and Competition

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

15.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Fire and Fuel Management

16. Threat- Fishing/Collecting

16.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

16.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Fishing and Collecting

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

18.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Livestock

19. Threat- Logging

19.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.1.1. **Recovery Action:** Prevent impairment to watershed processes

19.1.1.1. **Action Step:** Explore feasibility and benefits of an HCP, GCP or safe harbor with CalFire, BOF, industrial and non-industrial forestland owners.

19.1.1.2. **Action Step:** Facilitate as soon as possible mechanisms to promote sustainable forestry practices and reduce forest conversions, including development of county ordinances.

20. Threat- Mining

20.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

20.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Mining

21. Threat- Recreation

21.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

21.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Recreation

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.1.1. **Recovery Action:** Prevent impairment to watershed processes

22.1.1.1. **Action Step:** Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.1.2. **Action Step:** Encourage Sonoma and Mendocino counties to develop and implement ordinances (i.e. Santa Cruz County Code 2008) to restrict subdivisions by requiring a minimum acreage limit for parcels in concert with limits on water supply and groundwater recharge areas.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

23.1.1.1. **Action Step:** The threat of roads rated the highest for this Stratum. Road effects to salmon and their habitats must be control by county-wide road management planning for mainline transportation, rural residential and other road corridors.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

24.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Severe Weather

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Petition SWRCB to declare CCC coho salmon watersheds with existing populations and ongoing diversions in the Navarro Point-Gualala Point Diversity Stratum declared as fully appropriated during the summer months. Encourage water right applications for existing rights holders who seek to shift the timing or manner of diversion from a less protective to more protective practice.

25.1.1.2. **Action Step:** Coordinate efforts between Federal and State, and county law enforcement agencies to remove illegal diversions from streams.

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

26.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Watershed Processes

Central CA Coast Coho Salmon ~ Coastal Diversity Stratum

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**
   - 1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 1.1.1. **Recovery Action:** Increase extent of estuarine habitat
       - 1.1.1.1. **Action Step:** Implement recommendations in NMFS's Russian River biological opinion (specifically estuary management RPA's).
     - 1.1.2. **Recovery Action:** Implement ESU and population level recovery actions for Estuaries
2. **Restoration- Floodplain Connectivity**
   - 2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range
     - 2.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Floodplain Connectivity
3. **Restoration- Habitat Complexity**
   - 3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 3.1.1. **Recovery Action:** Improve Habitat Complexity
       - 3.1.1.1. **Action Step:** To promote channel complexity, improve baseflows and provide rearing habitat investigate the feasibility and benefit of beaver re-location and re-introductions to Sonoma County (such as Austin, Green Valley, lower Russian River independent populations and Salmon Creek) and Marin County (such as Lagunitas, Pine Gulch, Redwood, and Walker Creek populations).
     - 3.1.2. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity
4. **Restoration- Hydrology**
   - 4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range
     - 4.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Hydrology

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Prevent increased landscape disturbance

5.1.1.1. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

5.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

5.1.2.1. **Action Step:** Conserve open space in intact landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.

5.1.3. **Recovery Action:** Reduce adverse impacts to landscape patterns

5.1.3.1. **Action Step:** Work with Mendocino, Sonoma and Marin counties (including cities and local jurisdictions) to improve permitting processes, road maintenance, ordinances, etc. to reduce ongoing impacts of urbanization, agriculture, road building, grading activities, and timberland conversions.

5.1.3.2. **Action Step:** Encourage development of a county-wide HCP's with Marin and Sonoma that includes State Parks, major water diverters, counties, municipalities, timberland, and vineyard owners.

5.1.3.3. **Action Step:** Implement recommendations in NMFS' Russian River biological opinion (specifically estuary management, and Russian River flow RPA's).

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

6.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Passage

7. Restoration- Pool Habitat

7.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

7.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

8.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Riparian Vegetation

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Sediment

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase density, abundance, spatial structure, and diversity

10.1.1.1. **Action Step:** Re-introduce coho salmon to extirpated watersheds, while minimizing departure from the genetic profile that historically existed in the Stratum.

10.1.1.2. **Action Step:** Conduct a feasibility study regarding the potential contribution the Laguna de Santa Rosa to Russian River viability targets. As the largest freshwater wetland in the CCC coho salmon ESU a historical ecology study of the Laguna de Santa Rosa is recommended to identify physical processes that have been disrupted. The study could provide the foundation for a conceptual plan to prevent wetland loss and improve wetland habitats and functions for CCC coho salmon.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase density, abundance, spatial structure, and diversity

10.2.1.1. **Action Step:** Work with Sonoma and Marin county district attorney to address environmental crimes that adversely impact coho salmon and/or their habitat.

10.3. **Objective:** Address other natural or manmade factors affecting the species continued existence

10.3.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.3.1.1. **Action Step:** Continue the operation of the Russian River Captive Broodstock Program.

10.3.1.2. **Action Step:** Utilize resources to increase genetic variability in captive broodstock programs as well as for adult re-introduction efforts in Marin and Sonoma County streams lacking current salmonid presence (Walker and Salmon Creek Programs are models for others).

10.3.1.3. **Action Step:** Augmentation or intervention such as juvenile collection and retention at established rearing facilities for release as adults (or other intervention methods) may be necessary at this time due to extremely low populations to ensure long-term genetic diversity is preserved. Watersheds of particular interest include Lagunitas/Olema Creek, Redwood Creek, Pine Gulch Creek and Walker Creek.

10.3.1.4. **Action Step:** Annually monitor juvenile and adult coho salmon to assess success of the implemented augmentation/intervention strategies (e.g. number of adult returns, spawning success, juvenile survival etc.) to determine if there is an increase in abundance of natural production of coho salmon in each population.

10.3.1.5. **Action Step:** Evaluate and conduct nutrient enrichment projects to improve freshwater growth and increase smolt escapement utilizing available carcasses from hatcheries and other methods (e.g. salmon analogs).

10.3.1.6. **Action Step:** Annually capture or retain (during rescue efforts) - adequate numbers of fish from streams in Marin and Sonoma County for use as broodstock.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

11.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Water Quality

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present of threatened destruction, modification or curtailment of the species habitat or range

12.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

12.1.1.1. **Action Step:** Implement BMP's for agricultural activities similar to those in the Fish Friendly Farming program (CDFG 2004).

12.1.1.2. **Action Step:** Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with salmon recovery priorities.

12.1.1.3. **Action Step:** Streamline permit processing where landowners are conducting actions aligned with recovery priorities.

12.1.1.4. **Action Step:** Agricultural users should utilize BMP's in Vineyard Frost Protection: A guide for Northern Coastal California (Sotoyome Resource Conservation District, 2011).

12.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.2.1. **Recovery Action:** Prevent impairment to riparian species composition and structure

12.2.1.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do.

12.2.1.2. **Action Step:** Enforce requirements of local regulations and riparian setbacks.

12.2.1.3. **Action Step:** Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

12.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity

12.2.2.1. **Action Step:** Utilize HCPs, Safe Harbor agreements or other regulatory authorities to protect coho salmon and their habitat.

12.2.2.2. **Action Step:** Work with Sonoma, Mendocino and Marin counties to develop more protective regulations in regard to vineyard development.

13. Threat- Channel Modification

13.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.1.1. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

13.1.1.1. **Action Step:** All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.

13.1.1.2. **Action Step:** Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow "emergencies."

13.1.1.3. **Action Step:** Develop a mitigation policy that requires in-kind replacement of removed large woody debris at a 3:1 ratio.

13.1.2. **Recovery Action:** Prevent impairment to floodplain connectivity

13.1.2.1. **Action Step:** Encourage counties to develop a Sensitive Habitat Ordinance similar to that in place for the County of Santa Cruz.

13.1.2.2. **Action Step:** Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

14.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Disease, Predation and Competition

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

15.1.1. **Recovery Action:** Prevent impairment to water quality

15.1.1.1. **Action Step:** Reconcile differences between USFS fire retardant and suppression guidelines with recommendations in the NPS EIR for fire management on National Park lands within the Lagunitas, Pine Gulch, and Redwood Creek watersheds.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Encourage the NPS to adopt the ESA emergency consultation guidelines and biological resource protection so that ESA consultations are initiated whenever coho salmon resources are at risk from fires and/or fire suppression activities.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

16.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Fishing/Collecting.

17. Threat- Hatcheries

17.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

17.1.1. **Recovery Action:** Improve density, abundance, spatial structure, and diversity

17.1.1.1. **Action Step:** Ensure the threat of hatcheries remains low. See Viability actions for specific recommendations regarding hatchery practices.

18. **Threat- Livestock**

18.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

18.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

18.1.1.1. **Action Step:** Livestock and Ranch Managers should utilize Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California (MRCD, 2007), and Management Tips to Enhance Land & Water Quality for Small Acreage Properties (Sotoyome Resource Conservation District, 2007), and The Grazing Handbook (Sotoyome Resource Conservation District, 2007).

19. **Threat- Logging**

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Logging

20. **Threat- Mining**

20.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

20.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Mining

21. **Threat- Recreation**

21.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

21.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Recreation

22. **Threat- Residential/Commercial Development**

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to riparian species composition and structure

22.1.1.1. **Action Step:** Use native plants when landscaping and discourage the use of exotic invasive plants.

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.2.1. **Recovery Action:** Prevent impairment to riparian species composition and structure

22.2.1.1. **Action Step:** Encourage Sonoma and Marin counties to develop and implement ordinances (e.g. Santa Cruz County Code 2008) to restrict

subdivisions by requiring a minimum acreage limit for parcels in concert with limits on water supply and groundwater recharge areas.

22.2.1.2. **Action Step:** Provide technical and staff support to counties to encourage general plan updates to include measures to protect coho salmon (CDFG 2004).

22.2.1.3. **Action Step:** Enforce existing building permit programs to minimize unpermitted construction.

22.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.2.1. **Action Step:** Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Forest and ranch managers should utilize the Handbook for Forest and Ranch Roads (PWA, 1994).

23.1.1.2. **Action Step:** Mendocino, Sonoma and Marin Public works departments should utilize the Fishnet 4C Road Manual or an equivalent manual (e.g., 5 Counties Road Manual) for all related road activities.

23.1.2. **Recovery Action:** Prevent impairment to passage and migration

23.1.2.1. **Action Step:** Using the most recent established protocols, conduct passage assessments where they do not currently exist.

23.1.2.2. **Action Step:** Assess private and public road stream crossings for barrier potential and implement recommendations.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.2.1.1. **Action Step:** Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

24.1.1.2. **Action Step:** Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Promote water conservation best practices such as drip irrigation for vineyards.

25.1.1.2. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.1.1.3. **Action Step:** Institutionalize programs to purchase easements on water rights to encourage the maintenance of surface flows.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinate efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.2. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

25.2.2.1. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

25.2.2.2. **Action Step:** Evaluate requests for on-stream dams above migratory reaches for effects on the natural hydrograph and the supply of spawning gravel for recruitment downstream (CDFG 2004).

25.2.2.3. **Action Step:** Develop and implement regulations for groundwater use.

25.2.3. **Recovery Action:** Improve flow conditions

25.2.3.1. **Action Step:** Petition SWRCB to declare CCC coho salmon watersheds with existing populations and ongoing diversions in the Coastal Diversity Stratum declared as fully appropriated during the summer months. Encourage water right applications for existing rights holders who seek to shift the timing or manner of diversion from a less protective to more protective practice.

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

26.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Watershed Process

Central CA Coast Coho Salmon ~ Santa Cruz Mountains

Diversity Stratum

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

1.1.1.1. **Action Step:** Work with CalTrans to ensure the planned replacement of the existing Highway 1 bridge allows complete restoration of the Scott Creek estuary which is critical to smolt health and marine survival. Scott Creek is a very high priority for this Stratum.

1.1.1.2. **Action Step:** Improve estuarine habitat complexity and water quality and prevent future degradation of estuarine habitat.

1.1.1.3. **Action Step:** Work with California Coastal Commission and USACE to address standards, protocols, and beneficial structural improvements to minimize the frequency of "emergency" sandbar breaching requests.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

2.1.1. **Recovery Action:** Improve floodplain connectivity with the main channel

2.1.1.1. **Action Step:** Floodplain connectivity has been significantly impaired by channel modification activities. Efforts to protect all existing floodplains and re-establish floodplain connectivity should be a high priority.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Improve Habitat Complexity

3.1.1.1. **Action Step:** Conduct outreach and education to private landowners regarding the importance of instream large wood and its role in providing essential habitats for coho salmon survival.

3.1.1.2. **Action Step:** Continue working with Santa Cruz RCD and Coastal Conservancy to identify willing landowners to implement restoration projects in Core and Phase I areas.

3.1.1.3. **Action Step:** Conduct outreach and education to private landowner regarding the importance of instream large wood and its role in providing critical habitats for coho salmon survival.

3.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

3.2.1. **Recovery Action:** Improve Habitat Complexity

3.2.1.1. **Action Step:** Backfill CDFG Fisheries positions and consider increases in NOAA/NMFS participation in San Mateo and San Cruz counties to facilitate development and outreach for FRGP funded restoration projects.

3.2.1.2. **Action Step:** Work with the County of San Mateo to develop a large woody debris management program similar to that developed by County of Santa Cruz.

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

4.1.1. **Recovery Action:** Improve flow conditions

4.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to landscape patterns

5.1.1.1. **Action Step:** Conduct outreach and education to private landowners regarding the importance of instream large wood and its role in providing essential habitats for coho salmon survival.

5.1.1.2. **Action Step:** Continue working with Santa Cruz RCD and Coastal Conservancy to identify willing landowners to implement restoration projects in Core and Phase I areas.

5.1.1.3. **Action Step:** Strongly encourage Santa Cruz and San Mateo counties (including cities and local jurisdictions) to take a leadership role and work with their various departments on permitting, road maintenance, ordinances, etc., to

reduce the ongoing impacts of urbanization, agriculture, road building, grading activities, timber conversions, etc., to salmon and their habitats.

5.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.2.1. **Recovery Action:** Work with Santa Cruz and San Mateo County district attorneys to address environmental crimes that adversely impact coho salmon and/or their habitat

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

6.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Passage

7. Restoration- Pool Habitat

7.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

7.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

8.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Riparian Vegetation

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

9.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Sediment

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase density, abundance, spatial structure and diversity

10.1.1.1. **Action Step:** Reintroduce coho salmon to watersheds where they are extirpated, using appropriate genetic stocks. Reintroduction should only occur in watersheds where habitat conditions are suitable for all freshwater lifestages. To minimize risk of extirpation in this stratum, this recommendation should be implemented immediately in San Gregorio Creek, Pescadero Creek, Waddell Creek, Soquel Creek and Aptos Creek.

10.1.1.2. **Action Step:** Evaluate feasibility and benefits of constructing and operating a conservation hatchery for the propagation of CCC coho salmon. Construct, fund, and operate the facility if determined to be feasible and beneficial using HGMP protocols. The Monterey Bay Salmon and Trout Project operate a coho broodstock program in Scott Creek. The facility at Scott Creek is constrained due to its location and cannot be easily expanded due to financial, physical, and water supply constraints. A larger facility could serve as a regional conservation hatchery for multiple populations in the Santa Cruz Mountain's Diversity Stratum.

10.1.1.3. **Action Step:** Secure long term funding for the operation of the MBSTP if an alternative regional conservation hatchery is determined infeasible or its development is under long term planning.

10.1.1.4. **Action Step:** Conduct a thorough historical analysis (including archeological analysis of Indian middens) and determine whether coho salmon historically occupied streams south of Elkhorn Slough in Monterey County. If positive data are discovered, evaluate the feasibility and likelihood of success of re-establishing coho salmon populations into the Big Sur and Little Sur Rivers.

10.1.1.5. **Action Step:** Salmonid monitoring in this Stratum is a high priority and long-term funding, for the continuation of current programs and their expansion, should be secured.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

11.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Water Quality

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

12.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Agricultural Practices

13. Threat- Channel Modification

13.1. **Objective:** Address inadequacies of regulatory mechanisms

13.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes

13.1.1.1. **Action Step:** Stream channel and estuarine habitats of four populations in the Stratum are impacted by channel modification. Projects should institute a net gain for these habitats and prevent further impairment.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address disease or predation

14.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.1.1.1. **Action Step:** Evaluate impacts of predation from introduced species in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

15.1.1. **Recovery Action:** Prevent impairment to watershed processes

15.1.1.1. **Action Step:** Five populations in Stratum were identified with a high fire threat. A Fire Response Plan should be developed in coordination with relevant agencies to ensure protection of CCC coho salmon and their habitats.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the overutilization for commercial, recreational, scientific or educational purposes

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Work with CDFG and Fish and Game Commission to improve freshwater sport fishing regulations to minimize unintentional and unauthorized take, and incidental mortality, of CCC coho salmon by anglers during the CCC coho salmon migration period in the Santa Cruz Mountains Diversity Stratum. This effort could include development specific emergency regulations during adult migration periods, development of appropriate low-flow closure thresholds and angler outreach programs.

17. Threat- Hatcheries

17.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

17.1.1. **Recovery Action:** Improve density, abundance, spatial structure, and diversity

17.1.1.1. **Action Step:** Ensure the threat of hatcheries remains low. See Viability actions for specific recommendations regarding hatchery practices.

18. **Threat- Livestock**

18.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

18.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Livestock

19. **Threat- Logging**

19.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.1.1. **Recovery Action:** Prevent impairment to watershed processes

19.1.1.1. **Action Step:** Explore feasibility and benefits of HCP, GCP or safe harbor with CalFire, BOF, industrial and non-industrial forestland owners (e.g., Soquel Demonstration State Forest, Big Creek, CalPoly, etc.). Facilitate as soon as possible mechanisms to promote sustainable forestry practices and reduce forest conversions which including development of county ordinances, BOF rule changes to conversion permits, incentives for sustainable practices, etc.

20. **Threat- Mining**

20.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

20.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Mining

21. **Threat- Recreation**

21.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

21.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Recreation

22. **Threat- Residential/Commercial Development**

22.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

22.1.1. **Recovery Action:** Prevent impairment to watershed processes

22.1.1.1. **Action Step:** Four populations have high or very high threats from residential and commercial development. Recommend continuing the County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.

23. **Threat- Roads/Railroads**

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

23.1.1. **Recovery Action:** Prevent increased landscape disturbance

23.1.1.1. **Action Step:** The threat of roads rated the highest for this Stratum. Road effects to salmon and their habitats must be controlled by county-wide road management planning for mainline transportation, rural residential and other road corridors.

23.1.2. **Recovery Action:** Increase density, abundance, spatial structure and diversity

23.1.2.1. **Action Step:** Work with CalTrans to ensure the planned replacement of the existing Highway 1 bridge allows complete restoration of Scott Creek and its estuary which are critical to smolt health and marine survival. Scott Creek is a critical watershed to preserve coho salmon across the Stratum.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

24.1.1. **Recovery Action:** The threat of severe weather was found high or very high across 6 populations. A regional severe weather plan should be developed that addresses proactive measures for climate change and a drought/flooding management and response plan.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.1.1.2. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Improve flow conditions

25.2.1.1. **Action Step:** Petition SWRCB to declare CCC coho salmon watersheds with existing populations and ongoing diversions in the Santa Cruz Mountains Diversity Stratum declared as fully appropriated during the summer months. Encourage water right applications for existing rights holders who seek to shift the timing or manner of diversion from a less protective to more protective practice.

25.2.1.2. **Action Step:** Work with major water diverters and others to encourage development of a regional HCP in the streams of Santa Cruz County as opposed to individual stand-alone HCPs.

25.2.1.3. **Action Step:** Encourage the County of Santa Cruz to develop a conjunctive management plan for water resources in mid-County streams.

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of habitat or range

26.1.1. **Recovery Action:** Implement ESU and population level recovery actions for Watershed Processes

Central CA Coast Coho Salmon ~ San Francisco Bay Diversity Stratum

ACTIONS FOR RESTORING HABITATS

Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impact to landscape patterns

5.1.1.1. **Action Step:** Evaluate the feasibility and likelihood of success of re-establishing coho salmon populations into tributaries on the SF Bay where potential habitat exists. In addition, efforts should continue to protect those habitats from further degradation to increase the likelihood of successful re-establishment in the future.

FOCUS POPULATIONS

Albion River

Location	•Mendocino County
Watershed Area	•43 Square Miles
Potential Habitat	•59.2 Stream Miles
Vegetation	•74% Coniferous, 8% Riparian or Hardwood Forest
Erodability	•Moderate
Ownership Patterns	•99% Private; 1% Public
Dominant Land Uses	•Timber Harvest
Housing Density	•Moderately Low
TMDL Pollutants	•Sediment, Temperature

Albion River estuary
Photo provided by Friends of the Gualala River, photographer Rixanne Wehren, and is used with permission. All rights reserved.

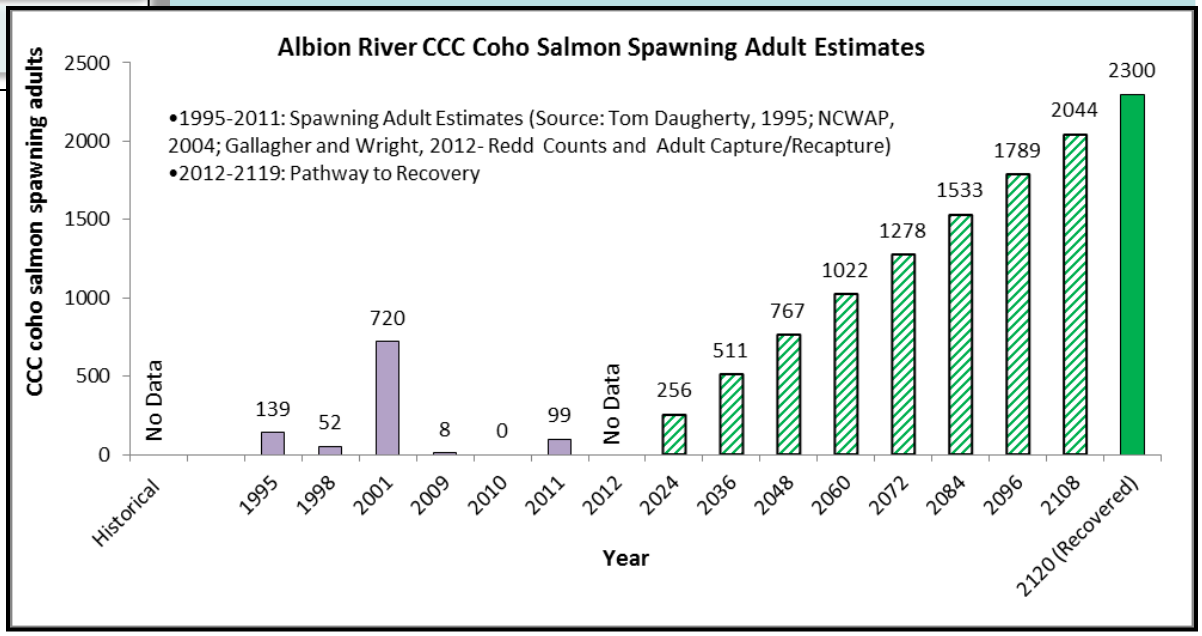
Albion River Coho Salmon: Persistent – Moderate Abundance

Recovery Goals
✓Consider establishment of life cycle monitoring station

Albion River
Adult Spawner Targets

Downlisting to Threatened
1,150

Delisting
2,300



STEELHEAD: YES
CHINOOK SALMON: YES

Albion River

Potential Habitat: 59.2 miles
Recovery Target: 2,300 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	GOOD	FAIR	POOR	FAIR	FAIR	GOOD	FAIR	FAIR

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Retain, recruit and actively input large wood into streams
- Eliminate depletion of summer flows
- Treat high priority slides and landings to reduce sediment input
- Consider establishing a life-cycle monitoring station

Priority 2 & 3: Long-Term Restoration Actions

- Replace riprap with bioengineered solutions and LWD in the estuary
- Promote restoration projects designed to create or restore off channel habitat
- Promote off-channel storage
- Investigate the feasibility of removing the earthen dam on Marsh Creek
- Restore and protect riparian vegetation
- Conduct coho salmon carcass surveys

Recovery Partners

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, Eli Asarian and Morgan Bond, SWFSC

Albion River

Potential Habitat: 59.2 miles
Recovery Target: 2,300 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	LOW	LOW	MEDIUM	LOW	NA	LOW	MEDIUM	NA	LOW	MEDIUM	HIGH	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Prevent impairment of instream substrate and food productivity
- Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Design new roads that are hydrologically disconnected from the stream network and use best management practices for maintenance, management and decommissioning

Priority 2 & 3: Long-Term Threat Abatement Actions

- Prevent increased landscape disturbance from logging
- Reduce the percent acres of the watershed harvested to less than 25 percent in a ten year period
- Discourage home building or other incompatible land use in areas identified as timber production zones
- Limit winter use of unsurfaced roads and recreational trails
- Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes

Wild coho salmon in Albion River. *Photo courtesy:Marilyn Stubbs*

Conservation Highlights

- The County of Mendocino has recently improved passage on the mainstem Albion by replacing a problematic culvert.
- The Mendocino Redwood Company has made road upgrades and improved passage by replacing old culverts with bridges that allow for improved passage for salmonids.

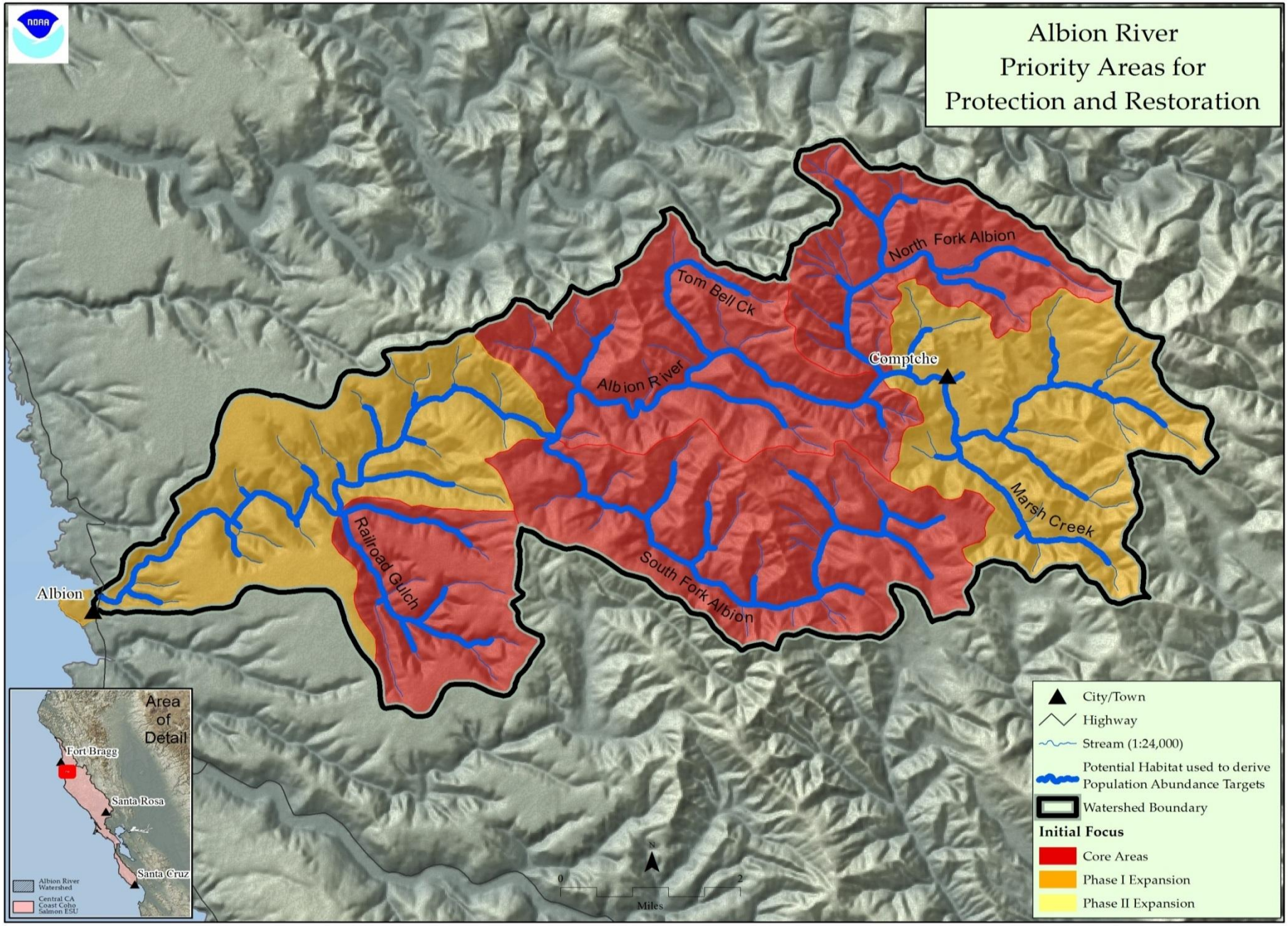


Figure 1: Map of Albion River

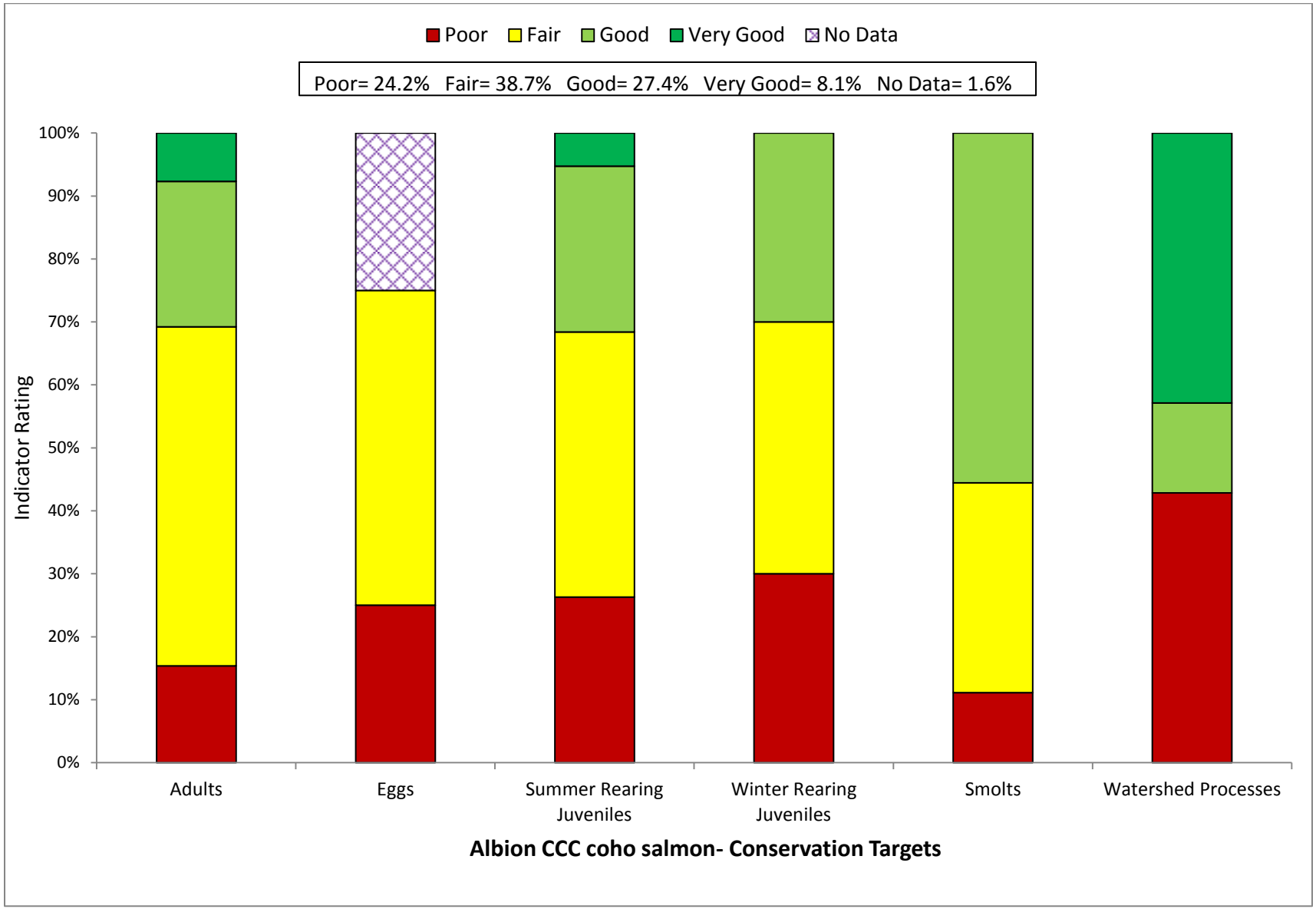


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Albion River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**2.1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**1-1.3 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50-74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**91% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**43% Class 5 & 6 across IP-km**	Fair	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**0**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**4.4 spawner/IP-km**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**ND**	0	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**<50% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**2.1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**1-1.3 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**22% streams; 2% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**33% streams; 44% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**11% streams; 2% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =67**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score= 51-75**	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**1.1 - 5 Diversions/10 IP km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**>90% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**75% to 90% of streams/ IP-km (>85% average stream canopy)**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**43% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**0**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**>90% of streams/ IP-km maintains severity score of 3 or lower**	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**2.1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**1-1.3 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<50% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**75% of IP-km to 90% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**43% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**0**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.89 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces moderate risk spawner density**	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.14% of Watershed in Impervious Surface**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.06% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**41% of Watershed in Timber Harvest**	Poor	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**8% of watershed >1 unit/20 acres**	Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**>75% Intact Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**7.7 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**6.4 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Albion River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Low	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition	Low	-	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Medium	Medium
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Low	High	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Medium	Medium
12	Roads and Railroads	Medium	High	Medium	Medium	Low	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Low	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	Medium	Medium	Medium	Medium	High	High

Central CA Coast Coho Salmon ~ Albion River

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase and enhance habitat complexity features

1.1.1.1. **Action Step:** Remove riprap and gabion rock within the estuary and restore with a bioengineering solution.

1.1.1.2. **Action Step:** Identify key locations to install LWD structures to improve shelter within the estuary.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.1.1.2. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.1.1.1. **Action Step:** Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.

3.1.1.2. **Action Step:** Utilize information developed on LWD demand and recruitment potential in the MRC Albion Watershed Analysis.

3.1.1.3. **Action Step:** Improvement of in-channel LWD densities, and associated habitat benefits, could be most easily accomplished by the addition of large key pieces, conifer trees and root wads. It is recommended that this be achieved by cutting large trees and dropping them into the channel, or preferably by pulling them partially into the channel complete with rootwad, at appropriate upstream locations. Downed logs may be transported to proper location to be placed in the stream.

3.1.1.4. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking. Consider falling existing riparian trees as a method to increase complexity and LWD frequencies.

3.1.2. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.2.1. **Action Step:** Increase the frequencies to 75% of the streams within the watershed

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the Comptche area to minimize effects to the North Fork Albion and mainstem Albion.

4.1.1.2. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.1.2. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.2.1. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water uses.

4.1.2.2. **Action Step:** Require streamflow gaging devices to determine the level of impairment to natural flow. Determine sites appropriate for gaging below Comptche on the mainstem and the North Fork.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with road density

5.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

5.1.1.2. **Action Step:** Reduce adverse impacts to watershed processes associated with timber harvest

5.1.1.3. **Action Step:** Reduce the amount and rate of even aged management.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Identify and remove existing passage barriers.

6.1.1.1. **Action Step:** Investigate the feasibility of removing the earthen dam on Marsh Creek to increase habitat availability for coho salmon.

6.1.1.2. **Action Step:** Investigate a potential passage barrier for coho salmon on the South Fork Albion River below Bull Team Gulch. A low flow concrete structure placed in the mid-1990s may be causing passage problems for adult coho salmon.

6.1.1.3. **Action Step:** Continue to identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for coho salmon (CDFG 2004). Focus efforts on the Albion River and tributaries in the eastern part of the watershed.

8.1.1.2. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Investigate additional conservation easements with MRC, or other willing landowners in Core and Phase I stream reaches.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Treat high priority slides and landings that are identified in the MRC Albion River Watershed Analysis or other credible assessments.

9.1.1.2. **Action Step:** Provide incentives to restore high priority sites as determined by watershed analysis, CDFG, or CalFire.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Monitor the response of population abundance and key habitat attributes to recovery efforts across the watershed.

10.1.1.2. **Action Step:** Conduct coho salmon carcass surveys in areas of the mainstem Albion, South Fork Albion, and the North Fork Albion, and selected tributaries.

10.1.1.3. **Action Step:** The Albion watershed should be considered for a coho salmon life-cycle monitoring station.

10.1.1.4. **Action Step:** Support a community based salmonid monitoring program in the Albion watershed.

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.1.1. **Recovery Action:** Prevent increased landscape disturbance

19.1.1.1. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas.

19.1.1.2. **Action Step:** Reduce the percent acres of the watershed harvested to less than 25 percent in a ten year period.

19.1.1.3. **Action Step:** Work with private landowners to achieve reductions in area harvested.

19.1.1.4. **Action Step:** Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.1.1.5. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.1.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

23.1.1.3. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.4. **Action Step:** Assess and implement actions that hydrologically disconnect roads or reduce sediment sources in Core CCC coho salmon areas within five years, Phase I within 10 years, and Phase II areas within 15 years (from 2010).

23.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Assess and implement road upgrades on Docker Hill Road along the North Fork Albion River.

23.2.1.2. **Action Step:** Conduct road and sediment assessment on the Comptche Ukiah Road segment that drains to the Albion Watershed.

23.2.1.3. **Action Step:** Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology.

24.1.1.1. **Action Step:** Identify and work with water users in the Comptche area to minimize depletion of summer base flows during droughts. Provide restoration funding for alternatives such as storage tanks and rainwater harvest to rural residential residents.

24.1.1.2. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Albion River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
AIR-CCC-1.1.1	Recovery Action	Estuary	Increase and enhance habitat complexity features										
AIR-CCC-1.1.1.1	Action Step	Estuary	Remove riprap and gabion rock within the estuary and restore with a bioengineering solution.	2	5	California Coastal Conservancy, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited							Cost determined by extent of riprap and gabion rock to be removed and suitable bioengineered solution to employ.
AIR-CCC-1.1.1.2	Action Step	Estuary	Identify key locations to install LWD structures to improve shelter within the estuary.	2	10	CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners	125.00	125.00				250	Based on implementing 10 LWD at a rate of $25,000/mile.
AIR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
AIR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
AIR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFG, Mendocino Redwood Company, Private Landowners, Trout Unlimited	20.00					20	Use existing MRC watershed analysis, and channel typing information from habitat typing with field verification to determine floodplain restoration sites.
AIR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners	5.50	5.50				11	Use information from Action Step #1 to determine reaches for restoration. Cost based on treating 3 miles (assume 1 project per mile in 5% High IP) at a rate of $36,046/mile.
AIR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
AIR-CCC-3.1.1.1	Action Step	Habitat Complexity	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	1	2	CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners, Trout Unlimited						In-Kind	Work with stakeholders to develop a Plan.
AIR-CCC-3.1.1.2	Action Step	Habitat Complexity	Utilize information developed on LWD demand and recruitment potential in the MRC Albion Watershed Analysis.	2	2	CDFG, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						In-Kind	This recommendation will direct other action steps.
AIR-CCC-3.1.1.3	Action Step	Habitat Complexity	Improvement of in-channel LWD densities, and associated habitat benefits, could be most easily accomplished by the addition of large key pieces, conifer trees and root wads. It is recommended that this be achieved by cutting large trees and dropping them into the channel, or preferably by pulling them partially into the channel complete with rootwad, at appropriate upstream locations. Downed logs may be transported to proper location to be placed in the stream.	2	10	CalFire, CDFG, Private Landowners	440.00	440.00				880	Cost based on treating 35 miles (assume 50% High IP) at a rate of $25,000/mile.
AIR-CCC-3.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking. Consider falling existing riparian trees as a method to increase complexity and LWD frequencies.	3	50	CDFG, Mendocino Redwood Company, Private Landowners, Trout Unlimited						In-Kind	
AIR-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
AIR-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase the frequencies to 75% of the streams within the watershed	2	20	Campbell Timberland Management, CDFG, NMFS, NOAA RC						TBD	Cost should be accounted for in increase LWD frequency and primary pools.
AIR-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
AIR-CCC-4.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the Comptche area to minimize effects to the North Fork Albion and mainstem Albion.	2	5	NOAA RC, NRCS, Private Landowners, SWRCB	50.00					50	Cost based on small number of landowners participating in program during the first five years.
AIR-CCC-4.1.1.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	2	30	CDFG, NOAA RC, Private Landowners, SWRCB							
AIR-CCC-4.1.2	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
AIR-CCC-4.1.2.1	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	60	CDFG Law Enforcement, NMFS OLE, SWRCB						In-Kind	Continued enforcement will likely be required.
AIR-CCC-4.1.2.2	Action Step	Hydrology	Require streamflow gaging devices to determine the level of impairment to natural flow. Determine sites appropriate for gaging below Comptche on the mainstem and the North Fork.	3	10	CDFG, Mendocino Redwood Company, NMFS HCD, Private Landowners, USGS	100.00	100.00				200	Based on 2 gages for 10 years.
AIR-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
AIR-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with road density										
AIR-CCC-5.1.1.1	Action Step	Landscape Patterns	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, Campbell Timberland Management, Private Landowners	300.00	300.00	300.00	300.00		1,200	Costs may be significant and benefits should be weighed against additional upland disturbance and overall costs. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 93 miles of road network at a rate of $12,000/mile.
AIR-CCC-5.1.1.2	Action Step	Landscape Patterns	Reduce adverse impacts to watershed processes associated with timber harvest										
AIR-CCC-5.1.1.3	Action Step	Landscape Patterns	Reduce the amount and rate of even aged management.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
AIR-CCC-6.1.1	Recovery Action	Passage	Identify and remove existing passage barriers.										
AIR-CCC-6.1.1.1	Action Step	Passage	Investigate the feasibility of removing the earthen dam on Marsh Creek to increase habitat availability for coho salmon.	2	2	CDFG, NOAA RC, Private Consultants, Private Landowners	126.00					126	Cost based on treating non-structural element at a rate of $126,000/unit.
AIR-CCC-6.1.1.2	Action Step	Passage	Investigate a potential passage barrier for coho salmon on the South Fork Albion River below Bull Team Gulch. A low flow concrete structure placed in the mid-1990s may be causing passage problems for adult coho salmon.	2	5	CDFG, Mendocino Redwood Company, NOAA RC	75.00					75	Cost based on estimate by NMFS staff. Small concrete structure was constructed in early 1990's. This structure needs to be evaluated and may need to be removed or modified.
AIR-CCC-6.1.1.3	Action Step	Passage	Continue to identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	20	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NMFS, Private Landowners						In-Kind	
AIR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
AIR-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter										
AIR-CCC-8.1.1.1	Action Step	Riparian	Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for coho salmon (CDFG 2004). Focus efforts on the Albion River and tributaries in the eastern part of the watershed.	2	20	CDFG, Private Landowners	1,605	1,605	1,605	1,605		6,420	Cost based on treating 4 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.
AIR-CCC-8.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Investigate additional conservation easements with MRC, or other willing landowners in Core and Phase I stream reaches.	3	20	CDFG, Private Landowners						TBD	Cost will depend on size and scope of easements, current market value, and rate of turnover.
AIR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
AIR-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-9.1.1.1	Action Step	Sediment	Treat high priority slides and landings that are identified in the MRC Albion River Watershed Analysis or other credible assessments.	1	10	CDFG, Mendocino County, NOAA RC, Private Landowners						TBD	Need additional analysis to estimate. Cost for sediment assessment is estimated at 70,000.
AIR-CCC-9.1.1.2	Action Step	Sediment	Provide incentives to restore high priority sites as determined by watershed analysis, CDFG, or CalFire.	2	20	CDFG, FishNet 4C, NOAA RC, NRCS						TBD	Additional information needed.
AIR-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**										
AIR-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
AIR-CCC-10.1.1.1	Action Step	Viability	Monitor the response of population abundance and key habitat attributes to recovery efforts across the watershed.	3	24	CDFG, Mendocino Redwood Company, NMFS PRD, Private Landowners	250.00	250.00	250.00	250.00	200.00	1,200	Based on 50k per year for two 4 generation (12 year) periods, a total of 24 years , as suggested in Spence et al. (2008).
AIR-CCC-10.1.1.2	Action Step	Viability	Conduct coho salmon carcass surveys in areas of the mainstem Albion, South Fork Albion, and the North Fork Albion, and selected tributaries.	2	20	CDFG, Mendocino Redwood Company, NMFS PRD	83.25	83.25	83.25	83.25		333	Cost to conduct annual spawner survey for N. Central Coastal diversity stratum estimated at $16,650/year.
AIR-CCC-10.1.1.3	Action Step	Viability	The Albion watershed should be considered for a coho salmon life-cycle monitoring station.	1	20	CDFG, NMFS, Private Landowners	500	500	500	500		2,000	Cost based on $100k per year for 20 years.
AIR-CCC-10.1.1.4	Action Step	Viability	Support a community based salmonid monitoring program in the Albion watershed.	3	10	CDFG, NOAA RC, Private Landowners, Public							Cost accounted for in above action step. Cost could be less with community involvement.
AIR-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
AIR-CCC-10.1.2.1	Action Step	Viability	Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	3	15	CDFG, Private Landowners						TBD	Identify suitable imprinting stations and annual availability of smolts.
AIR-CCC-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										
AIR-CCC-19.1.1	Recovery Action	Logging	Prevent increased landscape disturbance	2	20	CalFire, CDFG, Mendocino County, NMFS, Private Landowners, Public, USFWS						TBD	Cost is expected to be the result of focused staff time directed at Mendocino BOS and various land use organizations.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-19.1.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas.	2	20	CalFire, CDFG, NMFS PRD, RWQCB						In-Kind	
AIR-CCC-19.1.1.2	Action Step	Logging	Reduce the percent acres of the watershed harvested to less than 25 percent in a ten year period.	2	20	CalFire, CDFG, Mendocino Redwood Company, NMFS PRD, Private Landowners, RWQCB						TBD	Work with private and corporate companies to reduce annual acres harvested.
AIR-CCC-19.1.1.3	Action Step	Logging	Work with private landowners to achieve reductions in area harvested.	2	20	CDFG, Mendocino Redwood Company, NMFS PRD, Private Landowners, RWQCB						In-Kind	
AIR-CCC-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3	60	CalFire, CDFG, Mendocino County, NMFS HCD, NMFS PRD, Private Landowners						In-Kind	This recommendation should be considered standard practice.
AIR-CCC-19.1.1.5	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	60	CalFire, Mendocino County, Mendocino Redwood Company, NMFS HCD						In-Kind	
AIR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
AIR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
AIR-CCC-23.1.1.1	Action Step	Roads/Railroads	Minimize new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	20	CDFG, Mendocino Redwood Company, Private Landowners, RWQCB						TBD	Cost associated with increased costs for land managers is unknown at this time, additional analysis needed to determine.
AIR-CCC-23.1.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	5	CDFG, NOAA RC, NRCS, Private Landowners, RCD	50.00					50	Estimated cost for materials to block roads and trails, large rock and gates.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-23.1.1.3	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	20	Mendocino County, NOAA RC, NRCS, Private Landowners, RCD						TBD	Number of rural roads and associated costs are unknown at this time.
AIR-CCC-23.1.1.4	Action Step	Roads/Railroads	Assess and implement actions that hydrologically disconnect roads or reduce sediment sources in Core CCC coho salmon areas within five years, Phase I within 10 years, and Phase II areas within 15 years (from 2010).	2	15	CDFG, Mendocino Redwood Company, Private Landowners, RWQCB						TBD	Many road upgrades have been done in this watershed. Additional information needed on the remaining road segments that need work to estimate cost.
AIR-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
AIR-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
AIR-CCC-23.2.1.1	Action Step	Roads/Railroads	Assess and implement road upgrades on Docker Hill Road along the North Fork Albion River.	1	10	Campbell Timberland Management, CDFG, Mendocino County, NOAA RC, Private Landowners						TBD	
AIR-CCC-23.2.1.2	Action Step	Roads/Railroads	Conduct road and sediment assessment on the Comptche Ukiah Road segment that drains to the Albion Watershed.	2	5	Mendocino County Department of Public Works, NOAA RC	50.00					50	May be possible to use some existing Mendocino County DOT road data.
AIR-CCC-23.2.1.3	Action Step	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	10	CDFG, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners, RWQCB						In-Kind	
AIR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
AIR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology.			CDFG							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
AIR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users in the Comptche area to minimize depletion of summer base flows during droughts. Provide restoration funding for alternatives such as storage tanks and rainwater harvest to rural residential residents.		10	Mendocino County, NOAA RC, Private Landowners, Trout Unlimited	500	500				1,000	Estimate based on 100 land owners at 10k per water storage system.
AIR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	2	20	CDFG, Private Landowners, SWRCB						TBD	The main benefit of this action is to improve flow conditions in the lower portion of the watershed where the majority of home owners and agricultural use occurs. Cost for a stream flow model estimated at $63,005. Acquiring or leasing water is contingent upon landowner participation and extent of protection for base flows.

Aptos Creek

Location	•Santa Cruz County
Watershed Area	• 24.5 Square Miles
Potential Habitat	•26.0 Stream Miles
Vegetation	•68% Coniferous •11% Oak Woodland
Erodability	•Low to Moderate
Ownership Patterns	•52% Private; 48% Public
Dominant Land Uses	•Rural Residential, Timber, Agricultural
Housing Density	•Moderate to High
TMDL Pollutants	•Pathogens, Sediment

Rio Del mar Beach lagoon, *Santa Cruz Sentinel*

Aptos Creek Coho Salmon: Nearly Extirpated

Recovery Goals

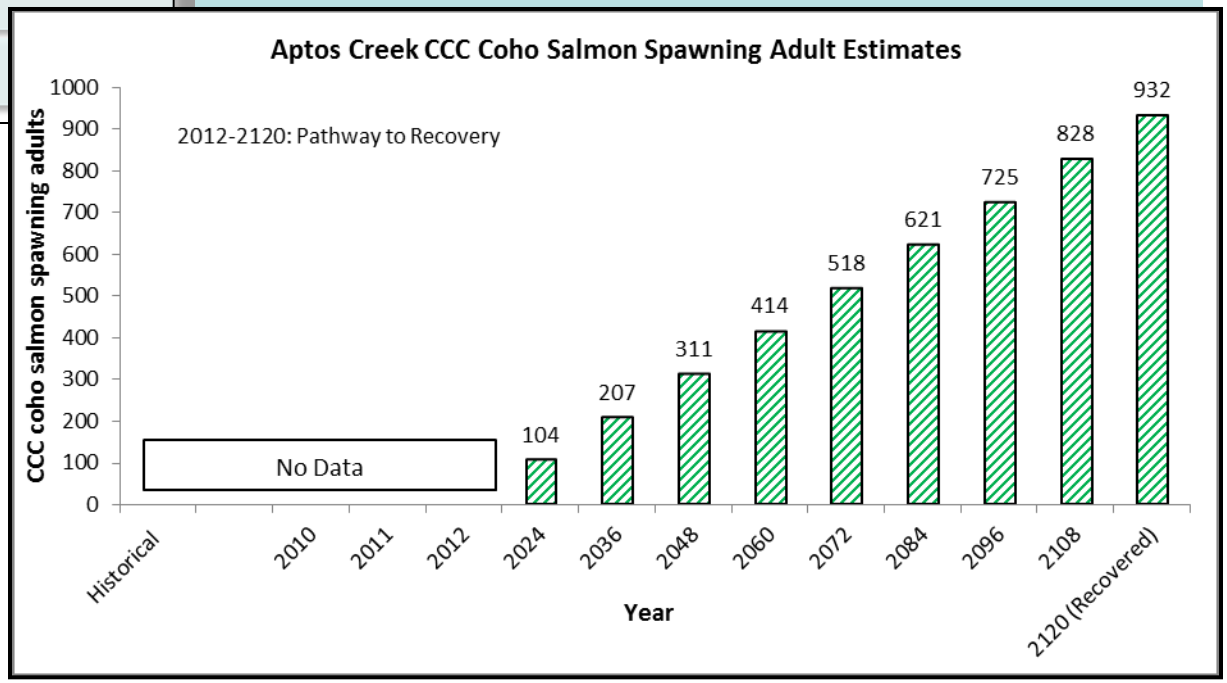
✓ CCC coho range recently extended to include Aptos Creek
✓Maintaining genetic diversity of this southernmost population
✓ Improve estuary lagoon management

Aptos Creek
Adult Spawner Targets

Downlisting to Threatened
466

Recovery
932

STEELHEAD: YES
CHINOOK SALMON: NO



Aptos Creek

Potential Habitat: 26.0 miles
Recovery Target: 932 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	GOOD	GOOD	FAIR	POOR	FAIR	POOR	POOR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Preclude new construction within remaining portions of the estuary
- Educate landowners, land managers, and County and municipal staffs on the importance of LWD
- Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements
- Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds

Priority 2 & 3: Long-Term Restoration Actions

- Ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws
- Post interpretive signs to discourage breaching of the lagoon
- Enhance aquatic cover and substrate in estuary
- Create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Incorporate large woody material into stream bank protection projects
- Implement a monitoring program
- Monitor instream summer water temperatures

Recovery Partners

California State Parks, Santa Cruz RCD, County of Santa Cruz, Coastal Watershed Council

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, City of Santa Rosa and Morgan Bond, SWFSC

Aptos Creek

Potential Habitat: 26.0 miles
Recovery Target: 932 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	HIGH	MEDIUM	HIGH	MEDIUM	NA	LOW	MEDIUM	NA	MEDIUM	HIGH	VERY HIGH	HIGH	HIGH

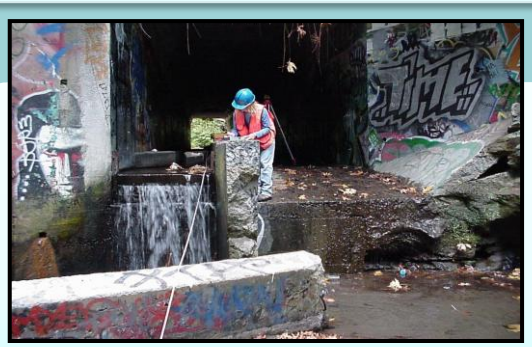
Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Design new development to allow streams to meander in historical patterns
- Discourage forest conversions to vineyards or rural residential housing
- Design new development and roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions
- Ensure current and future water supply demands can be met without impacting surface flow

Priority 2 & 3: Long-Term Threat Abatement Actions

- Eliminate the use of gabion baskets and undersized rock within the bankfull channel
- Implement sedimentation reduction techniques in concert with prescribed and fire suppression techniques
- Monitor the river mouth until river flows naturally breach the sandbar
- Ensure roads, hiking trails, and biking paths are winterized
- Educate landowners regarding the importance of maintaining instream large wood materials
- Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded



Culvert in Valencia Creek prior to being retrofitted with a new fish ladder in 2007, *photo by Ross Taylor and Associates*

Conservation Highlights

- The Coastal Watershed Council monitors the Aptos Creek watershed and has conducted a watershed assessment.
- Fish passage improvement at Valencia Creek culvert has been completed and improvements to a pipeline crossing are proposed which will improve fish passage. Culvert improvements were partially funded by fine monies from a NOAA enforcement case.

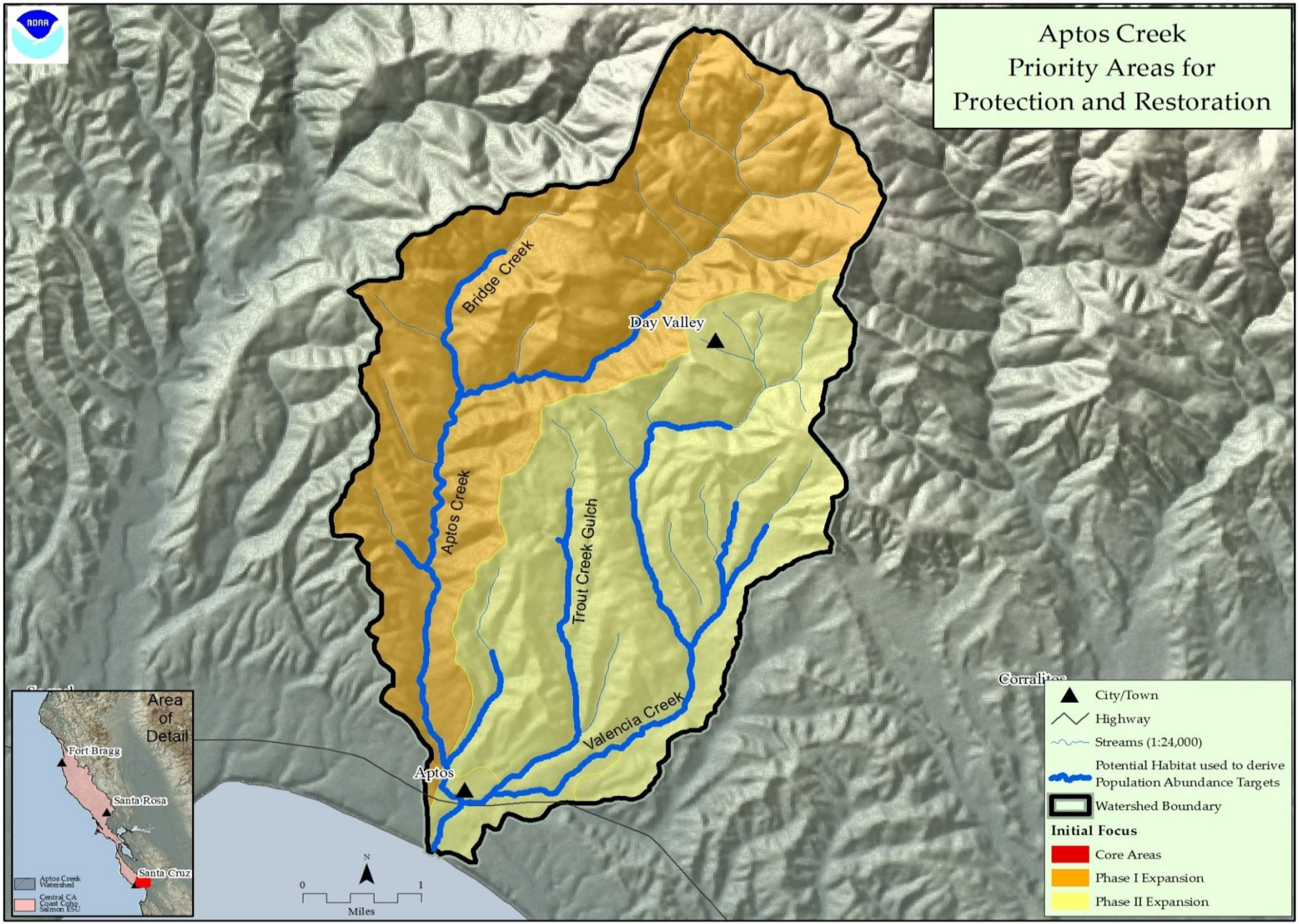


Figure 1: Map of Aptos Creek

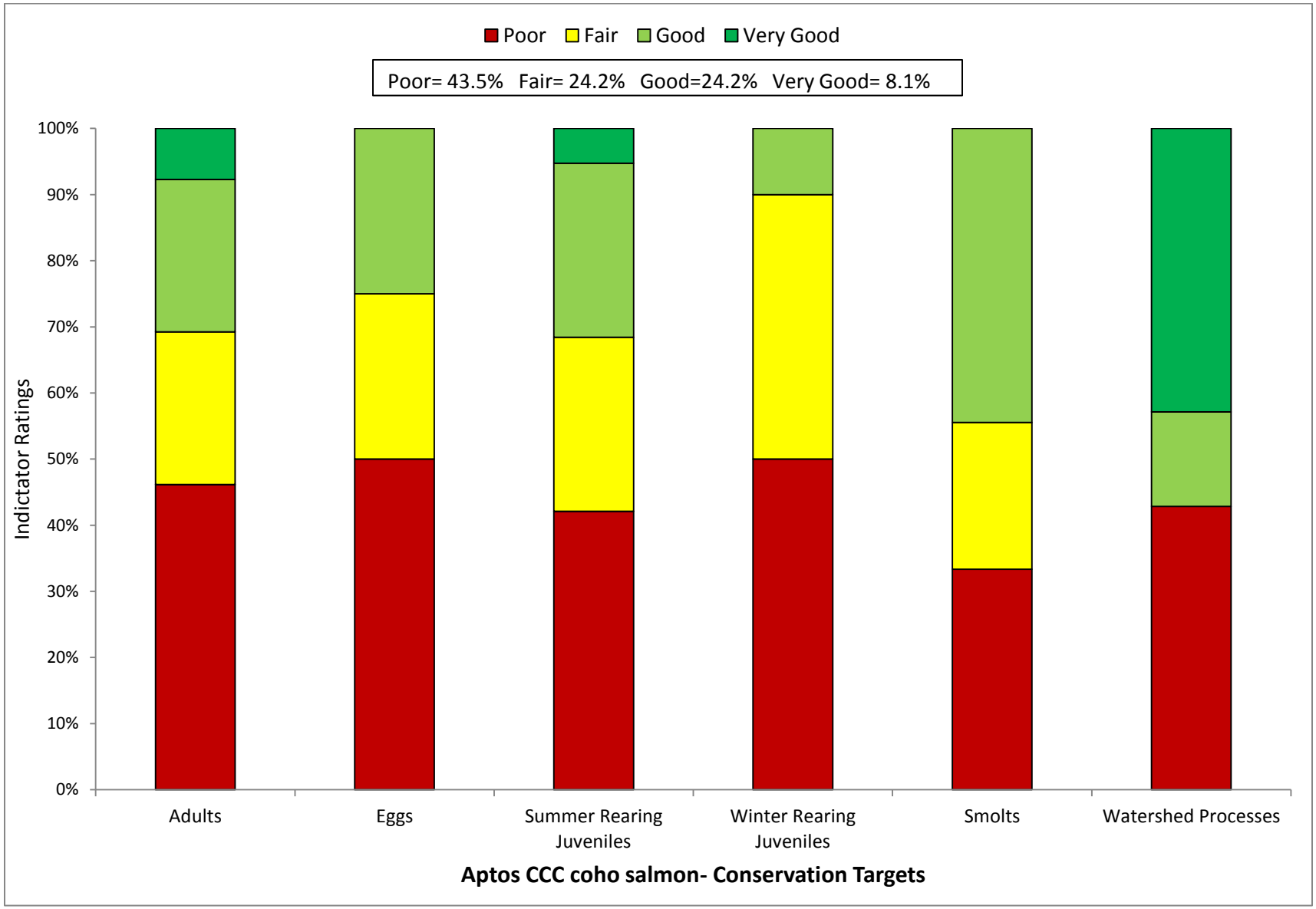


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Aptos Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**1.3 to 4 Key Pieces/100m**	Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**25% streams 49% IP (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**75 to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**<50% of IP-km or <16 IP-km accessible**	Poor	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**< 1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**25% streams 7% IP (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired and not functioning**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**1.3 to 4 Key Pieces/100 meters**	Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**25% streams 47 IP (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**25% streams 47% IP (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score 35-50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score <35**	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.37 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**50% of IP-km to 74% of IP-km accessible**	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**87% of streams/IP with average canopy >85%**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**25% streams 7% IP (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**1.3 to 4 Key Pieces/100 meters**	Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**25% streams 47% IP (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**50% of IP-km to 74% of IP-km accessible**	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**25% streams 7% IP (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.37 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density =0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**1.74% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**2.117% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**7% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**51% Historical Species Composition**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Intact Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**3.7 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.6 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Aptos Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Low	Medium	Low	Low	Low	Medium
2	Channel Modification	Medium	Low	High	Medium	High	Low	High
3	Disease, Predation and Competition	Medium	-	High	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	High	Medium	Medium	High	Medium	Medium	High
5	Fishing and Collecting	Medium	-	Medium	-	High	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Low	Medium	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Medium	Medium	Medium	Low	Medium	Medium	Medium
11	Residential and Commercial Development	High	High	High	High	High	Medium	High
12	Roads and Railroads	High	High	High	High	High	High	Very High
13	Severe Weather Patterns	High	Medium	Medium	High	Medium	Medium	High
14	Water Diversion and Impoundments	High	Medium	Medium	Low	High	Medium	High
Threat Status for Targets and Project		Very High	High	High	High	High	High	Very High

Central CA Coast Coho Salmon ~ Aptos Creek

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Evaluate restoration benefits to tidal prism by reducing the size of the Esplanade Parking Lot.

1.1.1.2. **Action Step:** Narrow Moosewood Drive and/or State Parks property down to one lane to expand overall tidal prism.

1.1.1.3. **Action Step:** Develop and implement other strategies to increase the current extent of the estuary/lagoon in efforts to increase high value habitat for migrating and rearing salmonids.

1.1.2. **Recovery Action:** Develop and implement programs to address water quality concerns.

1.1.2.1. **Action Step:** Isolate and correct source of impaired water quality in the lower Aptos Creek watershed.

1.1.2.2. **Action Step:** Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.

1.1.2.3. **Action Step:** Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.

1.1.2.4. **Action Step:** Enhance streambed aquatic cover and substrate in estuary.

1.1.2.5. **Action Step:** Encourage repaving and application of petrochemicals in the early summer to allow penetration and drying before fall rains.

1.1.2.6. **Action Step:** Use gull-proof lids on refuse cans at and around the lagoon and beach.

1.1.2.7. **Action Step:** Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary

1.1.2.8. **Action Step:** Develop and implement programs to address ongoing poor water quality in Aptos Lagoon.

1.1.3. **Recovery Action:** Reduce frequency of artificial breaching events

1.1.3.1. **Action Step:** Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.

1.1.4. **Recovery Action:** Reduce extent of estuarine shoreline development

1.1.4.1. **Action Step:** Preclude, prohibit or prevent the construction of new buildings and associated infrastructure within remaining open areas of the Aptos estuary tidal prism.

1.1.5. **Recovery Action:** Improve the quality of each estuarine habitat zone

1.1.5.1. **Action Step:** Evaluate and implement programs to enhance native riparian and wetland flora, reducing habitat related effects of past or present land-uses.

1.1.6. **Recovery Action:** Increase and enhance habitat complexity features

1.1.6.1. **Action Step:** Identify key locations and install large wood structures (or other appropriate surrogate) targeting increased pool depth and shelter within the estuary.

1.1.7. **Recovery Action:** Reduce toxicity and pollutants

1.1.7.1. **Action Step:** Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewer systems and storm drains.

1.1.7.2. **Action Step:** Evaluate and repair private sewer laterals, particularly in areas subject to high groundwater adjacent or upstream of the estuary.

1.1.7.3. **Action Step:** Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.

1.1.8. **Recovery Action:** Increase freshwater lagoon elevation during seasonal closures

1.1.8.1. **Action Step:** Evaluate and implement possible structural improvements to maintain lagoon water surface elevations during the summer through the late fall.

1.1.8.2. **Action Step:** Evaluate benefits of installation of a flume to control water surface elevation in the lagoon during summer and fall.

1.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.2.1. **Recovery Action:** Reduce frequency of artificial breaching events

1.2.1.1. **Action Step:** Encourage State Parks and County of Santa Cruz to fence off lagoon with temporary fencing rather than breach lagoon as a precaution to protect public health and safety.

1.2.1.2. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

1.2.1.3. **Action Step:** Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Aptos Creek lagoon.

1.2.1.4. **Action Step:** Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Institutionalize programs to purchase land/conservation easements to encourage the re-establishment of natural riparian communities. Prioritize Phase I areas (mainstem Aptos Creek) as well as the lagoon.

2.1.1.2. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.3. **Action Step:** Target habitat restoration and enhancement projects that will function between winter baseflow and flood stage.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Install large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.1.2. **Action Step:** Incorporate large woody material into stream bank protection projects, where appropriate.

3.1.1.3. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.

3.1.1.4. **Action Step:** Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.1.5. **Action Step:** Encourage retention of large woody debris for all historical coho salmon rearing habitats in Aptos Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.1.6. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.2. **Recovery Action:** Improve shelter rating

3.1.2.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.1.3. **Recovery Action:** Increase frequency of primary pools

3.1.3.1. **Action Step:** Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (DFG 2004).

3.1.4. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.4.1. **Action Step:** Increase the frequencies of riffle habitat in 75% of the streams within the watershed

4. Restoration- Hydrology

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

5.1.1.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources

5.1.2. **Recovery Action:** Reduce adverse impacts to watershed processes associated with streamside road density (< 100 meters)

5.1.2.1. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.2.2. **Action Step:** Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

5.1.2.3. **Action Step:** Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.

6. **Restoration- Passage**

No species-specific actions were developed.

7. **Restoration- Pool Habitat**

No species-specific actions were developed. See Habitat Complexity.

8. **Restoration- Riparian**

No species-specific actions were developed.

9. **Restoration- Sediment**

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into Aptos Creek.

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Prioritize and treat erosion sources in Table 11 of the Aptos Geomorphic and Erosion Source Technical Report.

9.1.2.2. **Action Step:** Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

10. **Restoration- Viability**

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Initiate juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

10.2.2. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.2.2.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. The upper portion of Aptos Creek should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2.2.2. **Action Step:** Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.

10.2.3. **Recovery Action:** Increase spawner density

10.2.3.1. **Action Step:** Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery

10.2.3.2. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species range or habitat

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.

11.1.2. **Recovery Action:** Reduce toxicity and pollutants

11.1.2.1. **Action Step:** Remove invasive exotic vegetation at problematic sites, such as the Old Mill site, and revegetate with native plants.

11.1.2.2. **Action Step:** Install continuous water quality samplers in and adjacent to Mangels Gulch, Trout Gulch, and Valencia Creek.

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

11.1.3.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

11.1.3.3. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment to instream substrate

13.1.1.1. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.1.1.2. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.

13.1.1.3. **Action Step:** Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.

13.1.2. **Recovery Action:** Prevent impairment to habitat complexity

13.1.2.1. **Action Step:** Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

14.1.1.1. **Action Step:** Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation (i.e., eucalyptus, acacia, cape ivy) within the stream and riparian corridor.

14.2. **Objective:** Address disease or predation

14.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.2.1.1. **Action Step:** Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.5. **Action Step:** Encourage CalFire to provide plan to all non-County fire fighters when providing firefighting assistance in the Aptos Creek watershed (and all other watersheds in the County).

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Work with County planners to define future impacts of proposed rural development on fire suppression and fuel load buildup.

15.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.3.1. **Action Step:** Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.

15.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

15.2.1.2. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

15.2.1.3. **Action Step:** Avoid use of toxic aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.

15.2.1.4. **Action Step:** Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to site water quality and the structure of the biological community.

15.2.1.5. **Action Step:** Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.

16.1.1.2. **Action Step:** Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.

16.1.1.3. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) of fishing regulations low flow minimum flow closure for Aptos Creek.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

21.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

21.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

21.1.1.1. **Action Step:** Encourage development of a trail management plan/maintenance guidelines for Forest of Nisene Marks State Park. Use plan to develop a program to reduce erosion, decommission illegal or duplicate trails, and keep users on designated trails.

21.1.1.2. **Action Step:** Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

21.1.1.3. **Action Step:** Place educational materials/signage at stream crossings and interpretive centers about salmon and how to minimize impacts.

21.1.1.4. **Action Step:** Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.1.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

22.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

22.1.2.1. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.

22.1.2.2. **Action Step:** Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.

22.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

22.1.3.1. **Action Step:** Design new development to allow streams to meander in historical patterns, protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

22.1.3.2. **Action Step:** Santa Cruz County should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from flooding.

22.1.3.3. **Action Step:** Evaluate watershed for infrastructure for high risk of flooding.

22.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.1.4.1. **Action Step:** Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

22.1.5. **Recovery Action:** Prevent increased landscape disturbance

22.1.5.1. **Action Step:** Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.5.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.2.1.1. **Action Step:** Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.

22.2.2. **Recovery Action:** Prevent impairment to water quality

22.2.2.1. **Action Step:** Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the Aptos Creek Watershed.

22.2.2.2. **Action Step:** Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.

22.2.3. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.3.1. **Action Step:** Implement ordinances and policies so new development meets a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.

22.2.3.2. **Action Step:** As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.

22.2.4. **Recovery Action:** Prevent increased landscape disturbance

22.2.4.1. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.4.2. **Action Step:** Discourage Counties from rezoning forestlands to rural residential.

22.2.4.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.2.5. **Recovery Action:** Prevent impairment to floodplain connectivity.

22.2.5.1. **Action Step:** Minimize redevelopment within the 100 year floodplain.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

23.1.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.2.2. **Action Step:** Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.

23.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.3.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.3.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment and runoff related problems and determine level of hydrologic connectivity.

23.1.3.3. **Action Step:** Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.

23.1.3.4. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.3.5. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.1.3.6. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.3.7. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.3.8. **Action Step:** Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.

23.1.3.9. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.

23.1.3.10. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

23.1.4. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.4.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.1.5. **Recovery Action:** Prevent impairment to passage and migration

23.1.5.1. **Action Step:** Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

23.1.5.2. **Action Step:** All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.

23.1.5.3. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.6. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.6.1. **Action Step:** Discourage or eliminate unwanted vegetation types and species and promote desirable (native) vegetation.

23.1.6.2. **Action Step:** Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.1.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.2.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.2.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.2.2.3. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

23.2.2.4. **Action Step:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

23.2.2.5. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

23.2.2.6. **Action Step:** Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary

24.1.1.1. **Action Step:** Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).

24.1.1.2. **Action Step:** Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).

24.1.1.3. **Action Step:** Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.

24.1.2. **Recovery Action:** Prevent impairment to hydrology (impaired water flow)

24.1.2.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions.

24.1.2.2. **Action Step:** Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.

24.1.2.3. **Action Step:** Ensure all water diversions in the watershed are in compliance with all applicable laws and policies.

24.1.2.4. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.

24.1.3. **Recovery Action:** Prevent impairment to water quality

24.1.3.1. **Action Step:** Ensure tolerable water temperatures are maintained during drought periods.

24.1.3.2. **Action Step:** Implement performance standards in Stormwater Management Plans.

24.1.4. **Recovery Action:** Prevent impairment to passage and migration

24.1.4.1. **Action Step:** Work with CDFG, County of Santa Cruz and knowledgeable biologists to develop emergency rules and adopt implementation agreements.

24.1.4.2. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.

24.1.4.3. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could negatively impact coho salmon.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.

25.1.2.3. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.2.4. **Action Step:** Promote irrigation efficiency projects for agricultural uses in the watershed.

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in Aptos Creek.

25.1.3.2. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.4.1. **Action Step:** Ensure existing water diversions do not impair water temperatures in Aptos Creek.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.2. **Action Step:** Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.

25.2.1.3. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.4. **Action Step:** Minimize new or increased summer diversions.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Aptos Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ApC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
ApC-CCC-1.1.1.1	Action Step	Estuary	Evaluate restoration benefits to tidal prism by reducing the size of the Esplanade Parking Lot.	3	20	CA Coastal Commission, IWRP, Santa Cruz RCD, State Parks						In-Kind	A feasibility and benefits analysis should be conducted, prior to proceeding further with this recommendation. Reducing the size of the parking lot next to the estuary could increase the total quantity of lagoon habitat. Lagoon habitat could include greater wetted area or installation of a buffer zone. A buffer could benefit the lagoon by trapping some pollutants prior to entering the water. Reducing the size of the parking lot would likely be expensive and costs are uncertain due to unknown infrastructure constraints that would likely result in increased expenditures above a typical road decommissioning project. Additionally, this parking lot is popular with the local community because it provides easy beach access and parking is free.
ApC-CCC-1.1.1.2	Action Step	Estuary	Narrow Moosewood Drive and/or State Parks property down to one lane to expand overall tidal prism.	3	20	Santa Cruz County Department of Public Works, State Parks						TBD	Opportunities to improve estuarine function in Aptos estuary are extremely limited due to significant infrastructure located within the historical estuary tidal prism. Narrowing the drive may be infeasible due to political and social constraints. The ecological benefits should be carefully evaluated prior to moving forward with this recommendation. Prior to implementing this alternative, a feasibility and benefits analysis should be conducted. Narrowing the road could increase the total quantity of lagoon habitat. Lagoon habitat could include greater wetted area or installation of a riparian buffer zone. A riparian buffer could benefit the lagoon by trapping some pollutants prior to entering the water and increase shading which would help to reduce water temperature during the summer. The road narrowing would likely be expensive and costs are uncertain due to unknown infrastructure constraints that would likely result in increased expenditures above a typical road decommissioning project in a less impacted location.
ApC-CCC-1.1.1.3	Action Step	Estuary	Develop and implement other strategies to increase the current extent of the estuary/lagoon in efforts to increase high value habitat for migrating and rearing salmonids.	3	30	CA Coastal Commission, IWRP, Santa Cruz County, State Parks							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.2	Recovery Action	Estuary	Develop and implement programs to address water quality concerns.										
ApC-CCC-1.1.2.1	Action Step	Estuary	Isolate and correct source of impaired water quality in the lower Aptos Creek watershed.	3	10	RWQCB, Santa Cruz County							Swanson Hydrology and Geomorphology et al. (2003), in a review of water quality monitoring information from the Santa Cruz Health Dep, identified elevated levels of nutrients entering the lower portion of the watershed, primarily from Valencia Creek. Source is unknown but it has been hypothesized that a leaking sewer pipe may be a major source of contamination. Additional efforts should include working with landowners in the Valencia watershed to ensure septic systems are in compliance with State standards. All identified sources of water quality degradation should be corrected.
ApC-CCC-1.1.2.2	Action Step	Estuary	Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.	3	100	Santa Cruz County							Maintain existing programs for prompt cleanup of sewage spills and correction of problems with private sewer laterals that cause chronic leaks.
ApC-CCC-1.1.2.3	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	10	CDFG, Central Water District, NMFS, Private Landowners, SWRCB						In-Kind	Work would entail SWRCB reviewing all existing water diversions and contacting diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to bring into compliance which is reflected in the tentative cost estimate.
ApC-CCC-1.1.2.4	Action Step	Estuary	Enhance streambed aquatic cover and substrate in estuary.	2	15	Santa Cruz County, Santa Cruz RCD	103.33	103.33	103.33			310	Recommendation derived from the Lower San Lorenzo River and Lagoon Management Plan (Swanson Hydrology & Geomorphology et al. 2002) but is applicable to Aptos Creek. This recommendation includes installations of two types of structures: (1) log/boulder structures and (2) cobble and cattail bulrush structures. Although the site is heavily constrained, implementation of these recommendations would benefit water quality by reducing temperature, providing cover to juvenile salmonids, and improving water quality. Cost based on treating 1 acre (assume 25% of 4 acres of estuary) at a rate of $310,216/acre.
ApC-CCC-1.1.2.5	Action Step	Estuary	Encourage repaving and application of petrochemicals in the early summer to allow penetration and drying before fall rains.	3	100	CalTrans, Santa Cruz County, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.2.6	Action Step	Estuary	Use gull-proof lids on refuse cans at and around the lagoon and beach.	3	50	State Parks	1.00	1.00	1.00	1.00	1.00	10	Use enough refuse containers to satisfy the demand for refuse disposal. Gulls are a primary source of pollution, both for bio-stimulating nutrients and bacteria (Alley 2009). Cost based on increasing and replacing refuse containers.
ApC-CCC-1.1.2.7	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	3	10	IWRP, Santa Cruz County	75.00	75.00				150	Urban encroachment has adversely affected the overall hydrology and water chemistry of the estuary. Urbanization has also lead to the estuary being affected by poor water quality from upstream sources and unauthorized lagoon breaching,. Water quality assessment based on a cost of $5000/site for continuous monitoring, with a minimum of 3 sites within the lagoon. Cost could be significantly higher if additional sites are needed to identify source of pollution to estuarine water quality.
ApC-CCC-1.1.2.8	Action Step	Estuary	Develop and implement programs to address ongoing poor water quality in Aptos Lagoon.	3	15	IWRP, Public, RWQCB, Santa Cruz County, Santa Cruz RCD, State Parks, USEPA							Available information suggests the water quality in the lagoon is compromised due to sewage water input etc. Poor water quality, under current conditions, is more of a threat to human health than fish health. However, human health concerns often promulgate desires to artificially breach the sand bar as a way to remove impaired water from the lagoon. Cost for water quality assessment already accounted for.
ApC-CCC-1.1.3	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ApC-CCC-1.1.3.1	Action Step	Estuary	Develop strategies and implement practices with local stakeholders to reduce the frequency of artificial breaching events.	2	5	CDFG Law Enforcement, IWRP, NMFS OLE, Santa Cruz County, State Parks, USFWS	312.00					312	Breaching of the lagoon is not a common and the impacts are likely significant to listed salmonids and tidewater goby. Cost for estuary use is estimated to be $311,467.
ApC-CCC-1.1.4	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.4.1	Action Step	Estuary	Preclude, prohibit or prevent the construction of new buildings and associated infrastructure within remaining open areas of the Aptos estuary tidal prism.	1	100	Santa Cruz County, State Parks, USACE						In-Kind	Aptos estuary has been reduced in size following European arrival and especially after the development of Rio Del Mar in the 1930's. The Aptos estuary was extensively converted from a functional estuary to urban uses and most of the historical tidal prism has been reduced due to infill from permanent infrastructure (hardscape). Urban development in the tidal prism of the lagoon has severely constricted the area to a width of approximately 70 feet between two vertical concrete levees that extend from the high water line of the ocean upstream approximately 300 feet (CWC and SHG 2003).
ApC-CCC-1.1.5	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
ApC-CCC-1.1.5.1	Action Step	Estuary	Evaluate and implement programs to enhance native riparian and wetland flora, reducing habitat related effects of past or present land-uses.	3	10	IWRP, Santa Cruz RCD, State Parks	975	975				1,950	Areas at the upper end of the estuary should be initially targeted. Improved riparian vegetation composition could benefit lagoon conditions by reducing water temperature and providing a source of macroinvertebrate production. Cost based on treating 0.4 miles (assume 80 acres/mile in 5% High IP and high cost with a minimum of 1 mile) at a rate of $60,975/acre.
ApC-CCC-1.1.6	Recovery Action	Estuary	Increase and enhance habitat complexity features										
ApC-CCC-1.1.6.1	Action Step	Estuary	Identify key locations and install large wood structures (or other appropriate surrogate) targeting increased pool depth and shelter within the estuary.	2	10	IWRP, Santa Cruz County, Santa Cruz RCD, State Parks, USFWS	115.00	115.00				230	Cost based on treating 1 mile of estuary at a rate of $115,276/ELJ. Installation of ELJ should be in concert with increasing other elements such as aquatic cover, instream boulders, and riparian vegetation to reduce the redundancy of design and permitting.
ApC-CCC-1.1.7	Recovery Action	Estuary	Reduce toxicity and pollutants										
ApC-CCC-1.1.7.1	Action Step	Estuary	Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewer systems and storm drains.	3	20	Santa Cruz County							
ApC-CCC-1.1.7.2	Action Step	Estuary	Evaluate and repair private sewer laterals, particularly in areas subject to high groundwater adjacent or upstream of the estuary.	3	10	Santa Cruz County						TBD	An inventory of stormwater sewer systems will identify problematic sewer laterals. It is likely Santa Cruz County has this information.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.1.7.3	Action Step	Estuary	Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.	3	100	RWQCB, Santa Cruz County							Cost already accounted for water quality assessment.
ApC-CCC-1.1.8	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										
ApC-CCC-1.1.8.1	Action Step	Estuary	Evaluate and implement possible structural improvements to maintain lagoon water surface elevations during the summer through the late fall.	3	10	CA Coastal Commission, California Coastal Conservancy, IWRP, Santa Cruz County, Santa Cruz RCD, State Parks						TBD	Evaluation should include input from scientists familiar with coastal watershed dynamics. Cost cannot be determined until evaluation of potential structural improvements is completed. Anticipate estuary assessment will identify structural improvements.
ApC-CCC-1.1.8.2	Action Step	Estuary	Evaluate benefits of installation of a flume to control water surface elevation in the lagoon during summer and fall.	3	10	CA Coastal Commission, IWRP, Santa Cruz County, Santa Cruz RCD, State Parks, USFWS						TBD	Nearby Soquel Creek estuary flume operated by the City of Capitola should serve as a model for evaluation. Operation of the flume by the City of Capitola costs approximately $70,000 per year (this includes a monitoring component). Flume installation could allow sanctioned and effective management of Aptos Creek lagoon and minimize annual "emergency" declarations by beach front landowners.
ApC-CCC-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-1.2.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ApC-CCC-1.2.1.1	Action Step	Estuary	Encourage State Parks and County of Santa Cruz to fence off lagoon with temporary fencing rather than breach lagoon as a precaution to protect public health and safety.	3	3	CDFG, Santa Cruz County, State Parks						In-Kind	Costs will vary and will depend on variation in river mouth configuration.
ApC-CCC-1.2.1.2	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	5	Santa Cruz County, Santa Cruz RCD, State Parks	3.00					3	Additional educational signage along the estuary should be included with this recommendation. Signage should explain estuarine function and the benefits to endangered species and water quality of a properly functioning estuary. Cost of signs varies widely depending on materials used and content. Assume average cost of sign being $1,000/sign with a minimum of 3 posted near estuary.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-1.2.1.3	Action Step	Estuary	Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Aptos Creek lagoon.	2	10	CDFG Law Enforcement, NMFS, NMFS OLE, State Parks							Homeowners with property adjacent to the estuary often request local government agencies to address the meandering channel mouth when it may potentially threaten their beachside homes which often results in further encroachment into what remains of the natural estuary. Financial rewards may act as a deterrent to those involved in the unauthorized breaching of the lagoon. The lagoon has a long history of illegal breaches and to date no one has been successfully prosecuted for this activity. Breaching is believed to result in significant adverse impacts to steelhead rearing in the lagoon. Cost accounted for in above recovery action.
ApC-CCC-1.2.1.4	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.	2	100	NMFS, Santa Cruz County, State Parks						In-Kind	Close coordination by all parties would likely comprise the majority of the costs. Other methods should also be evaluated such as installation of cameras that provide real time oversight.
ApC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ApC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
ApC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment of natural riparian communities. Prioritize Phase I areas (mainstem Aptos Creek) as well as the lagoon.	2	100	CDFG, Santa Cruz County, Santa Cruz County Land Trust, The Nature Conservancy, Trust for Public Lands						TBD	Costs associated with development and implementation of this program are currently difficult to determine. Costs will vary significantly depending on market conditions, landowner participation, and programs actually used.
ApC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, USACE	82.50	82.50				165	Costs will vary significantly depending on site specific constraints and type of structure constructed. Many of the historical floodplain areas have been built upon. Remaining floodplains should be considered a high priority for preservation and enhancement actions. Assuming base application of restoring floodplain, cost based on treating 4 miles (assume 1 project/mile in 25% High IP) at a rate of $41,092/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement projects that will function between winter baseflow and flood stage.	3	5	CDFG, NOAA RC, Private Landowners, Santa Cruz RCD, USACE	130.00					130	An evaluation of these habitat features is needed in order to develop a reasonable cost estimate. Costs of an evaluation could be partially offset by leveraging past survey information and Aptos Creek watershed assessment. Cost for fish/habitat restoration implementation estimated at $126,758.
ApC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ApC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
													Cost based on treating 3 miles (assume 1 project/mile in 25% High IP) at a rate of $115,276/ELJ. Aptos Creek has approx. 16 km of IP habitat but it is assumed that many reaches will not be treated due to concerns over existing infrastructure. Available information indicates large woody material may not be limiting in upper Aptos and therefore we recommend initial efforts be directed at the lower reach, which may respond to LWD input. Costs are higher when engineered large wood placement approaches are used. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the watershed was allowed to stay in place. Unsecured LWD input should be evaluated for the portion of Aptos managed by State Parks and if feasible, significant cost saving could result over engineered structures. These actions will improve juvenile summer rearing, winter

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	10	IWRP, Private Landowners, Santa Cruz County, State Parks	175.00	175.00				350	rearing, and smolt survival by increasing the instream channel complexity in potential rearing and migration reaches. Additionally, it could improve egg survival by reducing redd scour in streams characterized by high bedload mobility. Existing documents (DFG stream survey records and Aptos Creek Watershed Assessment) could be used to identify key areas lacking or scarce in LWD. If additional information is needed and site specific surveys required, the costs will likely increase significantly. LWD should be properly sized and installed to viability table targets.
ApC-CCC-3.1.1.2	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate.	2	100	CalTrans, NMFS PRD, Private Landowners, RWQCB, Santa Cruz County Department of Public Works, Santa Cruz RCD, USACE							Costs will vary depending on site specific conditions, wood availability, and frequency of instream bank hardening projects.
ApC-CCC-3.1.1.3	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.	1	5	CalFire, CDFG, NMFS, NRCS, Private Consultants, Santa Cruz County Department of Public Works, Santa Cruz RCD, USACE						In-Kind	Costs would likely be minimal, consisting of staff time for public outreach and outreach materials.
ApC-CCC-3.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement woody debris restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	NOAA RC, NRCS, Private Landowners, RWQCB, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks, USACE						In-Kind	Cost should be minimal. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects.
ApC-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage retention of large woody debris for all historical coho salmon rearing habitats in Aptos Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CalFire, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	Manipulation of Large Woody Material should not occur until evaluated by the County of Santa Cruz staff and hydrologist and/or qualified biologist familiar with Central Coast streams. State Parks should approach LWM manipulation with caution due to the importance of upper Aptos as a source of LWM recruitment.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-3.1.1.6	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	3	100	CDFG, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						In-Kind	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Valencia Creek and it's tributaries should be the focus on these LWM supplementation projects.
ApC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating										
ApC-CCC-3.1.2.1	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, NRCS, Private Landowners, RPFs, Santa Cruz County, Santa Cruz RCD	97.50	97.50				195	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost could be minimal if incorporated into ongoing timber harvest plans. The upper portion of the watershed is managed by State Parks and much of the riparian zone is in later serial age classes. Cost for treating 1.5 miles (assume 80 acre/mile in 15% High IP) at a rate of $1,621/acre.
ApC-CCC-3.1.3	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
ApC-CCC-3.1.3.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (DFG 2004).	2	10		255.00	255.00				510	Cost based on treating 10% of 5 miles of stream at a rate of $101,120/ELJ.
ApC-CCC-3.1.4	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
ApC-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase the frequency of riffle habitat in 75% of the streams within the watershed	2	20							TBD	Cost accounted for in above action steps (i.e. increase frequency of primary pools).
ApC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with urbanization										
ApC-CCC-5.1.1.1	Action Step	Landscape Patterns	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-5.1.2	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with streamside road density (< 100 meters)										
ApC-CCC-5.1.2.1	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	1	100	CalFire, California Geological Survey, CDFG, NMFS, RWQCB, Santa Cruz County, USACE						In-Kind	This recommendation should be considered standard practice.
ApC-CCC-5.1.2.2	Action Step	Landscape Patterns	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	1	100	Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks						TBD	Cost are difficult to determine due to feasibility of conservation easements, participation of landowners, current fair market value, and rate of turnover.
ApC-CCC-5.1.2.3	Action Step	Landscape Patterns	Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County							Applications are currently approved without appropriate review.
ApC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ApC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
ApC-CCC-9.1.1.1	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into Aptos Creek.	3	10	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz County Parks and Cultural Resources	55.00	55.00				110	Ultimate reasons for bank failure should be identified and addressed. Bank and landslide stabilization should evaluate a full range of options to address instability such as setting back or removing problematic infrastructure (roads, etc.). Bioengineering should be the first stabilization method assessed. Bank hardening is not a preferred alternative. Initial efforts should be directed along the mainstem of Aptos Creek. A sediment assessment is estimated to cost $108,085 (assume 5% of total watershed acres at a rate of $1,578/acre).
ApC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-9.1.2.1	Action Step	Sediment	Prioritize and treat erosion sources in Table 11 of the Aptos Geomorphic and Erosion Source Technical Report.	2	15	California Geological Survey, CDFG, NMFS, NRCS, Santa Cruz RCD						TBD	Review Table 11 to develop appropriate recovery actions.
ApC-CCC-9.1.2.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, California Geological Survey, CDFG, NMFS, RWQCB, Santa Cruz County, USACE						In-Kind	This should be considered a standard practice by all regulatory agencies.
ApC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
ApC-CCC-10.1.1.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	CDFG, NMFS, NOAA SWFSC, Private Consultants, Santa Cruz County						In-Kind	
ApC-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.	2	10							TBD	Re-introduction should only occur in subwatersheds where instream habitat conditions are suitable for all coho salmon lifestages. Prioritize upper mainstem Aptos Creek in the Forest of Niesene Marks. Conditions evaluated should include summer flow conditions, cover, winter refugia, pools depths, instream temperature, and gravel quality. Determine suitable areas and numbers to repopulate Aptos Creek.
ApC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
ApC-CCC-10.2.1.1	Action Step	Viability	Initiate juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	3	10	CDFG, Private Consultants	95.00	95.00				190	Presence absence surveys using visual sampling methods should be given highest priority. Cost for annual juvenile sampling in Santa Cruz diversity stratum estimated at $18,823/year.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-10.2.2	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
ApC-CCC-10.2.2.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. The upper portion of Aptos Creek should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	20	CDFG, NOAA RC, Private Consultants, Santa Cruz County							Cost for fish/habitat monitoring could be incorporated in other recovery actions.
ApC-CCC-10.2.2.2	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	3	10	Public, State Parks						In-Kind	
ApC-CCC-10.2.3	Recovery Action	Viability	Increase spawner density										
ApC-CCC-10.2.3.1	Action Step	Viability	Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery	3	10	CDFG, NMFS	270.00	270.00				540	Cost for life cycle monitoring estimated at $267,444 (assume minimum of 10 years of operation).
ApC-CCC-10.2.3.2	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	21	CDFG, NOAA SWFSC, Private Consultants	285.71	285.71	285.71	285.71	57.14	1,200	Monitoring adult abundance in Aptos Creek is not as high a priority as in other watersheds in the Santa Cruz Mountains Diversity Stratum due to the watershed's designation as "Dependent" and the existing monitoring currently occurring in the Stratum. Periodic monitoring should have sufficient funding to document size of all three cohorts and should occur concurrently with smolt monitoring when possible. Cost for annual spawner surveys in Santa Cruz Mtns. diversity stratum estimated at $56,470/year.
ApC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species range or habitat**										
ApC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-11.1.1.1	Action Step	Water Quality	Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.	2	5	CDFG, NMFS, Public, State Parks	5.00					5	Temperature monitoring is relatively inexpensive. A thermograph should be installed in each tributary and in mainstem locations above and below each major confluence. Results should be compiled in one document and submitted to all participants and appropriate regulatory agencies on a yearly basis. Standard presentations should be used. Cost for stream temperature monitoring estimated at $500/gauge with a minimum of 10. Cost do not account for maintenance or data management.
ApC-CCC-11.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants										
ApC-CCC-11.1.2.1	Action Step	Water Quality	Remove invasive exotic vegetation at problematic sites, such as the Old Mill site, and revegetate with native plants.	3	20	IWRP, RWQCB, Santa Cruz County, Santa Cruz RCD	900	900	900	900		3,600	Costs will vary depending on degree of infestation and landowner participation. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP) at a rate of $45,114/acre.
ApC-CCC-11.1.2.2	Action Step	Water Quality	Install continuous water quality samplers in and adjacent to Mangels Gulch, Trout Gulch, and Valencia Creek.	2	6	IWRP, RWQCB, Santa Cruz County, Santa Cruz RCD	66.67	13.33				80	This is a high priority action in the Aptos Creek Watershed Assessment (CWC and SHG 2003), due to known water quality issues. Cost based on installation of continuous monitoring gauges (2) in Aptos Creek at a rate of $20,000 each; cost does not account for maintenance and operation.
ApC-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.
ApC-CCC-11.1.3.1	Action Step	Water Quality	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100							TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-11.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10							In-Kind	
ApC-CCC-11.1.3.3	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100							In-Kind	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort.
ApC-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to instream substrate										
ApC-CCC-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Department of Mines and Geology, CalTrans, FEMA, NRCS, Private Landowners, Santa Cruz RCD, State Parks, USACE						In-Kind	Costs will vary depending on extent and location of streambank work. Gabions and undersized rock are often used because they are cheaper than larger and more stable rock features. USDA estimated stream bank protection projects in general coast about 125 dollars per square foot in California. This recommendation should be considered standard practice.
ApC-CCC-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	3	100	CalTrans, FEMA, RWQCB, Santa Cruz County						In-Kind	This recommendation should be adopted as standard practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation.
ApC-CCC-13.1.1.3	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	3	100	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Public, Santa Cruz County, Santa Cruz RCD						In-Kind	This should become standard practice for all agencies and consulting firms engaged in constructing and designing solutions to address channel stability.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to habitat complexity										
ApC-CCC-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.	3	100	CalFire, California Geological Survey, CalTrans, CDFG, FEMA, NRCS, Private Landowners, Santa Cruz RCD, State Parks, USACE							A significant portion of the estuary has been lost due to channel modification. Any additional proposals within the extant estuary should result in a net gain in habitat complexity. Additional actions that further impair estuarine extent or function should not be sanctioned by regulatory agencies.
ApC-CCC-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ApC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
ApC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation (i.e., eucalyptus, acacia, cape ivy) within the stream and riparian corridor.	3	100	Private Landowners, Santa Cruz RCD							Initial efforts should be directed at landowners in Mangels Gulch and the Valencia Creek watershed. These areas have the greatest concentration of rural residential landowners most likely to foster exotic invasives. Cost accounted for in WATER QUALITY.
ApC-CCC-14.2	**Objective**	**Disease/Predation/Competition**	**Address disease or predation**										
ApC-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
ApC-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.	3	10	NOAA SWFSC	130.00	130.00				260	Cost for abundance/distribution estimated at $128,268/project.
ApC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ApC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity										
ApC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire						In-Kind	This recommendation should be considered a standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, State Parks						TBD	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
ApC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire						In-Kind	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out.
ApC-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						In-Kind	Standard business practice.
ApC-CCC-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing firefighting assistance in the Aptos Creek watershed (and all other watersheds in the County).	2	100	CalFire						In-Kind	Cost of providing the plan is minimal.
ApC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
ApC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed rural development on fire suppression and fuel load buildup.	2	10	CalFire, Santa Cruz County						In-Kind	
ApC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										
ApC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire							
ApC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
ApC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire, NMFS, RWQCB							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, Santa Cruz County						In-Kind	
ApC-CCC-15.2.1.3	Action Step	Fire/Fuel Management	Avoid use of toxic aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.	2	100							In-Kind	
ApC-CCC-15.2.1.4	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to site water quality and the structure of the biological community.	3	10	CalFire, CDFG, NMFS, RWQCB						In-Kind	
ApC-CCC-15.2.1.5	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire						In-Kind	
ApC-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
ApC-CCC-16.1.1.1	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFG, NMFS						In-Kind	
ApC-CCC-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CDFG						In-Kind	If river mouth has been artificially breached without appropriate authorization, prohibitions on offshore fishing should continue until appropriate flows occur.
ApC-CCC-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) of fishing regulations low flow minimum flow closure for Aptos Creek.	2	3	CDFG, NMFS						In-Kind	Low flow closures are needed for Aptos Creek and should be based on flow conditions from a watershed in the Santa Cruz Mountains (the San Lorenzo River would likely suit this requirement). Additionally, due to later (recent) migration patterns of CCC coho salmon in the streams south of the Golden Gate, the date of opening season should be pushed forward in the fishing season (currently fishing season starts on December 15) to at least January 15. Consideration should be given to pushing forward the entire fishing season so that the total number of angling days in not reduced significantly.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ApC-CCC-21.1.1	Recovery Action	Recreation	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ApC-CCC-21.1.1.1	Action Step	Recreation	Encourage development of a trail management plan/maintenance guidelines for Forest of Nisene Marks State Park. Use plan to develop a program to reduce erosion, decommission illegal or duplicate trails, and keep users on designated trails.	2	4	Santa Cruz RCD, State Parks						In-Kind	Development of a management plan should be relatively inexpensive if it draws from existing guidelines and sediment reduction protocols.
ApC-CCC-21.1.1.2	Action Step	Recreation	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	2	10	CalFire, RWQCB, Santa Cruz County Land Trust, Santa Cruz County Parks and Cultural Resources, Santa Cruz RCD, State Parks	14.00	14.00				28	Cost will vary depending on trail location and accessibility. Cost based on decommissioning 2 miles of trail at a rate of $13,680/mile. Cost may be lower for trails due to overall size and footprint and may range from $3,000 per mile to $23,000 per mile according to estimates in the State Coho Recovery Plan.
ApC-CCC-21.1.1.3	Action Step	Recreation	Place educational materials/signage at stream crossings and interpretive centers about salmon and how to minimize impacts.	2	5	NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	10.00					10	Cost for signs vary widely depending on materials used and content of signs. Assume signs average $500/sign for 20 signs.
ApC-CCC-21.1.1.4	Action Step	Recreation	Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.	2	100	CalFire, Farm Bureau, Private Landowners, State Parks						TBD	Costs will vary depending on access, prior weatherization practices, and severity of the problem. These data are currently unavailable.
ApC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ApC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
ApC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100	RWQCB, Santa Cruz County						In-Kind	This recommendation should be considered as a higher priority in subbasins with highly erodible soils (e.g., Valencia Creek sub-watershed).
ApC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.	2	100	FEMA, NMFS, Private Landowners, Santa Cruz County						In-Kind	
ApC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100							In-Kind	General recommendation that should be applied to all pre-existing and future landuse activities in the watershed.
ApC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Design new development to allow streams to meander in historical patterns, protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	RWQCB, Santa Cruz County						In-Kind	Costs would be minimal if this concept is adopted early in the planning process.
ApC-CCC-22.1.3.2	Action Step	Residential/Commercial Development	Santa Cruz County should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from flooding.	2	100	FEMA, Santa Cruz County						In-Kind	
ApC-CCC-22.1.3.3	Action Step	Residential/Commercial Development	Evaluate watershed for infrastructure for high risk of flooding.	3	10	FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks							Most of these structures have likely been identified. Cost associated with ground truthing and site specific evaluation. Sediment assessment accounted for in SEDIMENT.
ApC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
ApC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	10	Santa Cruz County						In-Kind	Outreach to landowners already occurs from many of the municipalities and water districts in the watershed.
ApC-CCC-22.1.5	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
ApC-CCC-22.1.5.1	Action Step	Residential/Commercial Development	Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	Santa Cruz County						In-Kind	This action encourages implementation of many existing policies.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-22.1.5.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	1	100	FEMA, Santa Cruz County, Santa Cruz County Land Trust						In-Kind	
ApC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
ApC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	2	5	Santa Cruz County						In-Kind	The weakness of the County of Santa Cruz's existing riparian ordinance stems from exemptions allowed for pre-existing development. County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs. mainstem. Incentives should be investigated to encourage landowners in key areas to allow establishment of a riparian buffer.
ApC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality										
ApC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the Aptos Creek Watershed.	2	100	RWQCB, Santa Cruz County, USEPA						In-Kind	This recommendation should be carefully balanced against expansion of rural residential development over a wider landscape.
ApC-CCC-22.2.2.2	Action Step	Residential/Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	3	100	RWQCB, Santa Cruz County, USEPA						In-Kind	
ApC-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
ApC-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.	2	10	RWQCB, Santa Cruz County						In-Kind	
ApC-CCC-22.2.3.2	Action Step	Residential/Commercial Development	As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	3	15	RWQCB, Santa Cruz County						In-Kind	Implementation of this recommendation will help reduce rates of channel incision, increase aquifer recharge, and reduce the likelihood of redd scour.
ApC-CCC-22.2.4	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-22.2.4.1	Action Step	Residential/Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	100	FEMA, HUD, Santa Cruz County						In-Kind	
ApC-CCC-22.2.4.2	Action Step	Residential/Commercial Development	Discourage Counties from rezoning forestlands to rural residential.	1	100	Santa Cruz County							
ApC-CCC-22.2.4.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County						0	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality.
ApC-CCC-22.2.5	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity.										
ApC-CCC-22.2.5.1	Action Step	Residential/Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	Santa Cruz County							The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection.
ApC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to stream hydrology (impaired water flow)										
ApC-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalTrans, Santa Cruz County						TBD	Cost of implementation will likely be high due to the large amount of existing infrastructure. This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides rather than maintained and highly traveled surface roads. Due to the friable geology in the Valencia Creek, major benefits to sediment remediation could be achieved if roads are properly decommissioned in this sub-watershed.
ApC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
ApC-CCC-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	10	CalTrans, NRCS, RWQCB, Santa Cruz County, State Parks, USACE	650	650				1,300	All new and replacement culverts should be sized to accommodate a 100 year flow event. Cost based on treating five stream crossings at a rate of $254,278/unit.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.2.2	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	2	10	CalFire, CDFG, NOAA RC, Santa Cruz County, Santa Cruz RCD	15.00	15.00				30	This action encourages implementation of many existing policies.
ApC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
ApC-CCC-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, NRCS, Private Landowners, RPFs, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	On many roads, located on both public and private lands in the Aptos watershed, periodic maintenance occurs but does not address chronic, localized erosion problems. In these circumstances, the grading of poorly drained roads and repair of failed fills and stream crossings can lead to continued and even exacerbated rate of fine sediment delivery.
ApC-CCC-23.1.3.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment and runoff related problems and determine level of hydrologic connectivity.	3	10	CalFire, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks	62.00	62.00				124	Initial assessment efforts should target Valencia Creek and lower mainstem Aptos Creek. Existing assessments should be used when possible. Excessive inputs of fine sediment in Aptos Creek watershed have compromised spawning and rearing habitat which directly impact the egg and adult lifestages. High instream sediment levels were identified as the most likely limiting factor to salmonids on both a watershed and individual reach scale (CWC and SHG 2003). Pool filling appears to have resulted from fine sediment transport from upslope sources with Valencia Creek having worse conditions than Aptos Creek. Roads are the largest contributor of chronic fine sediment into Aptos Creek (CWC and SHG 2003) although erosion from urban development (in the lower mainstem and Valencia Creek) and recreational trails are also a concern. Cost partially accounted for in SEDIMENT. Cost for road inventory estimated at $1,056/mile (assume 75% of road network).
ApC-CCC-23.1.3.3	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	20	Private Landowners, Santa Cruz County						In-Kind	Many road associations are inadequately funded. A road improvement fund for the Aptos watershed could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.3.4	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	30	CalFire, CalTrans, NRCS, Santa Cruz County, Santa Cruz RCD						TBD	Cost are likely accounted for with culvert replacement.
ApC-CCC-23.1.3.5	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Private Landowners, Santa Cruz County						TBD	Santa Cruz public works has been largely unsuccessful at finding spoils sites. A recent effort to locate potential sites in each major watershed failed to identify locations with willing landowners. Future efforts may require incentives to increase landowner participation.
ApC-CCC-23.1.3.6	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, Santa Cruz County						TBD	Roadside berms are common on many private and county roads in Santa Cruz County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails). Road inventory should identify roadside berms that are increasing runoff.
ApC-CCC-23.1.3.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County						TBD	The road inventory should identify the number and type of energy dissipaters needed.
ApC-CCC-23.1.3.8	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalTrans, FEMA, Private Landowners, Santa Cruz County, State Parks						TBD	Cost difficult to determine but may result in a long term cost savings. Current economic conditions will likely delay implementation of this recommendation, if adopted.
ApC-CCC-23.1.3.9	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.3.10	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, CalTrans, RWQCB, Santa Cruz County, State Parks	35.00	35.00	35.00	35.00		140	Road densities are high throughout the watershed, estimated at 3.7 miles of road per square mile of watershed area and 4.6 miles per square mile of riparian area. Actual road densities may be even higher as this estimate does not include seasonal roads used for timber harvest. Many of these roads are poorly situated, constructed, and improperly maintained. Legacy roads from past logging activity, having been adopted as year-round roads and recreational trails, continue to impact the Aptos watershed. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed (CWC and SHG 2003). This recommendation will be difficult to implement due to the extensive development in the Aptos Creek watershed. Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards in areas with erodible geology and/or near high risk landslides rather than maintained and highly traveled surface roads. Targeted areas should include sub watersheds with high erosion potential (e.g., Valencia Creek). Initial efforts should focus on infrequently used seasonal and unsurfaced roads in Valencia Creek. Roads in urbanized areas will be very difficult to decommission; roads in more remote areas, particularly those used for timber harvest will likely be much easier to target for decommissioning. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 2 miles of riparian and 8 miles of road network at a rate of $13,680/mile.
ApC-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
ApC-CCC-23.1.4.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, FEMA, IWRP, NRCS, State Parks						In-Kind	This recommendation should be considered standard practice.
ApC-CCC-23.1.5	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.1.5.1	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	10	CalTrans, IWRP, Santa Cruz County	1,700	1,700				3,400	According to CDFG (2004) cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. Cost based on providing passage (assume urban land use) at 2 total barriers at a rate of $1,124,448/unit and 2 partial barriers at a rate of $562,219/unit.
ApC-CCC-23.1.5.2	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	3	100	CalFire, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, USACE						In-Kind	Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001).
ApC-CCC-23.1.5.3	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, Santa Cruz County, USACE						In-Kind	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
ApC-CCC-23.1.6	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										
ApC-CCC-23.1.6.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation types and species and promote desirable (native) vegetation.	3	100	CalFire, Private Landowners, Santa Cruz County, State Parks						TBD	The road inventory should identify species and extent of removal of unwanted vegetation.
ApC-CCC-23.1.6.2	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalTrans, Santa Cruz County							
ApC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.2.1.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CalTrans, FEMA, Private Landowners, Santa Cruz County, State Parks, USACE						In-Kind	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
ApC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
ApC-CCC-23.2.2.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, CalTrans, Private Landowners, Santa Cruz County, State Parks						TBD	Road inventory cost accounted for in other recovery actions.
ApC-CCC-23.2.2.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	Private Landowners, Santa Cruz County, State Parks						In-Kind	
ApC-CCC-23.2.2.3	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	3	100	CalFire, PG&E, Santa Cruz County							
ApC-CCC-23.2.2.4	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFG, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, Santa Cruz County, USACE, USFWS						In-Kind	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
ApC-CCC-23.2.2.5	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	CalFire, Private Landowners, RPFs, RWQCB						In-Kind	Monitoring should occur throughout the periods between re-entry. Initial focus should occur in the highly erosive Valencia subwatershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-23.2.2.6	Action Step	Roads/Railroads	Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	Santa Cruz County						In-Kind	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the Aptos Creek watershed and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils in Valencia Creek are some of the largest contributors to degraded streambed conditions in the watershed.
ApC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ApC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary										
ApC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	CA Coastal Commission, FEMA, Santa Cruz County, State Parks, USACE							Cost accounted for in estuary.
ApC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	FEMA, Santa Cruz County, Santa Cruz RCD, State Parks, USACE							Cost accounted for in ESTUARY.
ApC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, Santa Cruz County, Santa Cruz RCD, State Parks, USACE							Cost accounted for in ESTUARY.
ApC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions.	3	5	CDFG, IWRP, SWRCB	72.00					72	Many stream reaches in the Valencia watershed have water diversions and it is likely that downstream reaches experience impacts during the summer months. Cost for stream flow modeling estimated at $71,825/project.
ApC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFG, IWRP, SWRCB						In-Kind	
ApC-CCC-24.1.2.3	Action Step	Severe Weather Patterns	Ensure all water diversions in the watershed are in compliance with all applicable laws and policies.	2	5	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						In-Kind	The SWRCB should conduct periodic sweeps of diversions in Aptos Creek to ensure they are in compliance with annual reporting requirements and annual water usage is accurately reported.
ApC-CCC-24.1.2.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	2	20	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						TBD	Determine critical low flow levels and adopt protective measures to maintain viable rearing habitat for juveniles. Cost vary depending on landowner participation and feasibility of protective measures.
ApC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality										
ApC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	2	100	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB							Water temperatures during drought will likely be directly affected by ongoing surface water diversions in Aptos Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost accounted for in WATER QUALITY.
ApC-CCC-24.1.3.2	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						In-Kind	
ApC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Work with CDFG, County of Santa Cruz and knowledgeable biologists to develop emergency rules and adopt implementation agreements.	3	10	CDFG, NMFS, Private Landowners, RWQCB, Santa Cruz County, SWRCB						In-Kind	
ApC-CCC-24.1.4.2	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	3	10	CDFG Law Enforcement, NMFS OLE						In-Kind	Costs are anticipated to be absorbed into ongoing activities.
ApC-CCC-24.1.4.3	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, Caltrans, other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could negatively impact coho salmon.	3	15	CalFire, CalTrans, CDFG, NMFS, RWQCB, SWRCB						TBD	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
ApC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ApC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										
ApC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	1	20	Santa Cruz County, SWRCB						TBD	Cost accounted for stream flow modeling in SEVERE WEATHER PATTERNS.
ApC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
ApC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	20	Santa Cruz County, SWRCB						TBD	Cost for stream flow modeling already accounted for.
ApC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	2	10	CDFG, IWRP, Santa Cruz County, SWRCB						TBD	Studies should include determining critical flow levels for stream reaches impacted by diversions, both current and future diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions would also be needed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	2	30	CDFG, IWRP, Santa Cruz County, SWRCB						In-Kind	Costs may be significant depending on site conditions and number of devices installed
ApC-CCC-25.1.2.4	Action Step	Water Diversion/Impoundment	Promote irrigation efficiency projects for agricultural uses in the watershed.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD							
ApC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
ApC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in Aptos Creek.	2	100	CDFG, IWRP, Santa Cruz County, SWRCB						In-Kind	Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in Aptos lagoon by improving water quality. Costs cannot be estimated because the location of illegal diversions are not known, and the quantities of water diverted are unknown. The willingness of those diverting water to come into compliance with State Law is also unknown. Particular attention should be directed towards the large number of private wells in the Aptos groundwater basin. County of Santa Cruz estimates there are 250 private wells in the Aptos/Valencia watersheds.
ApC-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFG, IWRP, Santa Cruz County, SWRCB						In-Kind	This recommendation should be considered standard practice.
ApC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
ApC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure existing water diversions do not impair water temperatures in Aptos Creek.	2	100	CDFG, IWRP, Santa Cruz County, SWRCB						In-Kind	As part of future 1600 agreement, CDFG should require installation of temperature thermographs upstream and downstream of diversions. These results should be reviewed on a yearly basis by the SWRCB and CDFG.
ApC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
ApC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ApC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	2	100	SWRCB						In-Kind	
ApC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFG, NMFS, SWRCB						TBD	
ApC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	2	5	CDFG, SWRCB						In-Kind	
ApC-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Minimize new or increased summer diversions.	2	100	CDFG, SWRCB						In-Kind	

Big River

Location	•Mendocino County
Watershed Area	•181 Square Miles
Potential Habitat	•214.8 Stream Miles
Vegetation	•64% Coniferous •14% Montane Hardwood
Erodability	•Moderately-High to High
Ownership Patterns	•77% Private, 23% Public
Dominant Land Uses	•Timber
Housing Density	•Moderate
TMDL Pollutants	•Sediment, Temperature

Historical stream conditions in Big River watershed
Photo courtesy of Alan Grass

Big River Coho Salmon: Persistent – low abundance

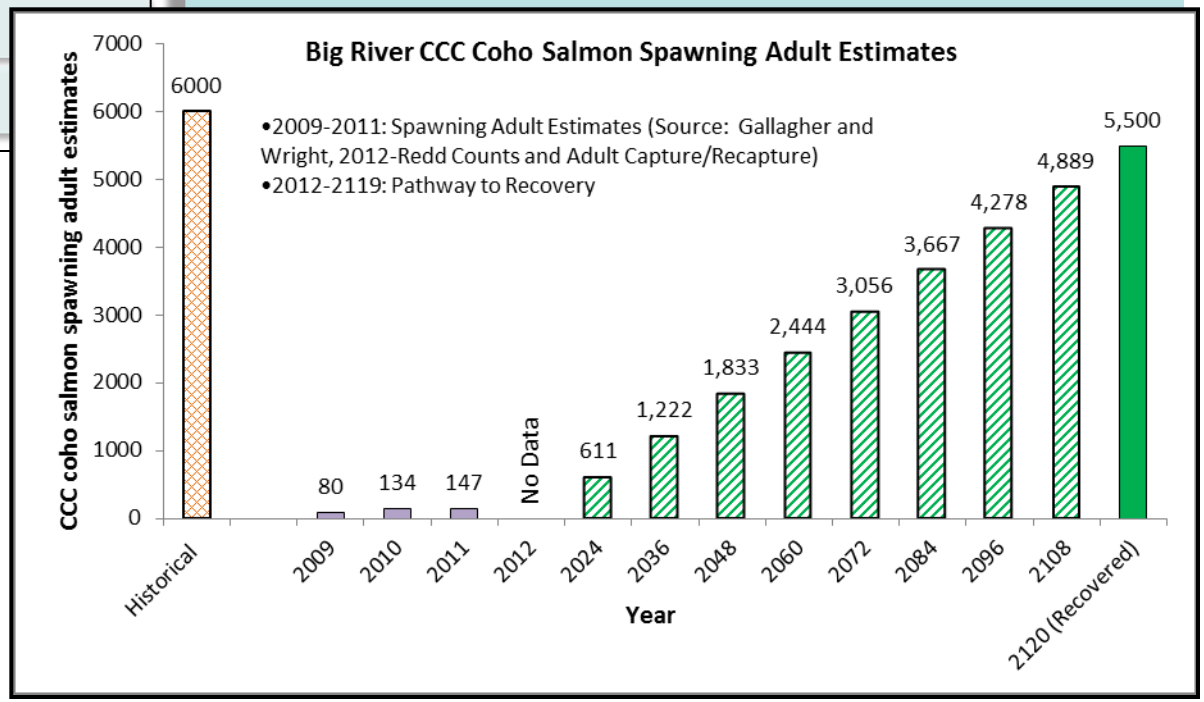
Recovery Goals
✓ Conduct spawner and/or juvenile surveys

Big River
Adult Spawner Targets

Downlisting to Threatened
2,750

Recovery
5,500

STEELHEAD: YES
CHINOOK SALMON: YES



Big River

Potential Habitat: 214.8 miles
Recovery Target: 5,500 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	GOOD	VERY GOOD	FAIR	POOR	POOR	POOR	GOOD	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Promote restoration projects to create or restore off channel habitats
- Retain, recruit and actively input large wood into streams
- Eliminate depletion of summer flows
- Modify two barriers on James Creek
- Develop riparian improvement projects
- Develop a sediment reduction plan

Priority 2 & 3: Long-Term Restoration Actions

- Encourage landowners to implement restoration projects as part of ongoing operations
- Protect and re-vegetate the native riparian plant community within inset floodplains and riparian corridors
- Address road network to minimize rate of sediment input

Recovery Partners

Jackson Demonstration State Forest,
CDFG

Photo courtesy from left to right: Campbell Timberland, Campbell Timberland, KRIS Information System , Eli Asarian and Morgan Bond, SWFSC

Big River

Potential Habitat: 214.8 miles
Recovery Target: 5,500 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	MEDIUM	LOW	MEDIUM	LOW	NA	LOW	MEDIUM	NA	LOW	LOW	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Address season of diversion, off-stream reservoirs, and bypass flows to be more protective of coho salmon

Priority 2 & 3: Long-Term Threat Abatement Actions

- Minimize increased landscape disturbance from timber harvest
- Develop a Road Sediment Reduction Plan
- Develop critical flow values to support to support juvenile rearing
- Conservation programs should be initiated to reduce current and future rates of water consumption.

Improved culvert crossing of James Creek.
Photo courtesy of Mendocino County.

Conservation Highlights

- California State Parks, Blencowe Forestry, Trout Unlimited (TU), and the NOAA Restoration Center collaborated on placement of large woody debris in the watershed.
- Mendocino Redwood Company, the Conservation Fund, California State Parks, and Coastal Ridges have upgraded roads, and improved passage at undersized and poorly designed crossings.

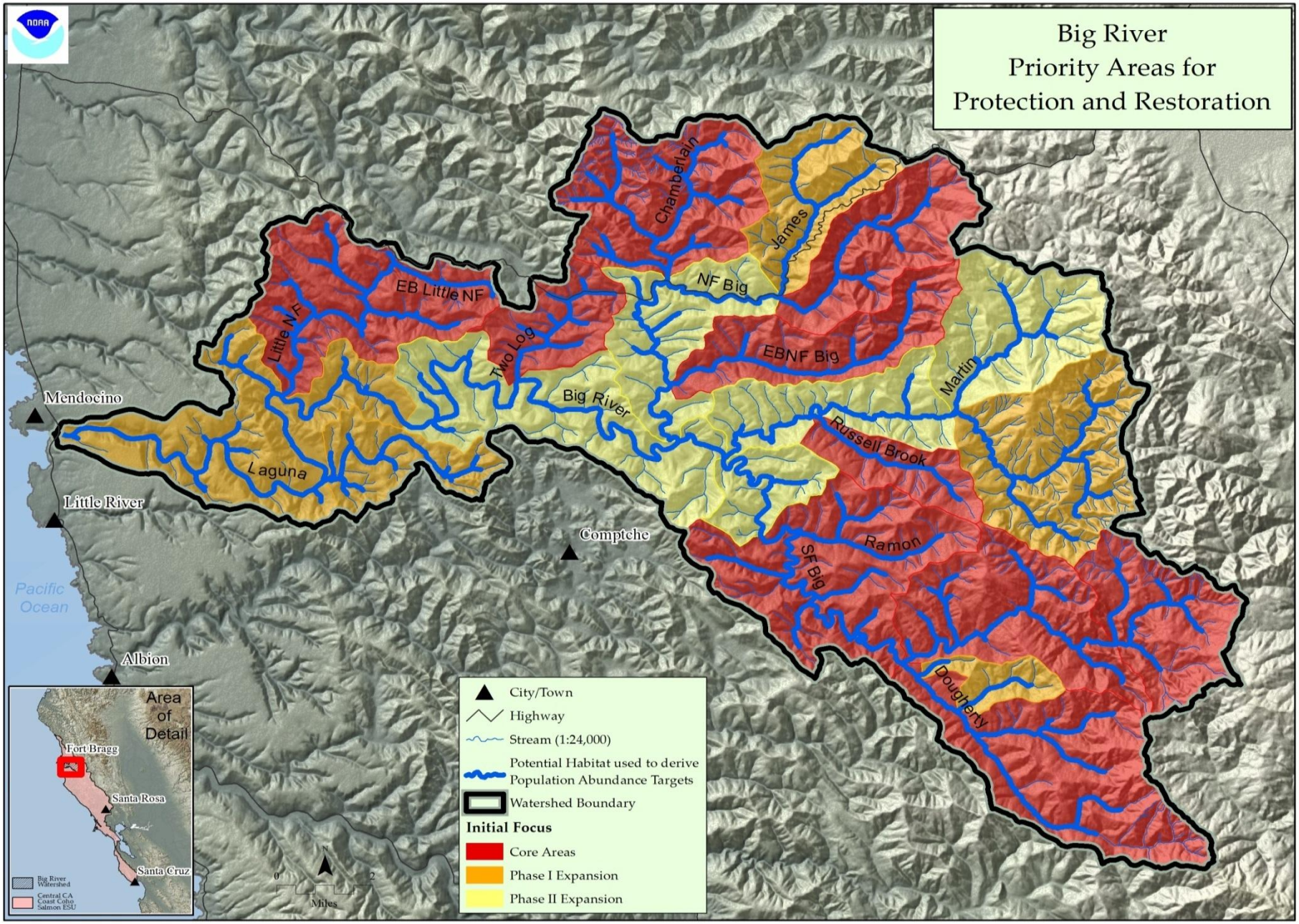


Figure 1: Map of Big River

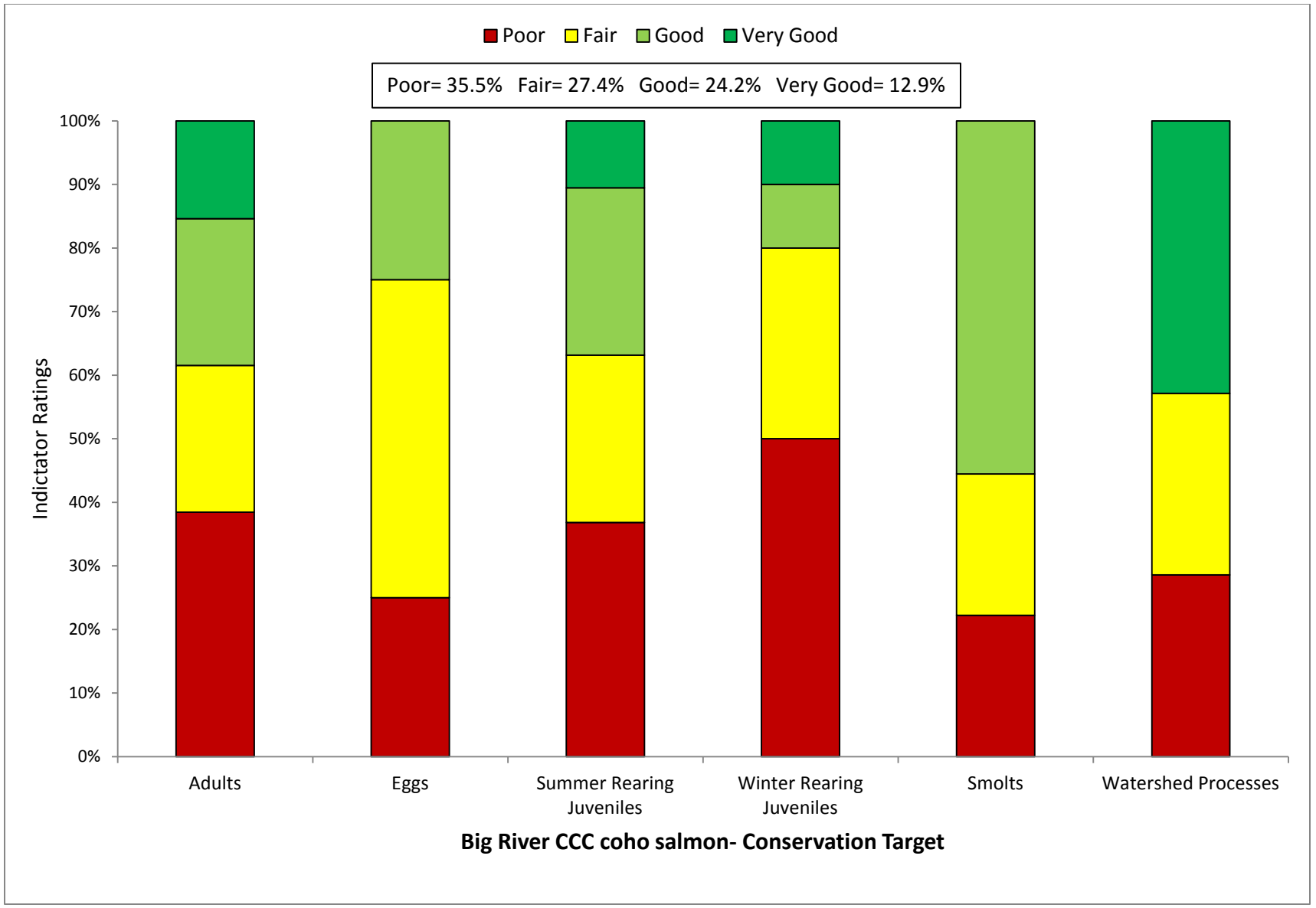


Figure 2 Viability Results by Lifestage

Table 1: CAP Viability Results ~ Big River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<5% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**99.1% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40% Class 5 & 6 across IP-km**	Fair	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% IP-km to 90% IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawners per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score 51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**47% streams; 51% IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4.26 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.32% Key Pieces/ 100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**10% streams; 24% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<53% streams/ 43% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**7% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =75**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.03 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**>90% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**46% of streams/ IP-km (>85% average stream canopy)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**43% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**<50% IP-km (<16 C MWMT)**	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**>90% of streams/ IP-km maintains severity score of 3 or lower**	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0.2-0.6 fish/meter^2**	Fair	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4.26 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<50% of IPkm meets LWD target**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<50% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**>90% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**43% of streams/ IP-Km (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.03 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =42**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-Km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**<1% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**26-35% of Watershed in Timber Harvest**	Fair	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**<1% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**25-50% Historical Species Composition**	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**6.3 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**8.7 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Big River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Medium	Medium	Low	Medium	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Medium	Medium
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Low	Medium	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Low	High	Medium	Medium	Low	High	High
13	Severe Weather Patterns	Medium	High	Medium	Medium	Low	High	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	High	High	Medium	Medium	High	High

Central CA Coast Coho Salmon ~ Big River

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

No species-specific actions were developed.

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.1.1.2. **Action Step:** Target habitat restoration and enhancement that will function between winter base flow and flood stage.

2.1.1.3. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.1.1.1. **Action Step:** Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.

3.1.1.2. **Action Step:** Fund a watershed coordinator.

3.1.1.3. **Action Step:** Install properly sized large woody debris to meet targets specified in recovery plan.

3.1.1.4. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.2. **Recovery Action:** Improve pool/riffle/flatwater ratios (hydraulic diversity)

3.1.2.1. **Action Step:** Increase the frequencies to 75% of the streams within the watershed

4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.1.1. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water uses.

4.1.1.2. **Action Step:** Improve coordination between agencies and others to address the season of water diversions, off-stream reservoirs, and bypass flows to better protect coho salmon and their habitats (CDFG 2004).

4.1.1.3. **Action Step:** Require compliance with the most recent update of NMFS' Water Diversion Guidelines.

4.1.1.4. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.1.2. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.2.1. **Action Step:** Assess and map water diversions (CDFG 2004).

4.1.2.2. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

4.1.2.3. **Action Step:** Require streamflow gauging devices to determine the current streamflow condition.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Modify or remove physical passage barriers

6.1.1.1. **Action Step:** Modify two barriers on James Creek. One barrier is one-half mile from the mouth of James Creek and is a bedrock cascade that needs modification for adult coho salmon passage. The second barrier is on the North Fork of James Creek and is located where Highway 20 encroaches on the stream channel and has created a barrier.

6.1.1.2. **Action Step:** Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

8.1.1.2. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

8.1.1.3. **Action Step:** Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs to the North and South Forks Big River, mainstem Big River, and Daugherty Creek.

8.1.1.4. **Action Step:** Develop riparian improvement projects along James Creek to increase canopy levels.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.

9.1.1.2. **Action Step:** Treat high priority slides and landings identified in credible landowner assessments. Focus efforts in the South Daugherty and Chamberlain Creek subbasins.

9.1.1.3. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Conduct monitoring activities to determine the population status of adult and salmonid smolts in Core and Phase 1 areas.

10.1.1.2. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency. Prioritize Core tributaries first, followed by Phase I and Phase II areas as appropriate.

10.1.2. **Recovery Action:** Increase abundance

10.1.2.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Plant native vegetation to promote streamside shade where otherwise deficient. Focus on tributaries in the Middle and Inland subbasins that do not meet canopy target of 70 percent. Use CDFG habitat typing data/reports to determine tributaries that do not meet canopy target.

11.1.1.2. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and increased riparian buffers (CDFG 2004).

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.1.1. **Recovery Action:** Prevent increased landscape disturbance

19.1.1.1. **Action Step:** Establish greater oversight for pre and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.

19.1.1.2. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas.

19.1.1.3. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

19.1.1.4. **Action Step:** Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.

23.1.1.2. **Action Step:** Continue efforts such as road improvements, and decommissioning to reduce sediment delivery to Big River and its tributaries. CDFG stream surveys indicated Kidwell Gulch, Two Log Creek, and Saurkraut Creek have road sediment inventory and control as a top tier tributary improvement recommendation.

23.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.1.4. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized users to decrease fine sediment loads.

23.1.1.5. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

24.1.1.1. **Action Step:** During Drought years CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting that could impact coho salmon. These agencies should use existing regulations or other mechanisms to minimize water use during the summer months.

24.1.1.2. **Action Step:** Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions in the summer and fall months. Focus stream gaging efforts on the South Fork Big River.

24.1.1.3. **Action Step:** Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.

24.1.1.4. **Action Step:** If predicted flows are below a level considered critical to maintain habitat conditions for coho salmon, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Big River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
BR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
BR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	CDFG, MMWD, SPAWN	50.00	50.00				100	Existing program (e.g. SPAWN) could be expanded at minimal cost. Estimate additional monitoring costs at $10K/year.
BR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	3	10	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, State Parks						TBD	Costs depend on level of technical assistance required and types of projects proposed. Many salmon recovery efforts and management programs are currently ongoing. It is possible that there could be additional salmon restoration costs identified based on recovery needs of the species; however, at this time we do no have sufficient information to estimate those potential costs or identify the actions under which they might fall.
BR-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, Trout Unlimited						TBD	Initiate projects should target stream reaches with high IP-km values, however, consideration should be also given to mainstem Big River, particularly mainstem reaches above the estuary.
BR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
BR-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-3.1.1.1	Action Step	Habitat Complexity	Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.	2	10	California Coastal Conservancy, CDFG, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks	56.00	56.00				112	These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority. Cost for fish/habitat monitoring is estimated at $111,192/project.
BR-CCC-3.1.1.2	Action Step	Habitat Complexity	Fund a watershed coordinator.	2	10	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, RCD, RWQCB, State Parks, Trout Unlimited	300.00	300.00				600	Currently, Big River is managed by five or six larger landowners - including State, private, and non-profit. A coordinator is likely necessary to focus actions and resources in key areas and to apply for grants that will span multiple landowners.
BR-CCC-3.1.1.3	Action Step	Habitat Complexity	Install properly sized large woody debris to meet targets specified in recovery plan.	1	20	California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, State Parks, UC Extension	225.00	225.00	225.00	225.00		900	Cost based on treating 36 miles (assume 50% High IP) at a rate of $25,000/mile. Costs may vary significantly due to access, varying paucity of large wood between sub-watersheds, and installation techniques. Much of Big River has been habitat typed and thus the stream reaches lacking wood can be readily identified. Permitting should be streamlined because of programmatic biological opinions for these types of actions. Many key areas in Big River have been targeted for LWD enhancement through the MRC HCP and on JDSF and total costs may be significantly less than projected.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-3.1.1.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CalFire, CDFG, Mendocino County, Mendocino County Department of Public Works, Mendocino Land Trust, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB, State Parks						In-Kind	Costs will vary with site specific conditions (such as access and availability of materials). However, significant cost saving could result if projects are implemented when other land management action are planned.
BR-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
BR-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase the frequencies to 75% of the streams within the watershed	2	20	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners						TBD	Cost should be accounted for in increase LWD frequency and primary pools.
BR-CCC-4.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
BR-CCC-4.1.1	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
BR-CCC-4.1.1.1	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFG, CDFG Law Enforcement, NMFS OLE, Private Landowners, SWRCB						TBD	
BR-CCC-4.1.1.2	Action Step	Hydrology	Improve coordination between agencies and others to address the season of water diversions, off-stream reservoirs, and bypass flows to better protect coho salmon and their habitats (CDFG 2004).	2	10	CDFG, NMFS, Private Landowners, SWRCB, USFWS						In-Kind	Cost of additional coordination is expected to be minimal.
BR-CCC-4.1.1.3	Action Step	Hydrology	Require compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	60	NMFS, NMFS OLE, Private Landowners, SWRCB						TBD	Further analysis is needed to determine cost to landowners to comply with guidelines for new diversions.
BR-CCC-4.1.1.4	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	1	10	NOAA RC, Private Landowners, RCD, SWRCB						TBD	Focus on Landowners in the South Fork Big River subbasin.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-4.1.2	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
BR-CCC-4.1.2.1	Action Step	Hydrology	Assess and map water diversions (CDFG 2004).	2	2	CDFG, NMFS, SWRCB	20.00					20	Rough cost estimate for Big River watershed only. This exercise should include Riparian and Appropriative diversions. The majority of the estimated cost would result from attempting to identify unreported Riparian diversions.
BR-CCC-4.1.2.2	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	2	10	SWRCB						TBD	Additional analysis needed.
BR-CCC-4.1.2.3	Action Step	Hydrology	Require streamflow gauging devices to determine the current streamflow condition.	2	10	NMFS, SWRCB, USGS	150.00	150.00				300	Cost based on 30k per year for two stations. This information could provide baseline information that would be useful in evaluating changes to baseflow over time.
BR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BR-CCC-6.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
BR-CCC-6.1.1.1	Action Step	Passage	Modify two barriers on James Creek. One barrier is one-half mile from the mouth of James Creek and is a bedrock cascade that needs modification for adult coho salmon passage. The second barrier is on the North Fork of James Creek and is located where Highway 20 encroaches on the stream channel and has created a barrier.	1	5	CDFG, Jackson Demonstration State Forest, NMFS HCD, NMFS PRD	300.00					300	Cost based on providing passage at the mouth of James Creek at a rate of $98,633/unit and passage at Highway 20 at a rate of $197,266/unit.
BR-CCC-6.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	20							TBD	Cost could be partially accounted for in fish/habitat monitoring. A total of 8 impassable barriers are currently known.
BR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
BR-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-8.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	20	CDFG, Coastal Ridges, Conservation Fund, Mendocino Redwood Company, Private Landowners, Redwood Forest Foundation, State Parks, The Nature Conservancy						TBD	Cost cannot be estimated because overall amount of landowner participation is unknown (particularly for conservation easements).
BR-CCC-8.1.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, CalTrans, Conservation Fund, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RWQCB, State Parks	803	803	803	803		3,210	Particular attention should be directed at implementing this action along mainstem Big River. Mainstem temperatures are very warm, particularly in the lower reaches, and it will take a considerable time to grow the riparian canopy to sufficient size to add in overall stream shading. Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.
BR-CCC-8.1.1.3	Action Step	Riparian	Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs to the North and South Forks Big River, mainstem Big River, and Daugherty Creek.	2		CalFire, Private Landowners						In-Kind	
BR-CCC-8.1.1.4	Action Step	Riparian	Develop riparian improvement projects along James Creek to increase canopy levels.	2	20	CDFG, Jackson Demonstration State Forest, NOAA RC, Trout Unlimited	400.00	400.00	400.00	400.00		1,600	Recommendation from DFG coastal watershed report. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $20,057/acre.
BR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
BR-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-9.1.1.1	Action Step	Sediment	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with survey focused on slides and other non-road related sediment sources in the watershed.	1	5	CalFire, Coastal Ridges, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USEPA						TBD	This sediment reduction plan could be part of a larger road and sediment reduction plan. This plan should tier off recommendations in the Big River TMDL.
BR-CCC-9.1.1.2	Action Step	Sediment	Treat high priority slides and landings identified in credible landowner assessments. Focus efforts in the South Daugherty and Chamberlain Creek subbasins.	2		CDFG, NOAA RC, Private Landowners, Trout Unlimited						TBD	A sediment assessment will identify high priority slides and landings.
BR-CCC-9.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino County Department of Public Works, RWQCB, State Parks	250.00	250.00	250.00	250.00	250.00	3,000	This infrastructure is likely present in much of the Big River subwatersheds. Additional sites may be installed as part of the timber harvest plan process and the cost for construction will likely be absorbed on a harvest plan by harvest plan basis. Ongoing maintenance will likely occur as part of yearly evaluation prior to the winter period. Maintenance costs are estimated at $50,000/yr. Most of these costs are not anticipated to be additional costs to landowners but should be viewed as expenses incurred for maintenance of existing infrastructure.
BR-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**										
BR-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
BR-CCC-10.1.1.1	Action Step	Viability	Conduct monitoring activities to determine the population status of adult and salmonid smolts in Core and Phase 1 areas.	2	12	CDFG, Conservation Fund, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners, State Parks	83.33	83.33	33.33			200	Cost may total on 100k per year for both adult and smolt surveys. However, due to other monitoring efforts in adjacent diversity stratum watersheds - Noyo in particular - monitoring in Big River may be of a lesser intensity. Monitoring in the Big River watershed should be closely coordinated and complementary with other ongoing monitoring efforts in the Lost Coast Diversity Stratum. Cost for annual spawning ground survey for N. Central Coast diversity stratum estimated at $16,650/year.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-10.1.1.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency. Prioritize Core tributaries first, followed by Phase I and Phase II areas as appropriate.		10	CDFG, Mendocino Redwood Company, Private Landowners						In-Kind	
BR-CCC-10.1.2	Recovery Action	Viability	Increase abundance										
BR-CCC-10.1.2.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners						In-Kind	Inter-agency coordination will continue as part of doing business to rescue juvenile coho salmon until habitat conditions are restored to prevent imminent risk of stranding and mortality.
BR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BR-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
BR-CCC-11.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient. Focus on tributaries in the Middle and Inland subbasins that do not meet canopy target of 70 percent. Use CDFG habitat typing data/reports to determine tributaries that do not meet canopy target.	2	10	CDFG, Mendocino Redwood Company, Private Landowners, RCD, Trout Unlimited							Cost accounted for in RIPARIAN.
BR-CCC-11.1.1.2	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and increased riparian buffers (CDFG 2004).	3	100	Campbell Timberland Management, CDFG, NOAA RC, Trout Unlimited						In-Kind	
BR-CCC-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										
BR-CCC-19.1.1	Recovery Action	Logging	Prevent increased landscape disturbance										
BR-CCC-19.1.1.1	Action Step	Logging	Establish greater oversight for pre and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.	3								In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-19.1.1.2	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas.	1	20	NMFS PRD						In-Kind	
BR-CCC-19.1.1.3	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3								In-Kind	
BR-CCC-19.1.1.4	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	3								In-Kind	
BR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
BR-CCC-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, California Geological Survey, Conservation Fund, Jackson Demonstration State Forest, Mendocino County, Mendocino Land Trust, Mendocino Redwood Company, RWQCB, State Parks	295.00	295.00				590	This plan should leverage the Big River TMDL. If most of the TMDL recommendations are adopted the total cost of this plan would likely be significantly less than that estimated here. Cost for road inventory is estimated at $927/mile (assume 50% of road network).
BR-CCC-23.1.1.2	Action Step	Roads/Railroads	Continue efforts such as road improvements, and decommissioning to reduce sediment delivery to Big River and its tributaries. CDFG stream surveys indicated Kidwell Gulch, Two Log Creek, and Saurkraut Creek have road sediment inventory and control as a top tier tributary improvement recommendation.	3								TBD	
BR-CCC-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10		19.00	19.00				38	Cost based on decommissioning 3.1 miles of riparian road network at a rate of $12,000/mile. If upgraded, cost would be $65,534.
BR-CCC-23.1.1.4	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized users to decrease fine sediment loads.	3								In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BR-CCC-23.1.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	100							In-Kind	
BR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
BR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to watershed hydrology										
BR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	During Drought years CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting that could impact coho salmon. These agencies should use existing regulations or other mechanisms to minimize water use during the summer months.		20	CDFG, CDFG Law Enforcement, Mendocino County, NMFS OLE, NOAA RC, Private Landowners, SWRCB						In-Kind	
BR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions in the summer and fall months. Focus stream gaging efforts on the South Fork Big River.	2	5	CDFG, NMFS, SWRCB	63.00					63	Initial efforts should be focused in upper South Fork Big River where numerous small landowners are believed to divert from Big River for domestic purposes. Cost for stream flow modeling estimated at $63,005/project
BR-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	2	10	CDFG, NMFS, SWRCB							Cost accounted for in other recovery actions.
BR-CCC-24.1.1.4	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for coho salmon, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	2	60	CDFG, NMFS, Private Landowners, SWRCB						TBD	Stream flow modeling will determine critical low flow levels. Conservation programs are contingent upon water users participation and feasibility of water conservation practices.

Big Salmon Creek

Location	•Mendocino County
Watershed Area	• 13.0 Square Miles
Potential Habitat	• 16.8 Stream Miles
Vegetation	• 71% Coniferous, 16% Grassland or Shrubland
Erodability	•Moderate
Ownership Patterns	•100% Private
Dominant Land Uses	•Timber
Housing Density	•Moderate
TMDL Pollutants	•None

Big Salmon Creek.
Photo Courtesy: Campbell Timberland Management

Big Salmon Creek Coho Salmon: Persistent – Low Abundance

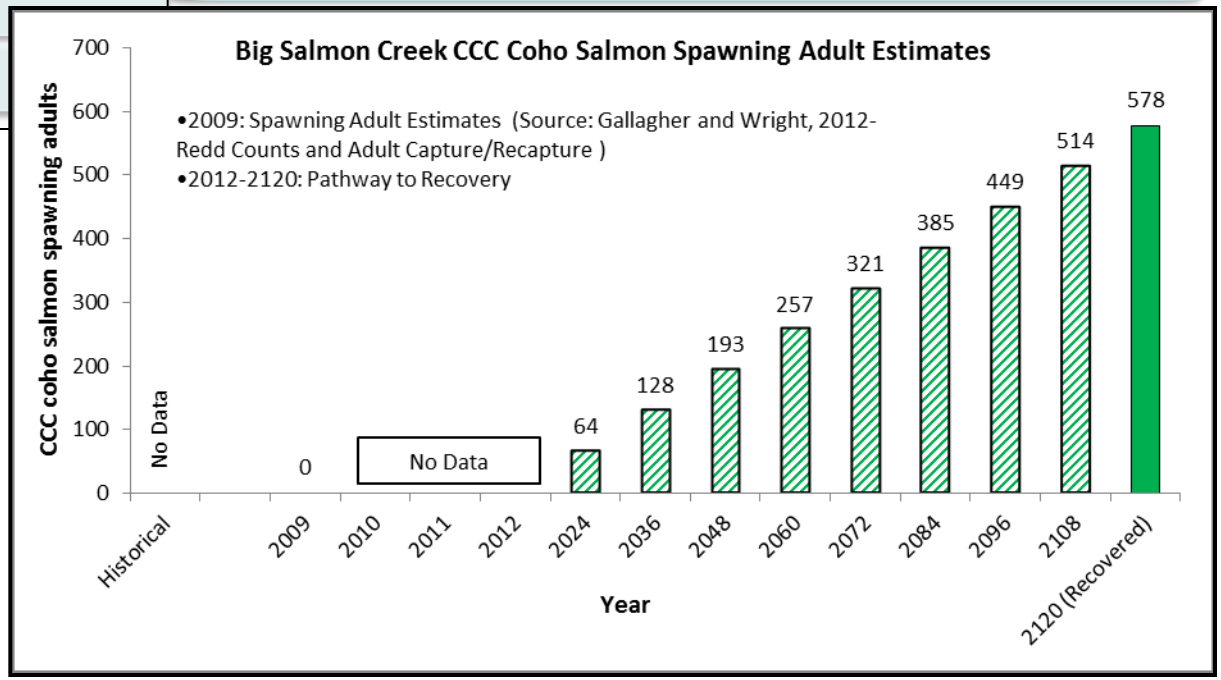
Recovery Goals

✓ Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed

Big Salmon Creek Adult Spawner Targets

Downlisting to Threatened
289

Recovery
578



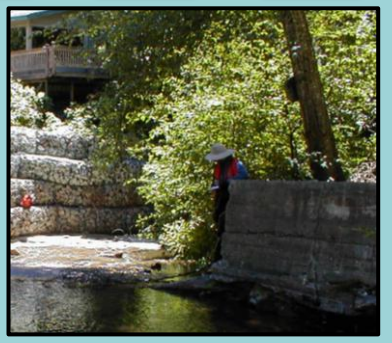
STEELHEAD: YES
CHINOOK SALMON: NO

Big Salmon Creek

Potential Habitat: 16.8 miles
Recovery Target: 578 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
VERY GOOD	FAIR	GOOD	VERY GOOD	POOR	POOR	GOOD	FAIR	FAIR	FAIR	FAIR



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Retain, recruit and actively input large wood into stream

Priority 2 & 3: Long-Term Restoration Actions

- Construct or create alcoves and backwater areas
- Conduct conifer release to promote growth of larger diameter trees where appropriate
- Conduct periodic, standardized juvenile surveys in the watershed
- Develop a Sediment Reduction Plan

Recovery Partners

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH&GAME

THE CONSERVATION FUND
America's Partner in Conservation

Photo courtesy from left to right: Campbell Timberland, Gualala River Watershed Council, Campbell Timberland, City of Santa Rosa and Kristen Kittleson, County of Santa Cruz.

Big Salmon Creek

Potential Habitat: 16.8 miles
Recovery Target: 578 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
NA	MEDIUM	MEDIUM	HIGH	LOW	NA	NA	MEDIUM	LOW	LOW	LOW	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage home building or other incompatible land use in areas identified as timber production zones
- Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Identify and eliminate depletion of summer base flows from unauthorized water uses

Priority 2 & 3: Long-Term Threat Abatement Actions

- Implement sediment reduction techniques in concert with prescribed fire and fire suppression techniques to minimize sediment impacts
- Timber harvest planning should avoid or minimize adverse impacts to off channel habitats, floodplains, ponds, and oxbows
- Protect headwater channels with larger buffers and encourage tree retention on the axis of headwall swales
- For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations
- Manage riparian areas for their site potential composition and structure
- Encourage timber landowners to implement restoration projects as part of their timber management practices

LWD placement in Big Salmon Creek.
Photo Courtesy: Campbell Timberland Management

Conservation Highlights

- The Conservation Fund recently purchased a 4,350 acre tract of timber from Hawthorne Timber Company, and plans on implementing practices to decrease the intensity of harvests, increase the time between harvests and widen riparian buffers.
- Hawthorne Timber Company had undertaken placement of large woody debris structures and sediment remediation projects.

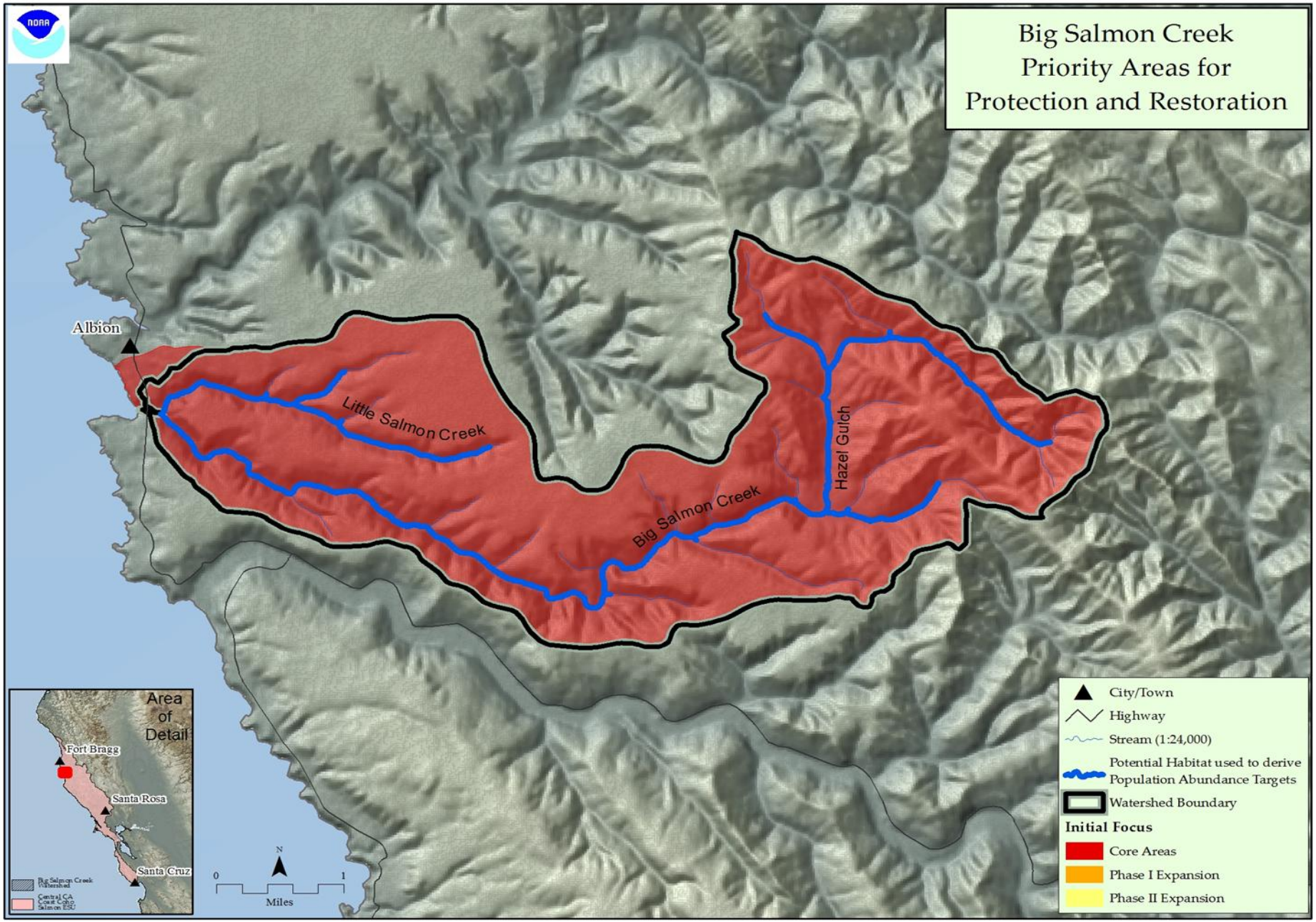


Figure 1: Map of Big Salmon Creek

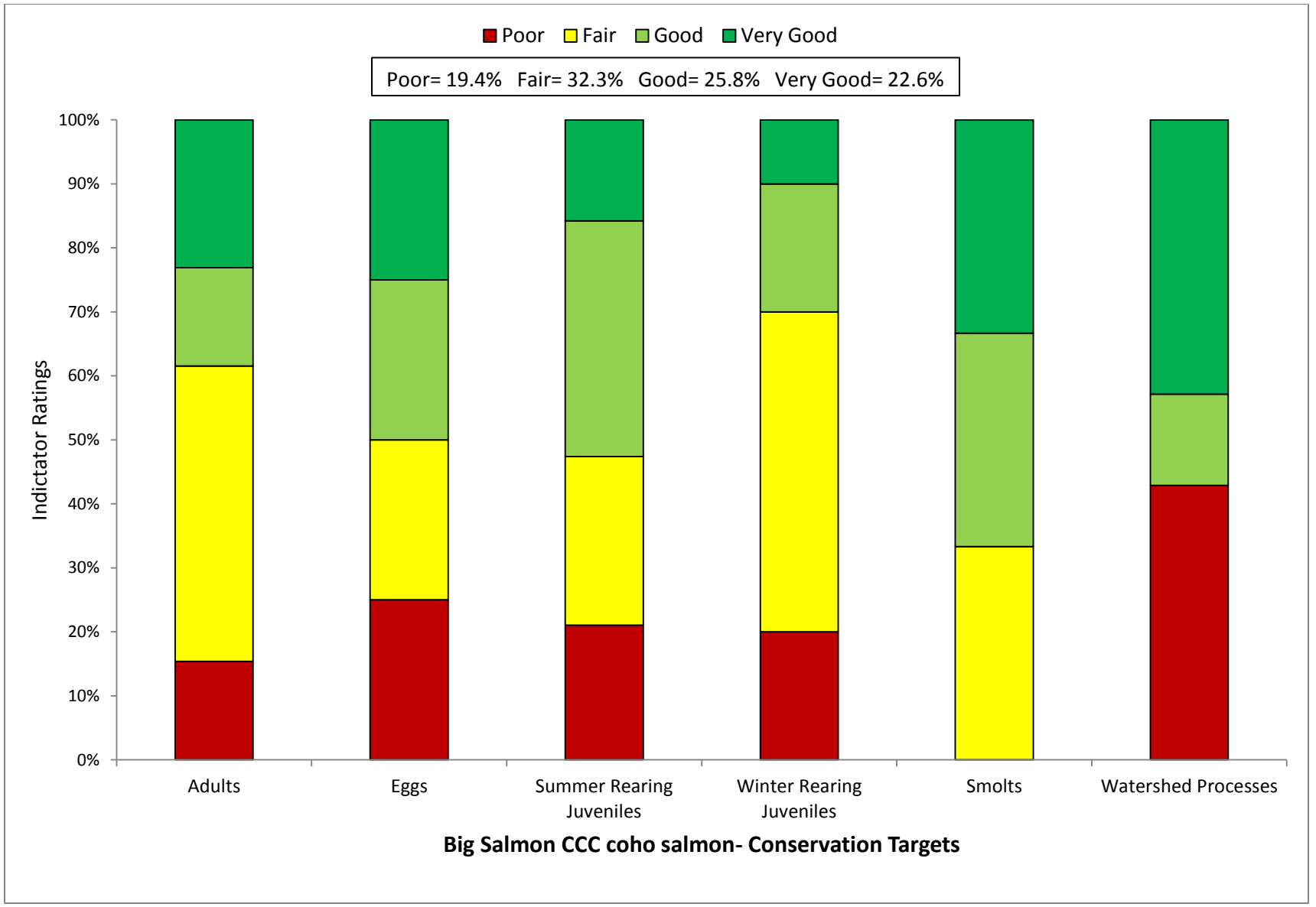


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Big Salmon Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**6.34 Key Pieces/100m**	Good	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams; 68% IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**20% streams; 59% IP-km (>80 stream average)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**33% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**>1 spawner per IP-km to < low risk spawner density**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**60% streams; 64% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Unimpaired Condition**	Very Good	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**6.34 Key Pieces/100m**	Good	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**<50% of streams/ IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams; 68% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**20% streams; 59% IP-km (>80 stream average)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =35-50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.59 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**33% of streams/ IP-km (>85% average stream canopy)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**33% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**60% streams; 64% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP-km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**>90% of Historical Range**	Very Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**6.34 Key Pieces/100m**	Good	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams; 68% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**20% streams; 59% IP-km (>80 stream average)**	Fair	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**33% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**60% streams; 64% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Unimpaired Condition**	Very Good	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**20% streams; 59% IP-km (>80 stream average)**	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.59 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score = <35**	Very Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces high risk spawner density per Spence (2008)**	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.26% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**20% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**33% of watershed >1 unit/20 acres**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**>75% Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**7.5 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**6.1 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Big Salmon Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	-	-	-	-	-	-	-
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	High	Low	High	Medium	High	Medium	High
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	-	-	-	-	-	-	-
8	Logging and Wood Harvesting	Medium	Low	Medium	High	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	High	Medium	Medium	High	High	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	High	High	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		High	Medium	High	High	High	Medium	High

Central CA Coast Coho Salmon ~ Big Salmon Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**
   - 1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 1.1.1. **Recovery Action:** Improve the quality of each estuarine habitat zone
       - 1.1.1.1. **Action Step:** Evaluate current conditions and potential limiting factors in Big Salmon Creek estuary.

2. **Restoration- Floodplain Connectivity**
   - 2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity
       - 2.1.1.1. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.
       - 2.1.1.2. **Action Step:** Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.

3. **Restoration- Habitat Complexity**
   - 3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 3.1.1. **Recovery Action:** Increase large wood frequency
       - 3.1.1.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.
       - 3.1.1.2. **Action Step:** Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).
       - 3.1.1.3. **Action Step:** Encourage retention and recruitment of large woody debris for all historical CCC coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.
     - 3.1.2. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.
       - 3.1.2.1. **Action Step:** Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.

4. **Restoration- Hydrology**

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with road density

5.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

5.1.2. **Recovery Action:** Prevent increased landscape disturbance

5.1.2.1. **Action Step:** Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems

5.1.2.2. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.2.3. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

6. **Restoration- Passage**

No species-specific actions were developed.

7. **Restoration- Pool Habitat**

No species-specific actions were developed. See Habitat Complexity

8. **Restoration- Riparian**

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

8.1.2. **Recovery Action:** Improve canopy cover

8.1.2.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).

8.1.2.2. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

8.1.2.3. **Action Step:** Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs.

9. **Restoration- Sediment**

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.1.1. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.1.1.1. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.

10.1.2.2. **Action Step:** Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species range or habitat

11.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.1.1. **Action Step:** Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion

19.1.3. **Recovery Action:** Prevent impairment to habitat complexity

19.1.3.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

19.1.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.4.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.4.2. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.4.3. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

19.1.4.4. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.5.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.6. **Recovery Action:** Prevent increased landscape disturbance

19.1.6.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.1.7. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, etc.)

19.1.7.1. **Action Step:** Reduce the amount and rate of even aged management.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Encourage timber landowners to implement restoration projects as part of their timber management practices in stream reaches and where large woody material is deficient. Particular focus should be directed to stream reaches in Hazel and Ketty Gulch.

19.2.1.2. **Action Step:** Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.1.2. **Action Step:** Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.2.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2.2. **Action Step:** Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.

23.1.2.3. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.

23.1.2.4. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.2.5. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.3. **Recovery Action:** Prevent impairment to passage and migration

23.1.3.1. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.2.2. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.

23.2.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.3.1. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.1.1. **Action Step:** Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.

24.1.1.2. **Action Step:** Develop offstream water containment sites for water trucks in order to minimize onstream diversions during the summer low flow period.

24.1.1.3. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water uses.

24.1.1.4. **Action Step:** Evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).

24.1.2. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.2.1. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.1.2.2. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Big Salmon Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BSC-CCC-1.1.1	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
BSC-CCC-1.1.1.1	Action Step	Estuary	Evaluate current conditions and potential limiting factors in Big Salmon Creek estuary.	3	10	California Coastal Conservancy, CDFG, Conservation Fund, NMFS	137.00	137.00				274	Cost is ultimately dependent on scope and extent of the limiting factors analysis. Cost based on estuary use/residence timing at a cost of $273,217. The study should include recommendations to address potential limiting factors. Big Salmon has an estuary that does not bar over during the summer low flow period. Comparisons between steelhead utilization and coho utilization in an open estuarine environment could also be evaluated.
BSC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										**These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority. Cost for fish/habitat monitoring is estimated at $111,192/project.**
BSC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
BSC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	10	CalFire, Conservation Fund, Public, RWQCB	30.00	30.00				60	
BSC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Construct or create alcoves and backwater areas where the lack of such habitat features limits carrying capacity.	2	10	CDFG, Conservation Fund, Private Landowners	23.00	23.00				46	This recommendation is more feasible within Big Salmon Creek watershed because a large portion of the watershed in owned by one landowner and most of the roads in adjacent to fish bearing watercourses are used exclusively for timber harvest activities. Many of these roads are dirt and most are used infrequently and viable alternative routes likely exist in many subbasins. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 12 miles of road at a rate of $12,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BSC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
BSC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	5	CalFire, CDFG, Conservation Fund, Private Landowners	125.00					125	
BSC-CCC-3.1.1.2	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	100	CalFire, CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-3.1.1.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical CCC coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
BSC-CCC-3.1.2.1	Action Step	Habitat Complexity	Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.	2	10	CDFG, Conservation Fund, Private Landowners	0.06	0.06				0	Historical logging practices effectively removed all of the original conifer overstory (principally redwood) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for Big Salmon Creek watershed suggests that riparian stands are relatively well stocked, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Cost is based on treating 1 mile (assume 80 acres/mile in 15% High IP) at a rate of $1,422/mile. Cost is expected to be minimal because most of the watershed is subject to active timber management.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BSC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with road density										Cost cannot be estimated because overall amount of landowner participation is unknown (particularly for conservation easements).
BSC-CCC-5.1.1.1	Action Step	Landscape Patterns	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	10	CalFire, Conservation Fund, Private Landowners	72.50	72.50				145	Particular attention should be directed at implementing this action along mainstem. Mainstem temperatures are very warm, particularly in the lower reaches, and it will take a considerable time to grow the riparian canopy to sufficient size to add in overall stream shading. Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.
BSC-CCC-5.1.2	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										
BSC-CCC-5.1.2.1	Action Step	Landscape Patterns	Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems	3	100	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners						In-Kind	
BSC-CCC-5.1.2.2	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	3	100	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners						In-Kind	
BSC-CCC-5.1.2.3	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	3	100	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners						In-Kind	Some roads have been rocked - often through the timber harvest process and these costs should be considered an ongoing operation expense and grant funds should be used sparingly excepting where critical needs exist on discrete problematic road segments. Big Salmon Creek lacks many readily available rock sources and rock will likely need to be imported from a location outside the basin.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										**Timber harvest remains a threat to coho salmon habitat in Big Salmon Creek, but at diminished levels compared to historical practices. Even with application of new California Forest Practice Rules this threat is anticipated to continue.**
BSC-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter										
BSC-CCC-8.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	20	CalFire, Conservation Fund, Private Landowners	28.50	28.50	28.50	28.50		114	Cost dependent on feasibility of surface road treatments for each road use and geology.
BSC-CCC-8.1.2	Recovery Action	Riparian	Improve canopy cover										
BSC-CCC-8.1.2.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	20	CDFG, Conservation Fund, Private Landowners						TBD	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number of trees left for future recruitment should be considered.
BSC-CCC-8.1.2.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CDFG, Conservation Fund, Private Landowners	80.25	80.25	80.25	80.25		321	
BSC-CCC-8.1.2.3	Action Step	Riparian	Ensure that adequate streamside protection measures are implemented to provide shade canopy and reduce heat inputs.			CDFG, Conservation Fund, Private Landowners						In-Kind	This recommendation should be considered standard practice.
BSC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										**Many roads in the watershed have inside ditches. Cost should be considered part of road maintenance costs.**

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but additional work remains before impairment is minimized. An effective road program should include a component that closes and remediates unnecessary roads and skid trails in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed and, based on the low rate of projected harvest in the watershed, the potential for sediment (both through chronic input and large episodic events) is high. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules. Cost based on road assessment for 92 miles (assume 75% of road network) at a cost of $927/mile.
BSC-CCC-9.1.1.1	Action Step	Sediment	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).	3	20	CDFG, Conservation Fund, Private Landowners						In-Kind	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Road inventory should identify extent and need for energy dissipaters.
BSC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										Costs may vary widely depending on number of riparian roads and the magnitude of the problem associated with the roads. Focus initial efforts (and/or continue ongoing efforts) in Hazel Gulch and Ketty Gulch. Cost accounted for in LANDSCAPE PATTERNS.
BSC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CDFG, Conservation Fund, Private Landowners						TBD	
BSC-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
BSC-CCC-10.1.1	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
BSC-CCC-10.1.1.1	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	100	CDFG, NMFS, Private Consultants, RFFI, State Parks						In-Kind	Cost based on stream flow modeling at a cost of $63,000.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										Cost will likely be captured within future timber harvest operational costs and compliance with 1600 streambed alteration agreements. At least two sites have already been constructed in Big Salmon Creek watershed. Due to low summer baseflows in Big Salmon Creek, this recommendation may reduce direct take of listed salmonids that may otherwise result from water truck diversions, particularly in dry years.
BSC-CCC-10.1.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	3	9		3.33	2.67				6	Low summer baseflows are present in Big Salmon Creek watershed. This baseline condition results in increased vulnerability of rearing juvenile coho salmon to diversions. Rates of diversion may increase in Big Salmon Creek watershed due to reduced rates of timber harvest (resulting in reduced oversight of some of the ownership in the watershed) and increasing rates of illegal (and legal) cannabis (marijuana) crops in Mendocino County.
BSC-CCC-10.1.2.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.	2	10	CDFG, Conservation Fund	2.50	2.50				5	Most diversions in Big Salmon watershed for dust control are for timber management actions. Most of these diversion have a 1600 agreement with the Department of Fish and Game and are likely incorporated into existing operations.
BSC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species range or habitat**										
BSC-CCC-11.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										This recommendation should be considered standard practice.
BSC-CCC-11.1.1.1	Action Step	Water Quality	Develop a Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, CDFG, Conservation Fund, Private Landowners						TBD	Assess high-risk shallow seeded landslide areas, prioritize, and develop plans to rehabilitate.
BSC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
BSC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners						In-Kind	Many of these types of roads are present in Big Salmon Watershed. Cost based on decommissioning 5 miles of riparian road network at a rate of $12,000/mile.
BSC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners						In-Kind	Use techniques that will require minimal management. Cost based on treating 1.25 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
BSC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
BSC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire						In-Kind	Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat according to shelter rating values. LWD was likely removed during past land management activities and well intentioned stream clearing practices. However, since these surveys were conducted, some efforts to improve instream habitat conditions have been conducted in the mainstem portions of Big Salmon Creek. While significant efforts have occurred, it is likely that instream habitat conditions overall are not at the viability targets for these attributes. Due to the lack of downstream infrastructure in Big Salmon Creek, it is assumed that most of the instream structure will consist of LWD and that most of this structure will be left unanchored. LWD should consist of logs 1.5 to 2 times the bankfull channel width. Cost based on treating 2.5 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										**To implement this recommendation, additional streamlining of the THP process for LWD input by regulatory agencies is necessary. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. In the stream reaches of Big Salmon Creek where there is extremely little downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation. Costs may vary significantly due to stream access, varying paucity of large wood between sub-watersheds, and installation techniques. Big Salmon Creek has been habitat typed and thus the stream reaches lacking wood can be readily identified. Projects occurring as part of ongoing timber harvest actions will have lower overall costs resulting in significant cost savings compared to restoration projects occurring absent timber management equipment already nearby.**
BSC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										This recommendation should be considered standard practice.
BSC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire							
BSC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels.
BSC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	
BSC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										
BSC-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						TBD	
BSC-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to habitat complexity										
BSC-CCC-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, CDFG, Conservation Fund, RPFs						In-Kind	Cost based on surveying 5 miles of High IP at a rate of $1,150/mile.. It is assumed that only sporadic sampling will occur in the Big Salmon Creek watershed due to its status as a Dependent watershed, and the overall magnitude of ongoing sampling occurring elsewhere in the Lost Coast Diversity stratum. Cost are estimated from survey methods developed by Gallagher and Gallagher (2005).
BSC-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										Cost based on periodic juvenile sampling (preferably snorkel counts) by trained biologist. Assume reach-scale surveys during summer months to identify presence/absence.
BSC-CCC-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	
BSC-CCC-19.1.4.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB	13.00	13.00				26	Cost for sediment assessment accounted for in LOGGING.
BSC-CCC-19.1.4.4	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	
BSC-CCC-19.1.5	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										Past logging resulted in a conversion of the forests from a redwood/Douglas-fir to many large brushy areas of ceanothus. These areas, while transitioning back to conifers, are at risk of burning. The juxtaposition of rural residential housing on the ridge tops may predispose Big Salmon Creek at greater risk of fire. The combination of younger conifer and hardwoods likely leaves some portions of the Big Salmon Creek watershed more vulnerable to wildfire than under historical conditions.
BSC-CCC-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	This recommendation should be considered a standard practice.
BSC-CCC-19.1.6	Recovery Action	Logging	Prevent increased landscape disturbance										This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
BSC-CCC-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Standard business practice.
BSC-CCC-19.1.7	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, etc.)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-19.1.7.1	Action Step	Logging	Reduce the amount and rate of even aged management.	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
BSC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
BSC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
BSC-CCC-19.2.1.1	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their timber management practices in stream reaches and where large woody material is deficient. Particular focus should be directed to stream reaches in Hazel and Ketty Gulch.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	
BSC-CCC-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CalFire, Mendocino County, Private Landowners, Public						0	
BSC-CCC-19.2.1.3	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CalFire, Mendocino County, NMFS, Private Landowners						0	
BSC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										**This recommendation should be considered standard practice.**
BSC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identify areas for prioritization. Cost based on erosion assessment (assume 25% of total watershed acres) estimated at $12/acre.
BSC-CCC-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	
BSC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										This recommendation should be considered standard practice.
BSC-CCC-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						TBD	
BSC-CCC-23.1.2.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Where feasible, this recommendation should be considered standard practice.
BSC-CCC-23.1.2.3	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB	43.00	43.00				86	
BSC-CCC-23.1.2.4	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						TBD	This recommendation should be considered standard practice.
BSC-CCC-23.1.2.5	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	30	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB							
BSC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Installing large woody material into stream deficient in large wood should be considered a top restoration priority. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint. Many landowners are discouraged from implementing these practices due complexities in the permitting process.
BSC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
BSC-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
BSC-CCC-23.2.1.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFG, NRCS, RWQCB, USACE						In-Kind	
BSC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
BSC-CCC-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	All new and replacement culverts should be sized to accommodate a 100 year flow event. This recommendation should be considered standard practice.
BSC-CCC-23.2.2.2	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	1	10	CalFire, CDFG, Conservation Fund, RPFs, RWQCB						In-Kind	These will likely be replaced as part of future timber harvest plans in Big Salmon watershed.
BSC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
BSC-CCC-23.2.3.1	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, CDFG, Conservation Fund, Private Landowners, RPFs, RWQCB						In-Kind	Legacy roads from past logging activity continue to impact Big Salmon Creek watershed. Many of these roads were poorly situated and constructed, improperly maintained, and many have been abandoned.
BSC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										**Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.**

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
BSC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
BSC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFG, Conservation Fund, Private Landowners	31.50	31.50				63	
BSC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Develop offstream water containment sites for water trucks in order to minimize onstream diversions during the summer low flow period.	2	10	CalFire, Conservation Fund, Private Landowners						In-Kind	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
BSC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	20	CDFG, CDFG Law Enforcement, Conservation Fund, NMFS OLE, Sheriff Department, SWRCB						TBD	
BSC-CCC-24.1.1.4	Action Step	Severe Weather Patterns	Evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CDFG, Conservation Fund, Private Landowners						TBD	Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions. Old roads (and rail road grades) should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to Class 1 streams with high IP value habitat.
BSC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										This recommendation should be considered standard practice.
BSC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CDFG, Conservation Fund, Private Landowners						In-Kind	
BSC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CDFG, Conservation Fund, Private Landowners						TBD	Cost should be considered part of land owner road management plans. Frequent monitoring of gates and potential pioneer trails will likely be an ongoing requirement in Big Salmon watershed.

Caspar Creek

Location	•Mendocino County
Watershed Area	• 8.0 Square Miles
Potential Habitat	• 12.5 Stream Miles
Vegetation	• 83% Coniferous, 17% Riparian or Montane Forest
Erodability	•Moderate to High
Ownership Patterns	•10% Private; 90% Public
Dominant Land Uses	•Timber
Housing Density	•Moderate
TMDL Pollutants	•None

Caspar Creek, Large Wood
Photo provided by Bob Coey, NMFS, and is used with permission. All rights reserved.

Caspar Creek Coho Salmon: Present – moderate abundance

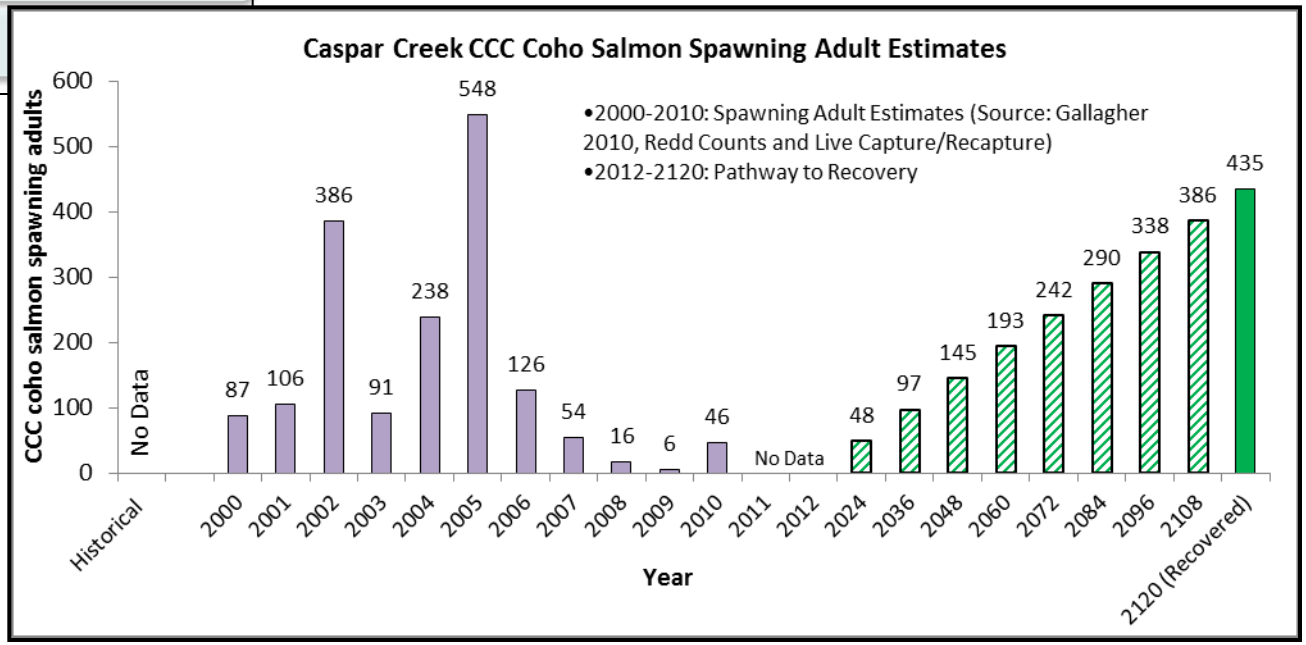
Recovery Goals
- ✓ Continue funding of life cycle station
- ✓ Continue ongoing juvenile monitoring efforts

Caspar Creek Adult Spawner Targets

Downlisting to Threatened
218

Recovery
435

STEELHEAD: YES
CHINOOK SALMON: YES



Caspar Creek

Potential Habitat: 12.5 miles
Recovery Target: 435 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	FAIR	VERY GOOD	VERY GOOD	GOOD	FAIR	FAIR	POOR	FAIR	FAIR	VERY GOOD

Preventing Extinction & Improving Conditions

- Target habitat restoration and enhancement that will function between winter base flow and flood stage
- Existing areas with floodplains or off channel habitats should be protected from future development of any kind
- Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth
- Continue funding of lifecycle station operated by CDFG, and continue ongoing juvenile sampling efforts in the watershed
- Promote restoration projects designed to create or restore alcove and backchannel habitats
- Decommission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access
- Close unauthorized trails and conduct appropriate decommissioning practices

Recovery Partners

Jackson Demonstration State Forest,
USFS Pacific Southwest Research Station

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, KRIS Information System , Eli Asarian and Morgan Bond, SWFSC

Caspar Creek

Potential Habitat: 12.5 miles
Recovery Target: 435 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM	NA	LOW	MEDIUM	NA	LOW	MEDIUM	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Identify and hydrologically disconnect problematic legacy roads or landings within WLPZ's
- Discourage rural residential housing on forest lands
- Limit winter use of unsurfaced roads and recreational trails
- Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Protect sources of cool water input from future diversions

Priority 2 & 3: Long-Term Threat Abatement Actions

- Conduct conifer release to promote growth of larger diameter trees where appropriate
- Encourage Jackson Demonstration State Forest and USFS to implement restoration projects
- Encourage low impact timber harvest techniques
- Conserve and manage forestlands for older forest stages
- Reduce the amount and rate of even aged management
- Implement the Jackson Demonstration State Forest Road Management Plan
- Replace or remove stream crossings if they cannot pass 100 year flow
- Minimize water withdrawals for dust control

North Fork Caspar Creek, Fish Ladder Construction
Courtesy Rick Macedo, CDFG, 2009

Conservation Highlights

- Watershed research actions since 1962 by Jackson Demonstration State Forest and US Forest Service Pacific Southwest Research Station.
- Coho salmon life cycle station operated by DFG.

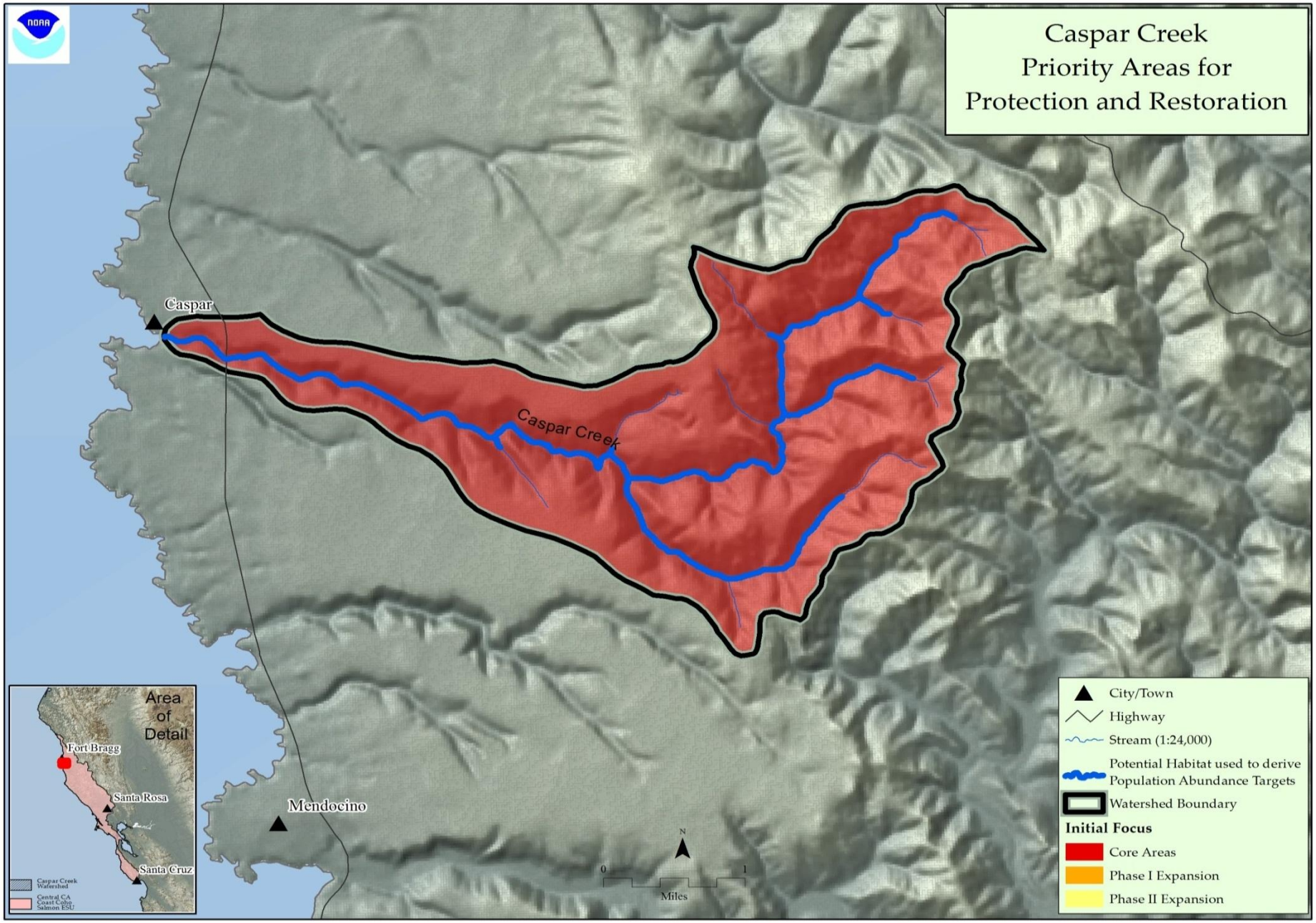


Figure 1: Map of Caspar Creek

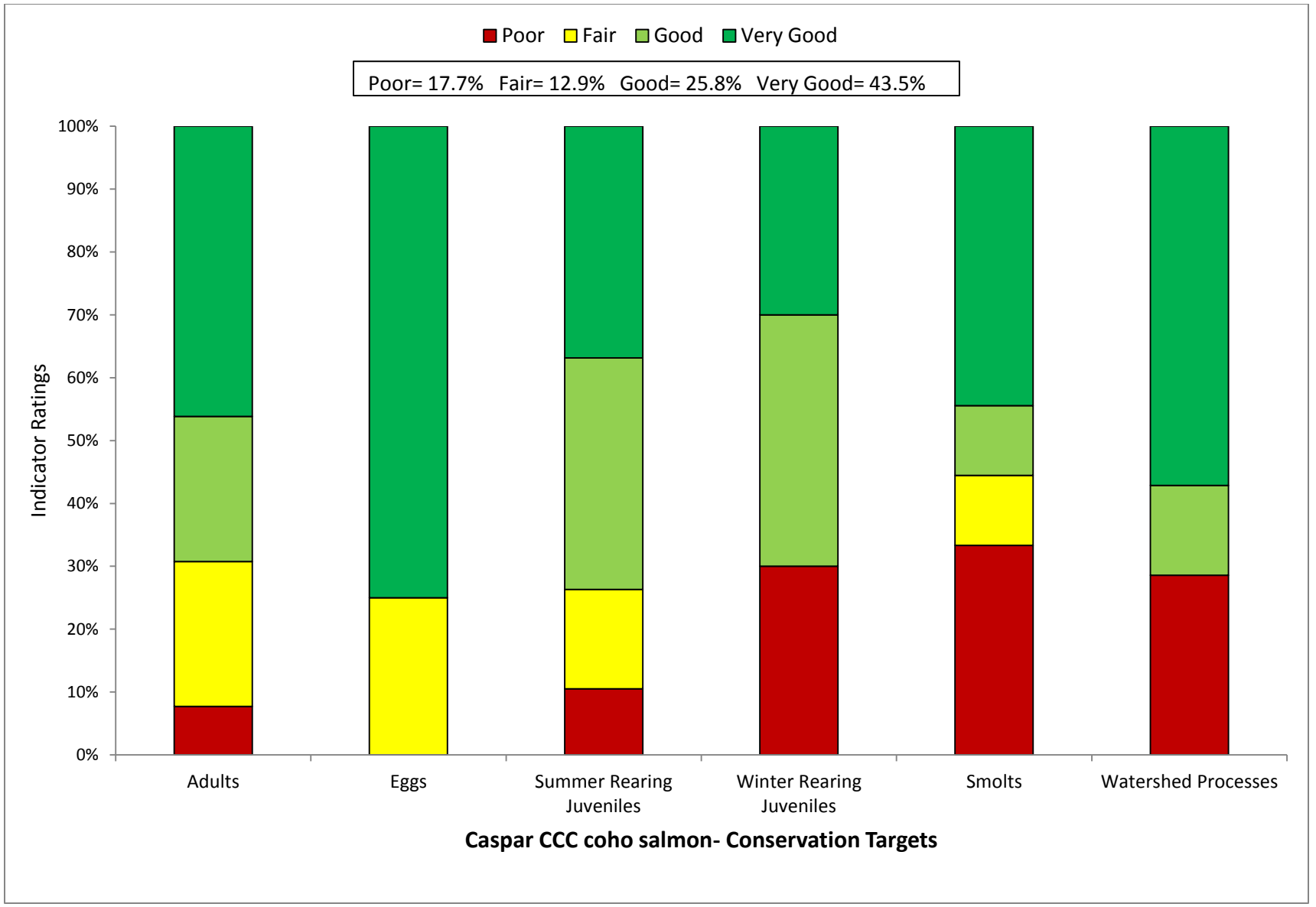


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Caspar Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**13.3 Key Pieces/100m**	Very Good	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**1.3 to 4 Key Pieces/100m**	Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**67% streams 95% IP-km (>30% Pools; >20% Riffles)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**33% streams 3% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =33**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**56% Class 5 & 6 across IP-km**	Good	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**1-20 per IP-km to < low risk spawner density**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**13.3 Key Pieces/100m**	Very Good	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**1.3 to 4 Key Pieces/100m**	Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**33% streams 23% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**67% streams 97% IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**33% streams 3% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =35-50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = <35**	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 Diversions**	Very Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**100% streams 100% IP-km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**56% Class 5 & 6 across IP-km**	Good	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0.2-0.5 fish/meter^2**	Fair	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**13.3 Key Pieces/100m**	Very Good	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**1.3 to 4 Key Pieces/100m**	Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**67% streams 95% IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**33% streams 3% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**56% Class 5 & 6 across IP-km**	Good	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**33% streams 3% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 Diversions**	Very Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score = <35**	Very Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**>90% IP-km (>6 and <14 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.233% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**2% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**7% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**5.1 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**5.8 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Caspar Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Medium	Low	Low	Medium	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium	-	Low	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Low	High	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Medium	Medium
12	Roads and Railroads	Medium	High	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	High	Medium	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
	Threat Status for Targets and Project	Medium	Medium	High	High	Medium	High	High

Central CA Coast Coho Salmon ~ Caspar Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

1.1.1. **Recovery Action:** Enhance and restore estuary function by improving complex habitat features.

1.1.1.1. **Action Step:** Evaluate enhancement opportunities for the Caspar estuary.

1.1.1.2. **Action Step:** Evaluate water quality conditions.

1.1.1.3. **Action Step:** Evaluate juvenile salmonid usage of the Caspar estuary during the summer and late fall period.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.2. **Action Step:** Target habitat restoration and enhancement that will function between winter base flow and flood stage.

2.1.1.3. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

2.1.1.4. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.1.1.1. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.1.2. **Action Step:** Install properly sized large woody debris placed and constructed to improve instream shelter ratings.

4. **Restoration- Hydrology**

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

9.1.1.2. **Action Step:** Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Continue funding of lifecycle station operated by CDFG.

10.1.1.2. **Action Step:** Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

10.1.2. **Recovery Action:** Increase abundance

10.1.2.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.1.1. **Action Step:** Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to habitat complexity

19.1.1.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

19.1.1.2. **Action Step:** Encourage Jackson Demonstration State Forest and USFS to implement restoration projects as part of their ongoing practices in priority stream reaches and where LWD is found lacking.

19.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.2.1. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.2.2. **Action Step:** New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.

19.1.2.3. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.1.3. **Recovery Action:** Prevent increased landscape disturbance

19.1.3.1. **Action Step:** Conserve and manage forestlands for older forest stages.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Reduce the amount and rate of even aged management.

19.2.1.2. **Action Step:** Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.2.2.1. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

19.2.2.2. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

19.2.2.3. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.2.3. **Recovery Action:** Prevent impairment to habitat complexity

19.2.3.1. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate

23.1.1.1. **Action Step:** Implement the Jackson Demonstration State Forest Road Management Plan.

23.1.1.2. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

23.1.1.3. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams.

23.1.1.4. **Action Step:** Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.

23.1.1.5. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.1.1.6. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to instream substrate

23.2.1.1. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

23.2.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.

23.2.1.3. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.1.1. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon during droughts.

24.1.2. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.2.1. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.1.2.2. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.3. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.1.3.1. **Action Step:** Protect sources of cool water input from future diversions.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Caspar Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
CaC-CCC-1.1.1	Recovery Action	Estuary	Enhance and restore estuary function by improving complex habitat features.										
CaC-CCC-1.1.1.1	Action Step	Estuary	Evaluate enhancement opportunities for the Caspar estuary.	3	10	CalFire, CDFG, Mendocino County, USFS	137.50	137.50				275	Evaluation should include analysis of the historical tidal prism compared to the current prism of the estuary. If breaching occurs it should also be evaluated and a series of recommendations (if necessary) should be proposed. Careful consideration should be given to preservation of historical foundations of the Caspar Saw Mill which is located in the estuary. The estuary is small and potential benefits should be carefully considered. Cost for estuary use is estimated at $273,217/project.
CaC-CCC-1.1.1.2	Action Step	Estuary	Evaluate water quality conditions.	3	10	CDFG, Jackson Demonstration State Forest, Mendocino County, RWQCB, USFS	7.50	7.50				15	Cost estimates may be on the high range and should not exceed this estimate. Sampling in the lagoon should be relatively straight forward due to the relatively small tidal prism of the Caspar estuary. Cost for continuous water quality monitoring is estimated at $5,000/station. Assume a minimum of 3 for the lagoon. Cost estimate does not account for maintenance or data management.
CaC-CCC-1.1.1.3	Action Step	Estuary	Evaluate juvenile salmonid usage of the Caspar estuary during the summer and late fall period.	3	10	CDFG, Jackson Demonstration State Forest, USFS							Coho salmon use of the Caspar estuary during the summer/late fall is unknown. Lagoons are documented to be important rearing habitats for juvenile steelhead and it is possible the Caspar lagoon may serve a similar role as documented by researchers in other central California lagoons. If coho salmon utilization is limited, measures to improve the overall productivity of this habitat feature should be evaluated and enhancement measures proposed. Cost for evaluating juvenile salmonid use of the estuary is accounted for in above action steps.
CaC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
CaC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	5	CalFire, Jackson Demonstration State Forest, USFS	36.00					36	Cost based on treating 1 mile (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
CaC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	5	CalFire, California Coastal Conservancy, CDFG, Jackson Demonstration State Forest, USFS	62.50					63	Floodplains have incised and it is likely, based on this incision, that undercut banks and other cover/shelter analogs are significantly less functional than under historical conditions. Based on these criteria high velocity refugia are considered marginal. Increased LWD frequencies may provide the winter habitat targeted by this action. Cost based on treating 2.5 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.
CaC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CalFire, Jackson Demonstration State Forest, USFS						In-Kind	
CaC-CCC-2.1.1.4	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	2	10	CalFire, Jackson Demonstration State Forest, USFS	12.00	12.00				24	Cost based on decommissioning 2 miles of riparian road network at a rate of $12,000/mile.
CaC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
CaC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
CaC-CCC-3.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CalFire, CDFG, Jackson Demonstration State Forest, USFS						In-Kind	Cost are minimal if passive management of key habitat features are left intact.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-3.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris placed and constructed to improve instream shelter ratings.	1	5	CalFire, CDFG, Jackson Demonstration State Forest, USFS	50.00					50	It is anticipated that significant cost savings (and ecological benefits) would be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used over engineered structures. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized it natural recruitment into the watershed was allowed to stay in place. These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity and shelter rating values in potential rearing and migration reaches. Some large woody debris supplementation has already occurred in the watershed. Supplementation programs that are a part of future timber harvest plans may result in significantly reduced costs. Due to the lack of downstream infrastructure in Caspar Creek, unsecured techniques should be used. Cost for treating 2 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile. This action step may be in concert with targeting restoration of winter base flow.
CaC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
CaC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										
CaC-CCC-9.1.1.1	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, Campbell Timberland Management, CDFG, Jackson Demonstration State Forest, NMFS, Private Landowners, RPFs, RWQCB, USFS						In-Kind	
CaC-CCC-9.1.1.2	Action Step	Sediment	Close unauthorized trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	2	100	CalFire, CDFG, Mendocino County, NMFS, RWQCB						In-Kind	Cost will likely be low since work will likely be absorbed by agency personnel.
CaC-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
CaC-CCC-10.1.1.1	Action Step	Viability	Continue funding of lifecycle station operated by CDFG.	1	10	CDFG, Jackson Demonstration State Forest	117.50	117.50				235	In 2004/2005, CDFG initiated sampling in the Caspar Creek watershed, according to criteria in an action plan for monitoring California's coastal salmonid populations (Boydstun and McDonald 2005). Under this monitoring scheme, Caspar Creek and two other local streams serve as life cycle monitoring streams to calibrate regional sampling consisting of extensive spawning surveys to estimate escapement. The sampling is based on redd counts selected under a random stratified survey of ten percent of available habitat each year. In the streams that serve as the life cycle stations abundance of adults and smolts are estimated and a complete census of red density is conducted (Gallagher and Wright 2009). Cost based on life cycle monitoring at a cost of $234,600.
CaC-CCC-10.1.1.2	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	1	15	CDFG, Jackson Demonstration State Forest, USFS	86.67	86.67	86.67			260	Caspar Creek watershed has been the site of an ongoing, long-term watershed study since 1962, conducted jointly by USFS-PSW and CalFire. Fisheries research has been conducted since the inception of the Caspar Creek study with numerous reports, including information on coho salmon. Burns (1972) evaluated the impacts of logging and road building on juvenile salmonid abundance in four northern California streams from 1966 through 1969, including Caspar Creek. Long term monitoring should continue to ensure a long-term data is collected. Cost based on abundance/distribution at a cost of $129, 391.
CaC-CCC-10.1.2	Recovery Action	Viability	Increase abundance										
CaC-CCC-10.1.2.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	CDFG, Jackson Demonstration State Forest, NMFS						In-Kind	Inter-agency coordination will continue as part of doing business to rescue juvenile coho salmon until habitat conditions are restored to prevent imminent risk of stranding and mortality.
CaC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
CaC-CCC-11.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-11.1.1.1	Action Step	Water Quality	Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.	3	10	CalFire, Jackson Demonstration State Forest, USFS	33.00	33.00				66	Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall or flooding events. Cost accounted for in other recovery actions. Cost for sediment assessment estimated at $12.22/acre.
CaC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
CaC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to habitat complexity										
CaC-CCC-19.1.1.1	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Jackson Demonstration State Forest, Private Landowners, USFS	57.00	57.00				114	Cost based on treating 1 mile (assume 80 acres/mile in 15% High IP with a minimum of 1 mile) at a rate of $1,422/mile.
CaC-CCC-19.1.1.2	Action Step	Logging	Encourage Jackson Demonstration State Forest and USFS to implement restoration projects as part of their ongoing practices in priority stream reaches and where LWD is found lacking.	2	30	CalFire, CDFG, Jackson Demonstration State Forest, USFS						In-Kind	Recovery actions should focus on retaining instream LWD to improve floodplain connectivity through placement of standard log/boulder habitat structures which can effectively increase holding and rearing habitat and retain instream gravels. Since virtually no infrastructure is present in downstream areas, properly sized trees could be felled into stream channels to create these structures. Retention of instream gravels could ultimately increase bed elevation and enhance stream channel interactions with floodplain areas
CaC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-19.1.2.1	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Campbell Timberland Management, CDFG, Jackson Demonstration State Forest, NMFS, Private Landowners						In-Kind	This recommendation should be considered standard practice.
CaC-CCC-19.1.2.2	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	20	CalFire, CDFG, Jackson Demonstration State Forest, NMFS, USFS						In-Kind	This should be considered an appropriate mitigation measure for future timber harvest plans in the watershed.
CaC-CCC-19.1.2.3	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Jackson Demonstration State Forest, USFS						In-Kind	Timber harvest remains a threat to salmonid habitat in the Caspar Creek, but at diminished levels compared to historical practices. For coho salmon timber harvest was listed as a threat to watershed processes due primarily to road use, road location and density, and the resulting increases in sediment input. Nonetheless, the Caspar Creek watershed is unique in that it is a very well-studied watershed and timber harvest plans receive a high degree of scrutiny and oversight, which may ameliorate impacts compared to timber operations in other watersheds.
CaC-CCC-19.1.3	Recovery Action	Logging	Prevent increased landscape disturbance										
CaC-CCC-19.1.3.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Jackson Demonstration State Forest, Private Landowners						In-Kind	
CaC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										
CaC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-19.2.1.1	Action Step	Logging	Reduce the amount and rate of even aged management.	2	100	CalFire, Jackson Demonstration State Forest, USFS						In-Kind	In 1962, the Caspar Creek Watershed Study was initiated to obtain more information on the effects of logging and road construction on sedimentation and aquatic habitat. The study is a cooperative effort between CalFire and the Pacific Southwest Reach Station Redwood Sciences Laboratory. The study has been conducted in two phases. The South Fork phase was designed as a traditional paired-watershed study and involved monitoring the impacts of road construction and selection harvesting by tractor on stream flow, suspended sediment, and bedload. The North Fork phase was started in the early 1980s and harvest units were logged using primarily skyline cable yarding techniques. Road and landing construction and tractor logging were limited to ridgetop and upper slope locations. Based on this study design, other areas in the watershed are likely targeted for even aged management.
CaC-CCC-19.2.1.2	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino County						In-Kind	
CaC-CCC-19.2.2	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
CaC-CCC-19.2.2.1	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	30	CalFire, CDFG, Jackson Demonstration State Forest, Private Landowners, USFS						In-Kind	
CaC-CCC-19.2.2.2	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, Jackson Demonstration State Forest, NMFS, Private Landowners						TBD	Cost of future sampling efforts is dependent on the number, location and frequency of sampling efforts.
CaC-CCC-19.2.2.3	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	40	CalFire, Jackson Demonstration State Forest, USFS						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-19.2.3	Recovery Action	Logging	Prevent impairment to habitat complexity										
CaC-CCC-19.2.3.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	2	100	NMFS						In-Kind	
CaC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
CaC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
CaC-CCC-23.1.1.1	Action Step	Roads/Railroads	Implement the Jackson Demonstration State Forest Road Management Plan.	2	20	CalFire, Jackson Demonstration State Forest						In-Kind	The cost of implementing the plan will likely be low, since the plan already exists and costs will be absorbed into existing management activities.
CaC-CCC-23.1.1.2	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	2	10		41.00	41.00				82	Road densities are high throughout the watershed, estimated at 4.9 miles of road per square mile of watershed area and at 5.7 miles per square mile of riparian area. Roads parallel many of the waterways within Caspar Creek and impinge on channel migration. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality. This is a feasible recommendation for the Caspar watershed due to the fact most of the watershed is in timber management and owned by only a few landowners. Riparian roads should be targeted for decommissioning. Cost based on decommissioning 7 miles of road network at a rate of $12,000/mile.
CaC-CCC-23.1.1.3	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams.	3	100	CalFire, Campbell Timberland Management, CDFG, Jackson Demonstration State Forest, Mendocino County Department of Public Works, Private Landowners, USFS						TBD	These areas are likely already established on the JDSF portion of the Caspar watershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-23.1.1.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	10	CalFire, Campbell Timberland Management, Jackson Demonstration State Forest, Private Landowners, USFS						In-Kind	Since the majority of the watershed is in timber management it is anticipated that the majority of these actions will occur as part of future road upgrades and therefore no costs are assigned to this action.
CaC-CCC-23.1.1.5	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	100	CalFire, Campbell Timberland Management, CDFG, Jackson Demonstration State Forest, NMFS, Private Landowners						TBD	Many high priority sites are identified in the JDSF EIR.
CaC-CCC-23.1.1.6	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, Campbell Timberland Management, Jackson Demonstration State Forest, Private Landowners, USFS						In-Kind	NMFS assumes some of the roads in the watershed have been upgraded as part of past timber operations. Costs cannot be estimated until a watershed-wide road inventory is conducted. Unsurfaced roads adjacent to watercourses should be rocked. However, rocked roads adjacent to watercourses should be closed during the winter period if feasible.
CaC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
CaC-CCC-23.1.2.1	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	10	CalFire, Jackson Demonstration State Forest, USFS	24.00	24.00				48	Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings. Cost for road inventory estimated at $47,277 (assume 75% of total road network)
CaC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
CaC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
CaC-CCC-23.2.1.1	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Jackson Demonstration State Forest, USFS						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	2	100	CalFire, Campbell Timberland Management, Jackson Demonstration State Forest, Private Landowners, Public, USFS						In-Kind	
CaC-CCC-23.2.1.3	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	100	CalFire, California Geological Survey, Jackson Demonstration State Forest, Private Landowners						In-Kind	Costs likely to be incurred as part of timber harvest operations. However, in some circumstances this may be a stand alone cost.
CaC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
CaC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
CaC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon during droughts.	2	100	CalFire, Jackson Demonstration State Forest, RWQCB, SWRCB, USFS						In-Kind	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
CaC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
CaC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalTrans, Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino County, USFS						In-Kind	
CaC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	20	CalFire, Jackson Demonstration State Forest, USFS						TBD	Sediment assessment should identify high-risk shallow-seeded landslide areas. Cost for protective measures cannot be determined until prioritization of landslide areas is identified.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CaC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
CaC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Protect sources of cool water input from future diversions.	1	100	CalFire, CDFG, Jackson Demonstration State Forest, SWRCB, USFS						In-Kind	

Cottaneva Creek

Location	•Mendocino County
Watershed Area	• 17.0 Square Miles
Potential Habitat	•14.5 Stream Miles
Vegetation	•73% Coniferous •21% Riparian or Montane Forest
Erodability	•High
Ownership Patterns	•100% Private
Dominant Land Uses	•Timber
Housing Density	•Very low
TMDL Pollutants	•None

Cottaneva Creek estuary and lower watershed.
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Cottaneva Creek Coho Salmon: Persistent – Low Abundance

Recovery Goals

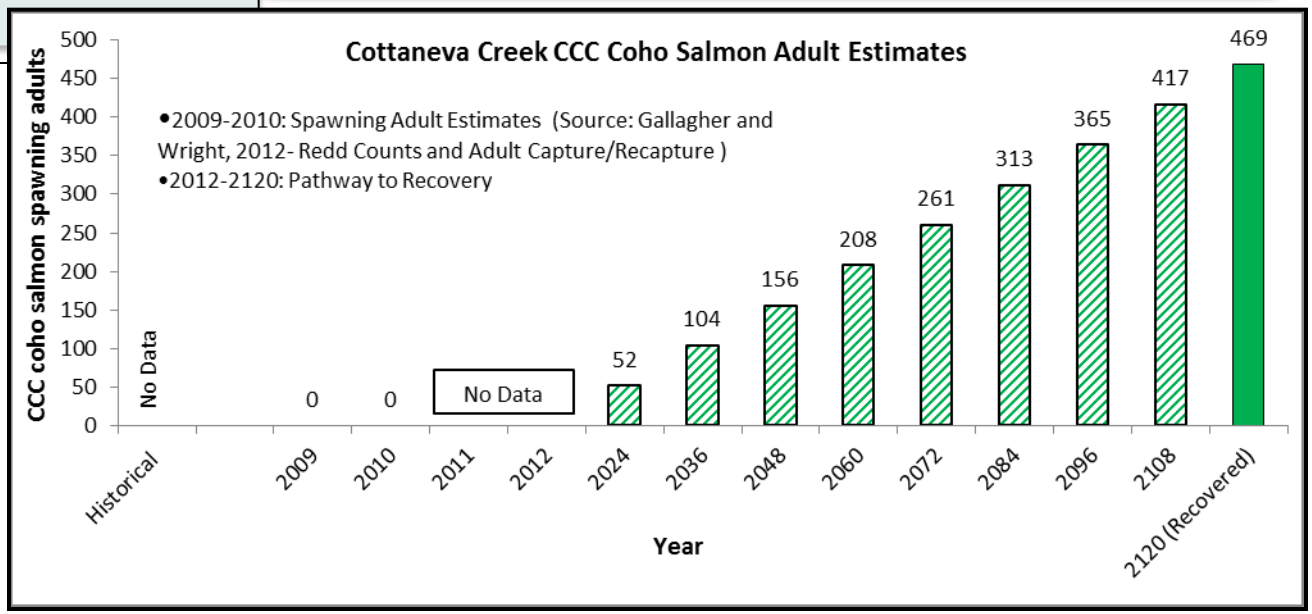
✓ Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed

Cottaneva Creek Adult Spawner Targets

Downlisting to Threatened
235

Recovery
469

STEELHEAD: YES
CHINOOK SALMON: NO

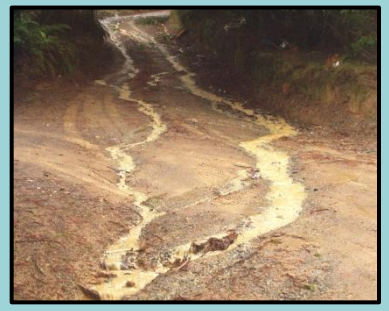


Cottaneva Creek

Potential Habitat: 14.5 miles
Recovery Target: 469 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
GOOD	POOR	VERY GOOD	VERY GOOD	GOOD	FAIR	GOOD	GOOD	FAIR	FAIR	GOOD



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth
- Decommission or upgrade roads
- Treat high priority roads, culverts, road slides and landings

Priority 2 & 3: Long-Term Restoration Actions

- Target habitat restoration and enhancement that will function between winter base flow and flood stage
- Promote restoration projects designed to create or restore off channel habitat
- Install large woody material, boulders, and other instream features
- Assess and implement sediment reduction measures associated with the 2008 Middle Fire
- Improve passage conditions through the aggraded estuary, mainstem, and lower reaches

Recovery Partners

Photo Courtesy: Campbell Timberland, Campbell Timberland, City of Santa Rosa and Morgan Bond, SWFSC

Cottaneva Creek

Potential Habitat: 14.5 miles
Recovery Target: 469 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
NA	MEDIUM	MEDIUM	MEDIUM	LOW	NA	NA	HIGH	LOW	LOW	LOW	HIGH	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage timber operations in areas with high erosion potential during wet conditions
- Protect existing areas with floodplains or off channel habitats from future development
- Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Use available best management practices for road construction, maintenance, management and decommissioning
- Discourage Caltrans from removing instream or near stream large woody material along Highway 1

Priority 2 & 3: Long-Term Threat Abatement Actions

- Encourage tree retention on the axis of headwall swales
- For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations
- Conserve and manage forestlands for older forest stages
- Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets
- Minimize water withdrawals for dust control

Cottaneva Creek. *Photo © Mendocino Redwood Company*

Conservation Highlights

- Mendocino Redwood currently manages the land for sustained timber harvest.
- Trout Unlimited, Mendocino Redwood Company, and Pacific Watershed Associates are working on a multi-phase, watershed wide approach to sediment reduction.
- California Conservation Corps and Mendocino Redwood Company are partnering to install large wood structures.

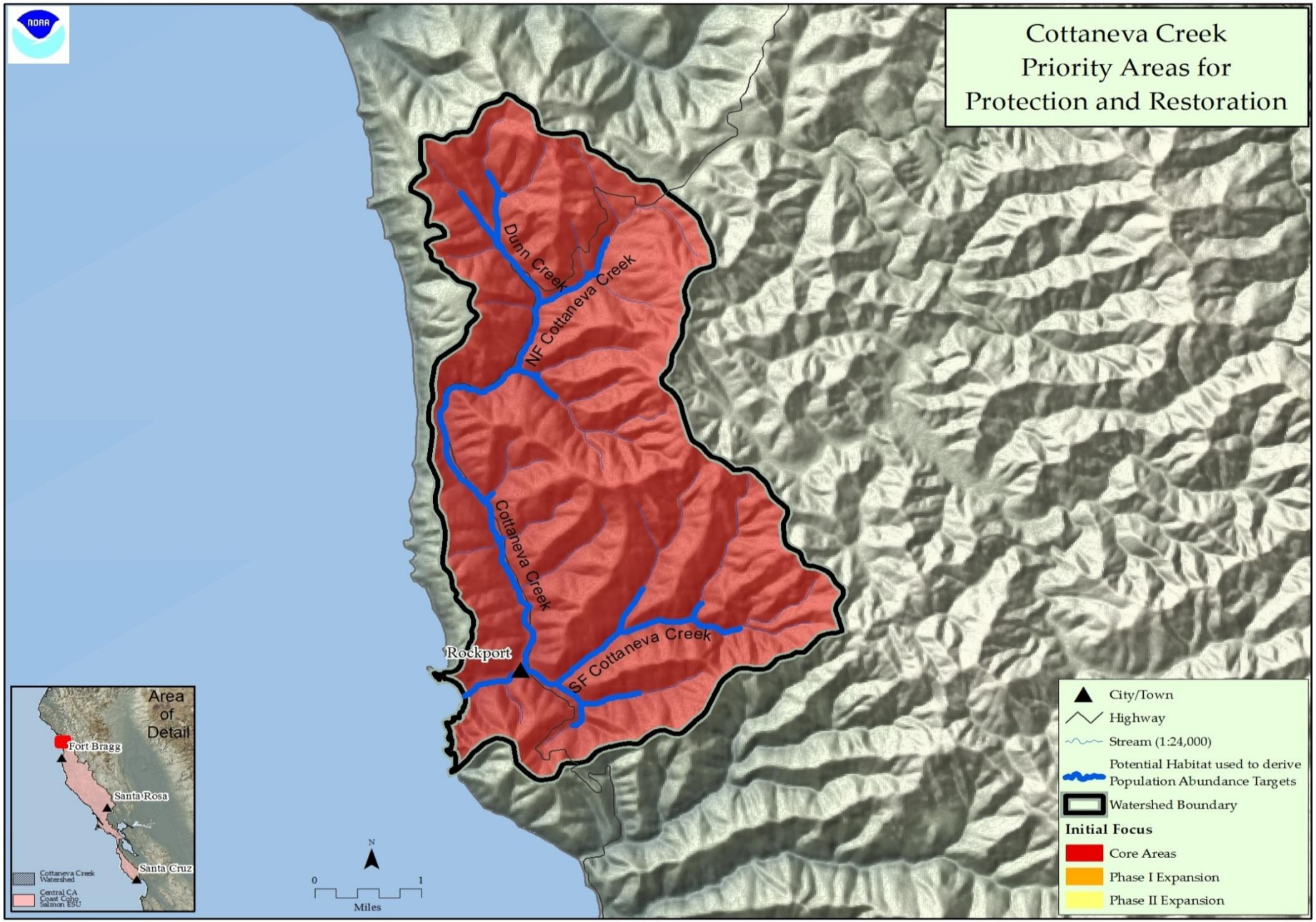


Figure 1: Map of Cottaneva Creek

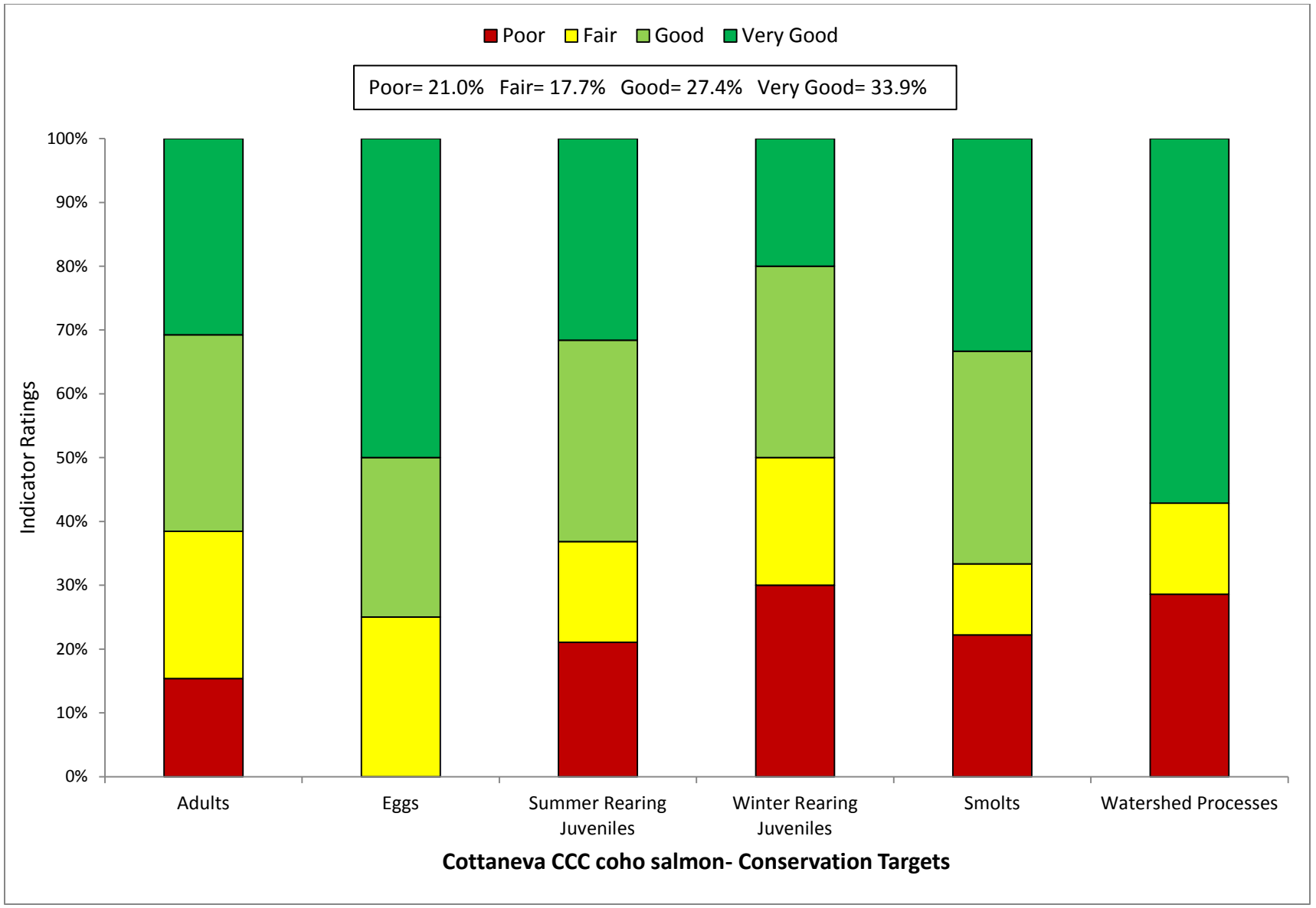


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Cottaneva Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**0.7 Key Pieces/ 100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0/10 IP-km**	Very Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**64% streams, 49% IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =33**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**> 90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**92% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**57%, Class 5 & 6 across IP-km**	Good	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**> 80 % Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**0.7-3.2 spawners per IP-km**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score = 33**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Properly Functioning Condition**	Good	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.7 Key Pieces/ 100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**0% (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**64% by streams; 49 by IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score 35-50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score 35-50**	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 Diversions/10 IP-km**	Very Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**> 90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**92% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**94% of streams/IP with average canopy >85%**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**57%, Class 5 & 6 across IP-km**	Good	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0.2-0.5 fish/meter^2**	Fair	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.7 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100 m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**64% by streams; 49% by IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**92% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**57% Class 5 & 6 across IP-km**	Good	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100 of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Properly Functioning Condition**	Good	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 Diversions/10 IP-km**	Very Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =33**	Very Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**> 90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-Km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces high risk spawner density**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.18% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**28% of Watershed in Timber Harvest**	Fair	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**0% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**> 75% Intact Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**6.9 Miles/Square Miles**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**6.8 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Cottaneva Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	-	-	-	-	-	-	-
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Low	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	-	-	-	-	-	-	-
8	Logging and Wood Harvesting	Medium	Low	Medium	High	Medium	High	High
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	High	High	High	High	High
13	Severe Weather Patterns	Medium	Low	Medium	High	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	Medium	High	High	High	High	High

Central CA Coast Coho Salmon ~ Cottaneva Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

No species-specific actions were developed.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.

2.1.1. **Recovery Action:** Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.

2.1.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.1.1.2. **Action Step:** Target habitat restoration and enhancement that will function between winter base flow and flood stage.

2.1.1.3. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase LWD, primary pools and shelter ratings.

3.1.1.1. **Action Step:** Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.1.2. **Action Step:** Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information from MRC Cottaneva Creek Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFG stream habitat data to help determine reaches for LWD placement.

3.1.1.3. **Action Step:** Allow trees in riparian areas to age, die, and recruit into the stream naturally.

4. **Restoration- Hydrology**

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

No species-specific actions were developed.

6. **Restoration- Passage**

No species-specific actions were developed.

7. **Restoration- Pool Habitat**

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Improve habitat conditions at multiple life stages by reducing sediment inputs to the stream at the watershed scale.

9.1.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels. Restoration projects that upgrade or decommission high risk roads in Core CCC coho salmon areas should be considered an extremely high priority for funding (e.g., PCSRF).

9.1.1.1. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

9.1.1.2. **Action Step:** Treat high priority roads, culverts, road slides and landings that are identified in the 2005 MRC Cottaneva Creek Watershed Analysis. Focus on 88 culverts determined to be high priority by MRC.

9.1.1.3. **Action Step:** Acquire funding for assessment and implementation of sediment reduction measures associated with the 2008 Middle Fire in the Cottaneva Creek watershed.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.1.2. **Recovery Action:** Monitor population status for response to recovery actions.

10.1.2.1. **Action Step:** Use standardized watershed assessments (Coastal Monitoring Plan) within sub-watersheds not previously evaluated in MRC's 2005 effort.

10.1.2.2. **Action Step:** Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.2.1. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.2.2. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.2.3. **Action Step:** Wet weather and/or winter operations should be discouraged in areas with high erosion potential.

19.1.2.4. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.3. **Recovery Action:** Prevent future impairment to instream habitat complexity (reduced large wood and/or shelter)

19.1.3.1. **Action Step:** Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.

19.1.3.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

19.1.4. **Recovery Action:** Prevent increased landscape disturbance

19.1.4.1. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.4.2. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.5.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.2. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

19.2.1.3. **Action Step:** Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse as a result.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

23.1.1.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.2. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams.

23.1.1.3. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas.

23.1.1.4. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.1.5. **Action Step:** Implement high and medium priority sediment reduction actions identified in the Mendocino Redwood Company's 2005 watershed analysis. Conduct a similar sediment reduction plan in the Dunn Creek subbasin.

23.1.2. **Recovery Action:** Prevent impairment to passage and migration

23.1.2.1. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.3. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.3.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.3.2. **Action Step:** Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.2.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.2.3. **Recovery Action:** Prevent impairment to instream substrate.

23.2.3.1. **Action Step:** Discourage Caltrans from removing instream or near stream large woody material along Highway 1.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to hydrology (impaired water flow)

24.1.1.1. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water

drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.

24.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

24.1.2.1. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Cottaneva Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.**										
CoC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.										
CoC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	3	5	CalFire, Mendocino Redwood Company, Private Landowners	40.00					40	This may be a GIS exercise with ground truthing. Available information exists from past habitat typing that may streamline this analysis and further reduce the overall cost.
CoC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	10	CalFire, California Coastal Conservancy, CDFG, Mendocino Redwood Company						TBD	Costs depend on level of technical assistance required and types of projects proposed.
CoC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CalFire, California Coastal Conservancy, CDFG, Mendocino Redwood Company, Private Landowners	36.00	36.00				72	Costs to promote and support restoration efforts depend on level of technical assistance provided and the types of projects proposed. Cost for treating 1 mile (assume 1 project/mile in 25% High IP with 1 mile minimum) at a rate of $36,046/mile.
CoC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
CoC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase LWD, primary pools and shelter ratings.										
CoC-CCC-3.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CalFire, CalTrans, CDFG, Mendocino Redwood Company, Private Landowners						In-Kind	Caltrans road maintenance practices should be carefully monitored in regard to large woody material management. There should be minimal cost if incorporated into management operations.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-3.1.1.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information from MRC Cottaneva Creek Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFG stream habitat data to help determine reaches for LWD placement.	2	10	California Conservations Corps, CDFG, Mendocino Redwood Company, Private Landowners, RPFs	25.00	25.00				50	Cost based on treating 2 miles (assume 50% High IP) at a rate of $25,000/mile. Cost could be lower based on updated information from MRC Cottoneva Creek Watershed Analysis.
CoC-CCC-3.1.1.3	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, CDFG, Mendocino County, Mendocino Redwood Company, PG&E, Private Landowners						In-Kind	
CoC-CCC-9.1	**Objective**	**Sediment**	**Improve habitat conditions at multiple life stages by reducing sediment inputs to the stream at the watershed scale.**										
CoC-CCC-9.1.1	Recovery Action	Sediment	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels. Restoration projects that upgrade or decommission high risk roads in Core CCC coho salmon areas should be considered an extremely high priority for funding (e.g., PCSRF).										
CoC-CCC-9.1.1.1	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	1	10	CalFire, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners, RWQCB	25.00	25.00				50	Costs may vary widely depending on number of riparian roads and the magnitude of the problem associated with the roads. Cost based on decommissioning 4 miles of riparian road network at a rate of $12,000/mile. TU, MRC, and Pacific Watershed Associates are working on sediment reduction in the Cottaneva Creek watershed. The restoration work is part of TU's North Coast Coho Project and is a multi-phase, watershed-wide approach to sediment reduction.
CoC-CCC-9.1.1.2	Action Step	Sediment	Treat high priority roads, culverts, road slides and landings that are identified in the 2005 MRC Cottaneva Creek Watershed Analysis. Focus on 88 culverts determined to be high priority by MRC.	1	5	CDFG, Mendocino Redwood Company, NOAA RC, Private Consultants, Trout Unlimited							Cost accounted for in ROADS/RAILROADS.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-9.1.1.3	Action Step	Sediment	Acquire funding for assessment and implementation of sediment reduction measures associated with the 2008 Middle Fire in the Cottaneva Creek watershed.	2	10	CalFire, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners	16.50	16.50				33	Cost based on sediment assessment for 2,643 acres (assume 25% of total watershed acres) at a rate of $12/acre.
CoC-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**										
CoC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
CoC-CCC-10.1.1.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	2	25	CDFG, Mendocino Redwood Company, Private Landowners	38.00	38.00	38.00	38.00	38.00	190	Cost based on annual spawning surveys for North Central Coast streams (assume 6 km in High IP) at a rate of $75,840/year.
CoC-CCC-10.1.2	Recovery Action	Viability	Monitor population status for response to recovery actions.										
CoC-CCC-10.1.2.1	Action Step	Viability	Use standardized watershed assessments (Coastal Monitoring Plan) within sub-watersheds not previously evaluated in MRC's 2005 effort.	2	10	CalFire, CalTrans, CDFG, Mendocino Redwood Company, NMFS, Private Consultants, Private Landowners						In-Kind	
CoC-CCC-10.1.2.2	Action Step	Viability	Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.	3	20	CDFG, Mendocino Redwood Company, Private Landowners	25.00	25.00	25.00	25.00		100	Some cost accounted for in spawning surveys. Cost based for smolt monitoring based on estimate of $50,000/unit/year.
CoC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
CoC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (quality & extent)										
CoC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	1	100	CalFire, Mendocino Redwood Company, Private Landowners, RPFs						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
CoC-CCC-19.1.2.1	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, California Geological Survey, Mendocino Redwood Company, Private Landowners, RPFs						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.1.2.2	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFG, Mendocino Redwood Company, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.1.2.3	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	1	100	CalFire, Mendocino Redwood Company, Private Landowners, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.1.2.4	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFG, Mendocino Redwood Company, Private Landowners, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.1.3	Recovery Action	Logging	Prevent future impairment to instream habitat complexity (reduced large wood and/or shelter)										
CoC-CCC-19.1.3.1	Action Step	Logging	Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	2	100							In-Kind	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
CoC-CCC-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Mendocino Redwood Company, RPFs	57.00	57.00				114	Cost based on treating 1.0 mile (assume 80 acres/mile in 5% of High IP with a minimum of 1 mile) at a rate of $1,422/acre.
CoC-CCC-19.1.4	Recovery Action	Logging	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-19.1.4.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Mendocino Redwood Company, Private Landowners						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.1.4.2	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, CDFG, Mendocino Redwood Company, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.1.5	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
CoC-CCC-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Mendocino Redwood Company, Private Landowners, RPFs						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
CoC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
CoC-CCC-19.2.1.1	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	Mendocino County, Mendocino Redwood Company, Private Landowners						In-Kind	
CoC-CCC-19.2.1.2	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CalFire, Mendocino County						In-Kind	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-19.2.1.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse as a result.	2	100	CalFire, California Geological Survey, CalTrans, CDFG, Mendocino Land Trust, Private Landowners, RPFs, RWQCB						In-Kind	
CoC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
CoC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										
CoC-CCC-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	100	CalFire, CalTrans, Mendocino Redwood Company, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-23.1.1.2	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams.	3	10	CalFire, CalTrans, Mendocino County, Mendocino Redwood Company						TBD	Cost cannot be estimated without analysis of feasibility of adequate spoils storage sites.
CoC-CCC-23.1.1.3	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas.	3	10	CalFire, California Geological Survey, CalTrans, Mendocino County, Mendocino Redwood Company, Private Consultants, Private Landowners, Trout Unlimited	36.00	36.00				72	Three road segments in Cottaneva Creek have been identified as potential candidates for decommissioning. These segments include roads 47- CC (South Fork Cottaneva near Kimball Creek), 47-PH 005 (South of Honky Tonk picnic area) and 47-G4 (Middle Fork Cottaneva Creek). A detailed evaluation will likely be required to determine if decommissioning is appropriate at these sites. The decommissioning target is likely achievable due to the extensive and seldom used logging roads in the watershed which are under the management of one large landowner. Most of these costs have be addressed as mitigation measures in the MRC HCP. Cost based on decommissioning 6 miles of road network at a rate of $12,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-23.1.1.4	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	2	100	CalFire, CalTrans, Mendocino County Department of Public Works, Mendocino Redwood Company						TBD	Standard business practice. Cost will be determined by inventory of quantity and type of energy dissipaters needed.
CoC-CCC-23.1.1.5	Action Step	Roads/Railroads	Implement high and medium priority sediment reduction actions identified in the Mendocino Redwood Company's 2005 watershed analysis. Conduct a similar sediment reduction plan in the Dunn Creek subbasin.	2	100	CalFire, California Geological Survey, Mendocino Redwood Company						In-Kind	Much of the cost is accounted for in other actions or will likely be incorporated into the MRC HCP.
CoC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
CoC-CCC-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, Mendocino Redwood Company						In-Kind	This recommendation should be considered standard practice.
CoC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
CoC-CCC-23.1.3.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	1	100	CalFire, California Geological Survey, CalTrans, Mendocino Redwood Company						In-kind	This recommendation should be considered standard practice.
CoC-CCC-23.1.3.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	1	20	CalFire, California Department of Mines and Geology, Mendocino Redwood Company, RPFs	450.00	450.00	450.00	450.00		1,800	Cost based on treating 8 stream crossings (assume 50% of current stream crossings) at a rate of $223,051/unit.
CoC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
CoC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, CalTrans, Mendocino Redwood Company, Private Landowners, RWQCB						In-Kind	This action is part of ongoing road maintenance. Some additional cost may be expected from increased inspections and resulting maintenance costs.
CoC-CCC-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	CalFire, Mendocino Redwood Company, Private Landowners, RWQCB						In-Kind	
CoC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
CoC-CCC-23.2.2.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	5	CalFire, CalTrans, CDFG, Mendocino Redwood Company, Private Landowners, RWQCB						TBD	
CoC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate.										
CoC-CCC-23.2.3.1	Action Step	Roads/Railroads	Discourage Caltrans from removing instream or near stream large woody material along Highway 1.	1	100	CalFire, CalTrans, CDFG, NMFS						In-Kind	
CoC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
CoC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
CoC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.	2	10	CalFire, CalTrans, CDFG, Mendocino County, Mendocino Redwood Company, NMFS HCD, Private Landowners, RPFs, RWQCB, SWRCB						In-Kind	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPS-certified compounds) that are consistent with maintaining or improving water quality.
CoC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
CoC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, California Geological Survey, CalTrans, CDFG, Mendocino County, Mendocino Redwood Company, Private Landowners, RPFs, RWQCB						TBD	An assessment of the quantity and extent of high-risk shallow-seeded landslide areas needs to be conducted prior to developing cost for this recovery action.

Garcia River

Location	•Mendocino County
Watershed Area	•114.0 Square Miles
Potential Habitat	•103.7 Stream Miles
Vegetation	•66% Coniferous, 18% Montane Hardwood
Erodability	•Moderate to High
Ownership Patterns	•99% Private
Dominant Land Uses	•Timber, Agriculture
Housing Density	•Moderate
TMDL Pollutants	•Sediment, Temperature

Garcia River. *Photo provided by KRIS Information System, and is used with permission*

Garcia River Coho Salmon: Persistent – Low Abundance

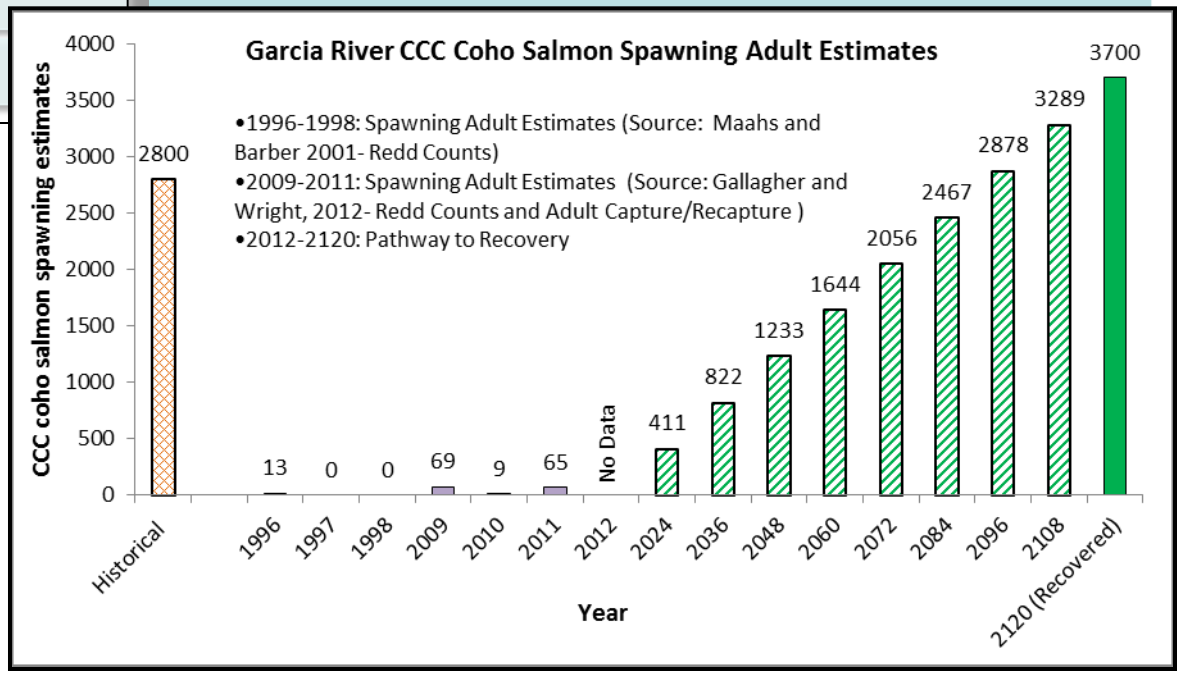
Recovery Goals

✓ Conduct monitoring to track population response to recovery action implementation

Garcia Creek Adult Spawner Targets

Downlisting to Threatened
1,850

Recovery
3,700



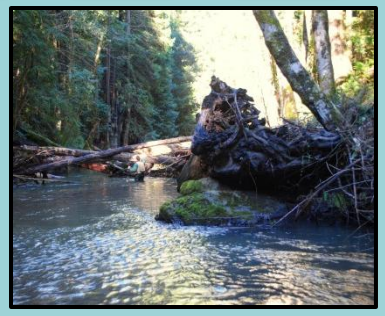
STEELHEAD: YES
CHINOOK SALMON: YES

Garcia River

Potential Habitat: 103.7 miles
Recovery Target: 3,700 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	FAIR	FAIR	GOOD	FAIR	FAIR	FAIR	GOOD	GOOD	POOR	GOOD



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Rehabilitate winter rearing floodplain habitat
- Install and maintain stream gauges in coldwater tributaries
- Complete remediation of erosion control sites
- Decommission or upgrade roads
- Encourage riparian planting
- Maintain, install and enhance LWD and other complex habitat features

Priority 2 & 3: Long-Term Restoration Actions

- Investigate possible realignment of the lower estuary channel
- Continue rehabilitation of the estuary and tidal sloughs
- Enhance back water and off channel habitats
- Upgrade water rights information system
- Promote off channel storage
- Continue implementation of the Garcia River TMDL and associated sediment reduction efforts
- Investigate the genetic diversity of coho salmon in the Garcia River

Recovery Partners

AmeriCorps, Mendocino Fish and Wildlife Advisory Board, The Conservation Fund, Salmonid Restoration Federation Field School

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, KRIS Information System and Morgan Bond SWFSC

Garcia River

Potential Habitat: 103.7 miles
Recovery Target: 3,700 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	MEDIUM	LOW	MEDIUM	MEDIUM	NA	HIGH	HIGH	LOW	LOW	MEDIUM	HIGH	MEDIUM	HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage timberland conversions
- Extend the monitoring period and upgrade road maintenance after harvest in highly erosive areas
- Upgrade forest practices
- Discourage incompatible land use in TPZs
- Limit winter use of unsurfaced roads and recreational trails
- Ensure new or replacement bridges are free span

Priority 2 & 3: Long-Term Threat Abatement Actions

- Implement water conservation strategies for drought contingencies
- Work with local tribal officials to stop gill netting
- Ensure forest management supports optimal levels of LWD recruitment
- Reduce road density by 10 percent over the next 10 years
- Identify and remediate stream crossings that cannot pass the 100 year flow
- Establish flow related adult and smolt migration thresholds prior to authorizing future water diversions
- Monitor and enforce existing water resource regulations
- Identify strategic locations to install LWD features within spawning and rearing areas

Installing LWD in Garcia River *Photo provided by KRIS Information System, and is used with permission*

Conservation Highlights

- The Conservation Fund (TCF) and The Nature Conservancy (TNC) purchased ~ 24,000 acres of the Garcia River watershed, and will manage the property for sustainable forestry.
- Trout Unlimited (TU), MRC, TCF, Mendocino County Fish and Wildlife Advisory Board, and TNC have undertaken various stream restoration actions.
- Established Salmonid Restoration Federation Field School

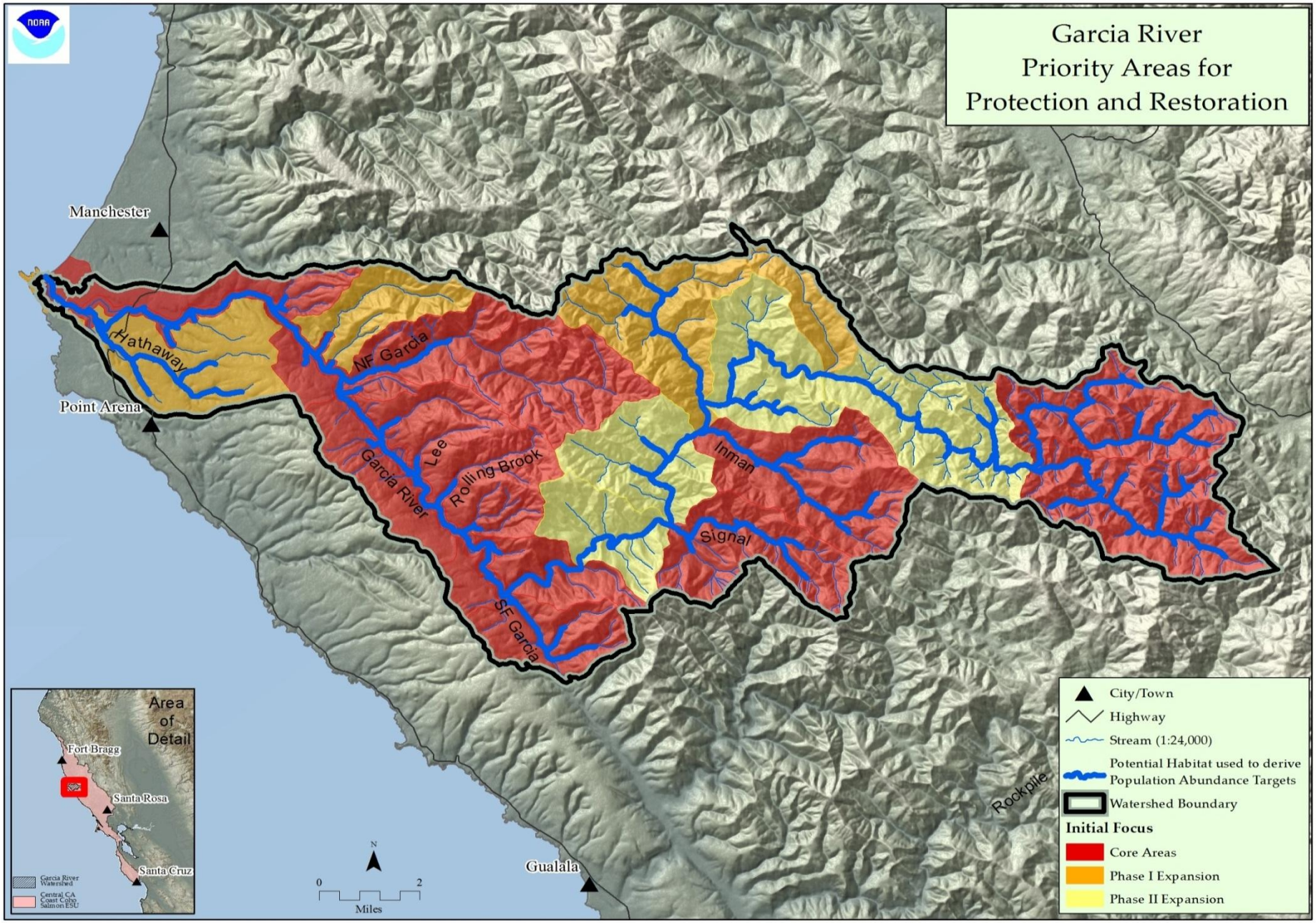


Figure 1: Map of Garcia River

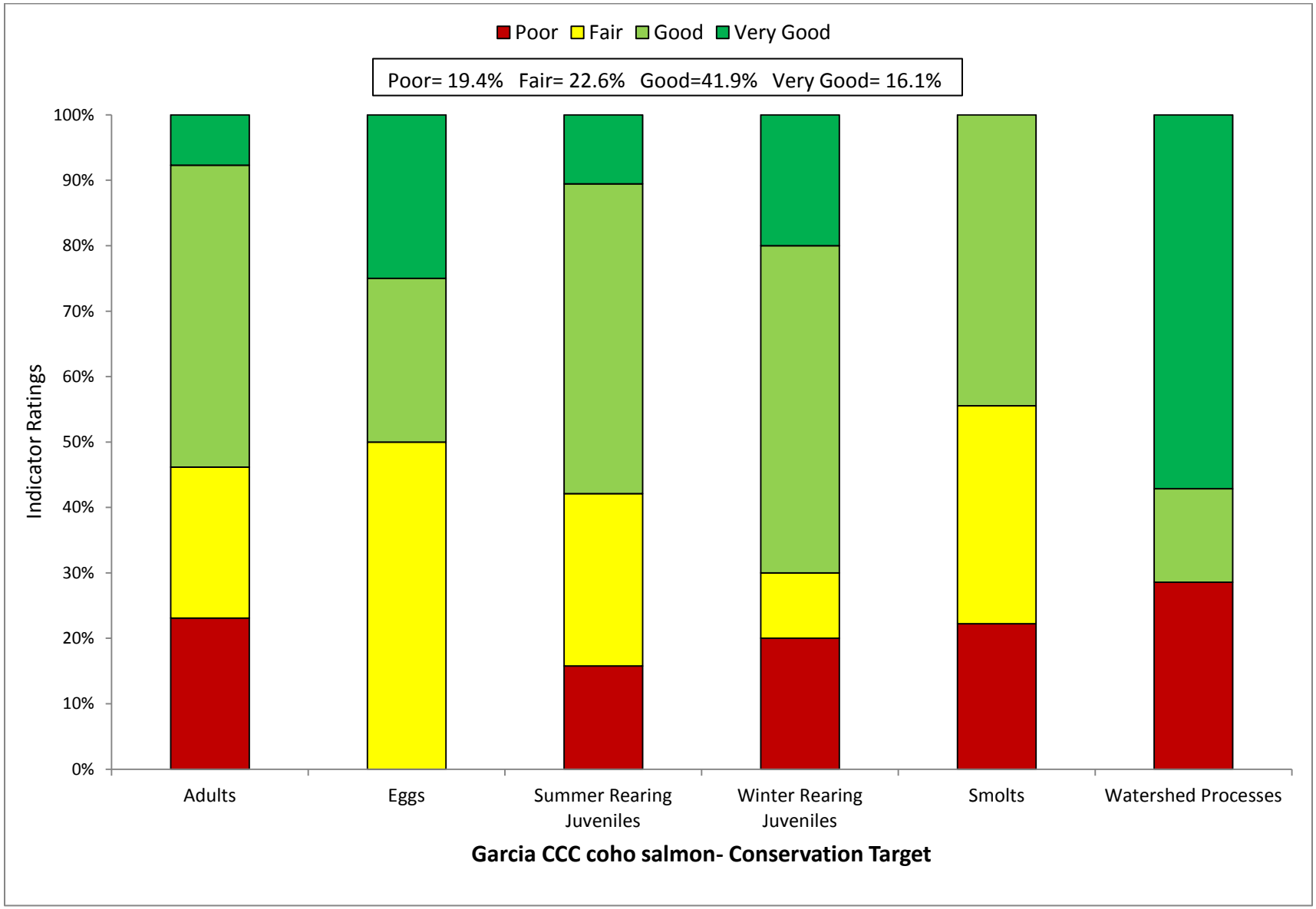


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Garcia River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**7.39 Key Pieces/ 100m**	Good	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0.48 Key Pieces/ 100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**55% streams 79% IP-km (>30% Pools; >20% Riffles)**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**18% streams 6% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**39% Class 5 & 6 across IP-km**	Fair	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**91% streams 97% IP-km (>50% stream average scores of 1 & 2)**	Very Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**7.39 Key Pieces/ 100m**	Good	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.48 Key Pieces/ 100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**64% streams 82% IP-km (>49% of pools are primary pools)**	Good	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**55% streams 77% IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**18% streams 8% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =58**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**.06 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**91% streams 56% IP-km with average canopy >85%**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**39% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**91 % streams 98% IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-Km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 Fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**7.39 Key Pieces/ 100m**	Good	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.48 Key Pieces/ 100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**55% streams 79% IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**18% streams 6% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**39% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**91 % streams 98% IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**18% streams 6% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**1.58 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <14 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**75% to 90% of streams/ IP-Km maintains severity score of 3 or lower**	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.147 of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**1.134 of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**15% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**1% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**80% Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**5.9 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**6.2 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Garcia River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Medium	Medium	Medium	Medium	Medium	Medium
2	Channel Modification	Medium	Low	Medium	Medium	Medium	Medium	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	High	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	High	Medium	High	Medium	High
8	Logging and Wood Harvesting	Medium	Medium	High	High	Medium	High	High
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Low	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Medium	High	Medium	High	Medium	High
	Threat Status for Targets and Project	High	Medium	High	High	High	High	High

Central CA Coast Coho Salmon ~ Garcia River

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Rehabilitate natural river mouth dynamics

1.1.1.1. **Action Step:** Investigate and determine if the river/estuary mouth dynamics have changed from historical conditions and patterns. Evaluate passage conditions relative to adult salmonid run timing.

1.1.1.2. **Action Step:** If determined necessary, develop and implement strategies that address adverse passage conditions for adult salmonids caused by altered river mouth dynamics.

1.1.2. **Recovery Action:** Rehabilitate inner estuarine hydrodynamics

1.1.2.1. **Action Step:** Investigate the possibility of re-aligning the lower estuary channel from Minor Hole to the mouth in efforts to increase estuary depth and improve tidal wetlands.

1.1.2.2. **Action Step:** If determined beneficial to estuary health and function, develop and implement a lower estuary channel re-alignment project.

1.1.3. **Recovery Action:** Increase the physical extent of estuarine habitat

1.1.3.1. **Action Step:** Investigate the extent of sedimentation within the estuary associated watershed legacy impacts (logging). Evaluate sediment transport within the estuary and determine if the estuary is "filling" with sediment or "flushing" sediment (recovering).

1.1.3.2. **Action Step:** Investigate and determine the current vs. historical extent of the Garcia estuary. Include tracts of salt and freshwater marshes, sloughs, tidal channels, etc.

1.1.3.3. **Action Step:** Evaluate, design, and implement strategies to enhance habitat conditions within Hathaway Creek and near its confluence with the Garcia River main stem. Consider thinning vegetation within lower Hathaway to increase hydrologic circulation. Optimize winter rearing habitat/refuge while considering upstream migration to upper Hathaway Creek if determined desirable.

1.1.3.4. **Action Step:** Evaluate, design, and implement rehabilitation projects targeting tidal sloughs and off-channel habitats impaired by cattle located within the historical extent of the Garcia River estuary.

1.1.3.5. **Action Step:** Continue estuary rehabilitation efforts (public acquisition and easements, Bell 2003).

1.1.4. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.4.1. **Action Step:** Increase the percentage of area containing high value habitat complexity elements and features (SAV, LWD, boulders, marshes, vegetation, pools > 2 meters).

1.1.4.2. **Action Step:** Identify key locations to install LWD structures targeting increased pool depth and habitat conditions within the Garcia estuary.

1.1.4.3. **Action Step:** Continue working with landowner and rehabilitating riparian conditions within the Garcia estuary.

1.1.5. **Recovery Action:** Improve estuarine freshwater inflow

1.1.5.1. **Action Step:** Install a stream gauge immediately upstream of the estuary to monitor inflow conditions during the dry season.

1.1.5.2. **Action Step:** Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions relative to juvenile salmonid estuarine summer rearing (osmo-regulating and non-osmoregulating).

1.1.5.3. **Action Step:** Identify and implement a minimum freshwater inflow threshold to ensure optimal estuary health and function for rearing salmonids.

1.1.6. **Recovery Action:** Improve estuarine water quality

1.1.6.1. **Action Step:** Install continuous water quality monitoring stations throughout the Garcia estuary.

1.1.6.2. **Action Step:** Identify and implement strategies to address point pollutant sources causing impairment to estuarine water quality conditions.

1.1.7. **Recovery Action:** Enhance macro-invertebrate abundance and taxa richness

1.1.7.1. **Action Step:** Investigate and identify prey items/availability for rearing salmonids and the associated water quality conditions they reside.

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Conduct a Lower Garcia River off-channel low gradient habitat assessment targeting juvenile coho salmon rearing requirements (biological performance criteria, i.e. reduced velocity targets relative to juvenile coho). Identify potential off-channel rehabilitation sites.

2.1.1.2. **Action Step:** Work with landowners and encourage rehabilitation activities within the lower Hathaway Creek area in efforts to enhance backwater/off-channel and floodplain habitat for winter rearing salmonids.

2.1.1.3. **Action Step:** Identify, design, and implement rehabilitation projects that target winter rearing floodplain habitat within the lower reaches of the Garcia River.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency (BFW 0-10 meters)

3.1.1.1. **Action Step:** Increase wood frequency in spawning and rearing areas to the extent that a minimum of six key LWD pieces exists every 100 meters in 0-10 meters BFW streams.

3.1.1.2. **Action Step:** Identify and install key LWD pieces in Rolling Brook to the extent that LWD frequency is optimized.

3.1.2. **Recovery Action:** Increase large wood frequency (BFW 10-100 meters)

3.1.2.1. **Action Step:** Increase wood frequency in seasonal habitat and migratory reaches to the extent that a minimum of 1.3 to 4 key LWD pieces exists every 100 meters in 10-100 meter BFW streams.

3.1.2.2. **Action Step:** Target Signal Creek, North Fork Garcia, Rolling Brook, lower Mill Creek, Pardaloe, Blue Waterhole, Lanmour, and upper Mill Creek sub-basins as high priorities for LWD placement and rehabilitation work.

3.1.2.3. **Action Step:** Evaluate and implement strategies to rehabilitate LWD frequency and natural recruitment within the Garcia River main stem.

3.1.2.4. **Action Step:** Identify strategic locations to install key LWD features in the SF Garcia mainstem to the extent that habitat complexity is optimized.

3.1.2.5. **Action Step:** Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).

3.1.3. **Recovery Action:** Increase primary pools frequency

3.1.3.1. **Action Step:** Increase the number of primary pools to the extent that more than 40% of summer rearing pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams.)

3.1.3.2. **Action Step:** Evaluate, develop, and implement strategies to increase primary pool frequency in high priority reaches within the following tributaries: Fleming Creek, Little SF Garcia, Signal Creek (and tribs).

3.1.3.3. **Action Step:** Maintain, install, and/or enhance LWD, boulders, and other channel forming features to improve pool frequency and depth. Use information from MRC Garcia Watershed Analysis, CDFG HAB-8, and TNC data to determine high priority reaches lacking adequate pool frequency and complexity relative to juvenile coho rearing requirements.

3.1.4. **Recovery Action:** Improve shelter

3.1.4.1. **Action Step:** Increase the number of pools that have a minimum shelter rating of 80 (See NMFS/CDFG criteria).

3.1.4.2. **Action Step:** Evaluate, identify, and improve shelter ratings in pools within the mainstem Garcia River and the following tributaries: Blue Waterhole, Fleming Creek, Graphite Creek, Inman Creek, Little SF Garcia, NF Garcia, and Signal Creek (and tribs).

3.1.5. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.5.1. **Action Step:** Increase the frequencies of riffles in 75% of the streams within the watershed

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Map all water diversions (including illegal and legal) and upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.

4.1.1.2. **Action Step:** Monitor, identify problems, and prioritize needed changes to permitted water diversions on known or potential summer rearing coho streams.

4.1.1.3. **Action Step:** Install and maintain stream gauges within the following tributaries that provide coldwater to the Garcia River mainstem: Hathaway, North Fork, Rolling Brook, Mill Creek (lower Garcia River), South Fork, Signal, Mill Creek (upper Garcia River).

4.1.1.4. **Action Step:** Identify strategic locations to install off-channel storage facilities to reduce impacts associated with water diversions (e.g. storage tanks for rural residential users).

4.1.1.5. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Prevent increased landscape disturbance

5.1.1.1. **Action Step:** Consider developing and/or identifying Salmonid Preserves. Consider the Garcia River watershed as a Salmonid Preserve.

5.1.1.2. **Action Step:** Should large tracts of forestlands within the Garcia River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or Salmonid Preserve.

5.1.1.3. **Action Step:** Discourage counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Modify or remove physical passage barriers

6.1.1.1. **Action Step:** Evaluate, design, and implement strategies to address potential impairment to passage due to vegetation encroachment or "choking" in Hathaway Creek. Ensure that winter rearing refuge for juvenile salmonids is optimize. Investigate habitat quality in upper Hathaway Creek.

6.1.1.2. **Action Step:** Evaluate, design, and implement appropriate fish passage at Bridge at Highway 1 on Hathaway Creek (Gasker Slough) (See CALFISH: PAD_ID 716762; Passage ID 26883).

6.1.1.3. **Action Step:** Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713213; Passage ID 16601).

6.1.1.4. **Action Step:** Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Mill Creek (See CALFISH: PAD_ID 705892; Passage ID 7210)

6.1.1.5. **Action Step:** Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Mill Creek (See CALFISH: PAD_ID 705893; Passage ID 7211).

6.1.1.6. **Action Step:** Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713212; Passage ID 16600).

6.1.1.7. **Action Step:** Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713213; Passage ID 16601).

6.1.1.8. **Action Step:** Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Sled Creek (See CALFISH: PAD_ID 713211; Passage ID 16599)

6.1.1.9. **Action Step:** Evaluate, design, and implement appropriate fish passage at private road crossing on Hathaway Creek (See CALFISH: PAD_ID 716763; Passage ID 26884).

6.1.1.10. **Action Step:** Evaluate, design, and implement appropriate fish passage at culvert at mouth on SF Garcia River (See CALFISH: PAD_ID 712859; Passage ID 16063).

6.1.1.11. **Action Step:** Evaluate, design, and implement appropriate fish passage at culvert on Flemming Creek (See CALFISH: PAD_ID 723443; Passage ID 9525)

6.1.1.12. **Action Step:** Evaluate, design, and implement appropriate fish passage at unnamed tributary to SF Garcia River (See CALFISH: PAD_ID 723441; Passage ID 9523).

6.1.1.13. **Action Step:** Evaluate, design, and implement appropriate fish passage at culvert on unnamed tributary to main stem Garcia River (See CALFISH: PAD_ID 723440; Passage ID 9522).

6.1.1.14. **Action Step:** Evaluate, design, and implement appropriate fish passage at identified logjams throughout the Garcia watershed (only if necessary).

6.1.1.15. **Action Step:** Identify and prioritize all logjams that are complete or partial barriers and indicate passage impairment to specific life stage (Bell 2006, as cited by KrisWeb 2011).

6.1.1.16. **Action Step:** Ensure that all logjams are carefully modified and that all LWD remains in the active stream channel (Monschke and Caldon 1992).

7. Restoration- Pool Habitat

No species-specific actions were developed.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.

8.1.1.2. **Action Step:** Plant and protect riparian vegetation, including redwood, on the lower 7 mile reach (Eureka Hill Road Bridge and Windy Hollow Road) or where necessary to provide the following: shade and lower water temperatures, cover, protection for fish, bank protection from erosion, and large organic debris in the future for habitat (Bell 2003).

8.1.1.3. **Action Step:** Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy within the Blue Waterhole sub-basin.

8.1.1.4. **Action Step:** Retain all existing native riparian vegetation where stream cover is provided.

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.

8.1.2.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

8.1.2.3. **Action Step:** Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.

8.1.2.4. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Focus on partnerships with railroad and timber industry, as well as large private landowners.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve and expand instream gravel quantity

9.1.1.1. **Action Step:** Increase the percentage of gravel quality embeddedness to values of 1s and 2s (See NMFS Conservation Action Planning Attribute Table Report) in all current and potential juvenile salmonid summer and seasonal (fall/winter/spring) rearing areas.

9.1.1.2. **Action Step:** Identify and implement strategies to treat landslides and old features such as stream side landings (Bell 2003).

9.1.1.3. **Action Step:** Complete the remaining 25% of erosion control sites identified in the South Fork Garcia River by the Trout Unlimited North Coast Coho Project.

9.1.1.4. **Action Step:** Treat high and medium priority sites that are identified in the MRC Garcia River Watershed Analysis, Garcia River Forest Integrated Resource Management Plan and other credible landowner assessments.

9.1.1.5. **Action Step:** Acquire funding for assessment and implementation of sediment reduction measures associated with the 2008 Jacks Fire which occurred in the North Fork Garcia River subbasin.

9.1.1.6. **Action Step:** Continue the implementation of the Garcia River TMDL and associated sediment reduction efforts.

9.1.1.7. **Action Step:** Develop and implement bank erosion prevention and riparian planting in Pardaloe Creek (Monschke and Caldon 1992).

10. Restoration- Viability

10.1. **Objective:** Address other natural or manmade factors affecting the species continued existence

10.1.1. **Recovery Action:** Increase spawner density

10.1.1.1. **Action Step:** Determine if there is a need for a conservation hatchery/supplementation/augmentation program. Assess the following prior to supplementation (Action Steps 2-7):

10.1.1.2. **Action Step:** Determine the biological or DPS significance of the Garcia coho salmon population.

10.1.1.3. **Action Step:** Investigate the population dynamics and viability status of coho salmon in the Garcia River watershed.

10.1.1.4. **Action Step:** Determine if the coho salmon population within the Garcia River watershed is at a short-term or immediate risk of extinction.

10.1.1.5. **Action Step:** Identify population viability goals and the expectations of a conservation hatchery/supplementation/augmentation program.

10.1.1.6. **Action Step:** Investigate the genetic diversity of coho salmon in the Garcia River.

10.1.1.7. **Action Step:** If determine necessary, identify a source population (in or out of basin stock) that could be used to start a population augmentation/supplementation/broodstock program.

10.1.2. **Recovery Action:** Increase spatial structure and diversity

10.1.2.1. **Action Step:** Conduct a comprehensive assessment of watershed processes (e.g., hydrology, geology, fluvial-geomorphology, water quality, and vegetation), instream habitat, and factors limiting coho salmon production (CDFG 2004). Use the watershed assessment template developed in portions of the watershed in Mendocino Redwood Company ownership, and apply to the rest of the Garcia River watershed.

10.1.2.2. **Action Step:** Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.

10.1.3. **Recovery Action:** Increase abundance

10.1.3.1. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Work with TNC and Stillwater Sciences to develop a "Basin Temp" model to aid in efforts to reduce stream temperatures between Signal and the Pardaloe/Mill creeks confluence.

11.1.1.2. **Action Step:** Work with landowners to plant riparian zones of Blue Waterhole, Inman Creek, and Pardaloe Creek with the goal of reducing instream water temperatures of the Garcia River main stem during the dry season.

11.1.1.3. **Action Step:** Identify and Implement actions to maintain and restore water temperatures to meet habitat requirements for CCC coho salmon in specific streams (CDFG 2004).

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Work with CDFG to modify Section 8.00(b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties. Discontinue using the Russian River at Guerneville gauging station for angling closures and use the Navarro River USGS gauging station (11468000) which better reflects hydrologic conditions in smaller unregulated coastal Sonoma/Mendocino streams.

16.1.1.2. **Action Step:** Reduce poaching of adult coho salmon by increasing law enforcement.

16.1.1.3. **Action Step:** Promote CalTip to discourage poaching (CDFG 2004).

16.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

16.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.2.1.1. **Action Step:** Investigate and work with local tribal officials in efforts to stop gill-netting in the Garcia River watershed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

18.1.1. **Recovery Action:** Prevent impairment to estuary quality and extent

18.1.1.1. **Action Step:** Work with BLM to ensure that future cattle leasing agreements do not reduce potential rehabilitation of high value summer and winter juvenile salmonid rearing habitat within the lower Garcia River and estuary.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to water quality (instream water temperature)

19.1.1.1. **Action Step:** Protect current riparian zones in all summer salmonid rearing areas to the extent that they are able to mature, provide, and maintain a minimum of 80% canopy cover.

19.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

19.1.2.1. **Action Step:** Ensure future forest management allows for optimal levels of natural LWD recruitment of larger older trees into stream channels

19.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

19.1.3.1. **Action Step:** Develop and implement low impact timber and wood harvest techniques (e.g., full-suspension cable yarding) in efforts to reduce turbidity impacts in streams. Example: Parker Ranch in the Ten Mile River Basin (Bell 2003).

19.1.3.2. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

19.1.3.3. **Action Step:** New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.

19.1.4. **Recovery Action:** Prevent increased landscape disturbance

19.1.4.1. **Action Step:** Areas adjacent to currently owned State parks or forestlands supporting Core, Phase I and Phase II priority areas should be considered for purchase (if feasible within the next 5 years).

19.1.4.2. **Action Step:** Should large tracts of forestlands within the Garcia River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or Salmonid Preserve.

19.1.4.3. **Action Step:** Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.

19.1.4.4. **Action Step:** Maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture or other land uses.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.2. **Action Step:** Work with the California Board of Forestry to design and implement a program of BMPs for logging areas that meets the approval of NMFS and CDFG.

19.2.1.3. **Action Step:** Conduct an assessment of the mechanisms driving forestland conversion and develop strategies to protect forestlands.

19.2.1.4. **Action Step:** Consider the development of a Watershed Database (similar to the CDFG Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.

19.2.1.5. **Action Step:** Develop a framework similar to Washington State that establishes a scientific framework for monitoring the effectiveness of practices in meeting watershed process goals and a decision-making process that is adaptive to the new information.

19.2.1.6. **Action Step:** Provide information to BOF regarding CCC coho salmon priorities and recommend upgrading relevant forest practices.

19.2.1.7. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

19.2.1.8. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).

19.2.1.9. **Action Step:** Develop a California Forest Practice monitoring protocol to determine whether specific practices are effectively meeting intended objectives and are providing for the protection of CCC coho salmon.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

23.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.1.2. **Action Step:** Map and identify stream crossings with the intention of replacement or removal if they cannot pass the 100 year flow. Designs should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.1.1.3. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.4. **Action Step:** Restoration projects that upgrade or decommission high risk roads in Core areas should be considered an extremely high priority for funding (e.g., PCSRF). Where no Core areas are designated, apply this action to Phase I areas.

23.1.1.5. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.1.6. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.1.2. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, dams, etc.)

23.1.2.1. **Action Step:** Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.

23.1.2.2. **Action Step:** Develop a Salmon Certification Program for road maintenance staff.

23.1.2.3. **Action Step:** All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.

23.1.2.4. **Action Step:** Evaluate existing and future stream crossings that impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.2.5. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.1.3. **Recovery Action:** Prevent impairment to passage and migration

23.1.3.1. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.3.2. **Action Step:** Ensure that all future road or bridge repairs at stream crossing provide unimpaired fish passage for all salmonid life stages.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology (stream flow)

24.1.1.1. **Action Step:** Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (stream flow)

25.1.1.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.1.2. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

25.1.2. **Recovery Action:** Prevent impairment to passage and migration

25.1.2.1. **Action Step:** Establish flow related adult and smolt migration thresholds prior to authorizing future water diversions.

25.1.3. **Recovery Action:** Prevent impairment to the estuary (quality and extent)

25.1.3.1. **Action Step:** Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months (ECORP and Kamman Hydrology & Engineering 2005).

25.1.4. **Recovery Action:** Prevent impairment to water quality (instream temperature)

25.1.4.1. **Action Step:** Ensure future water diversions do not impair instream water temperatures during the dry season.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (stream flow)

25.2.1.1. **Action Step:** Work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.2. **Action Step:** Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.

25.2.1.3. **Action Step:** Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures.

25.2.1.4. **Action Step:** Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.

25.2.1.5. **Action Step:** Improve compliance with existing water resource regulations via monitoring and enforcement.

25.2.1.6. **Action Step:** Support the SWRCB in regulating groundwater.

25.2.1.7. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Garcia River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-1.1.1	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
GR-CCC-1.1.1.1	Action Step	Estuary	Investigate and determine if the river/estuary mouth dynamics have changed from historical conditions and patterns. Evaluate passage conditions relative to adult salmonid run timing.	3	10	BLM, CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB	137.00	137.00				274	Cost for estuary use is estimated at $273,217/project.
GR-CCC-1.1.1.2	Action Step	Estuary	If determined necessary, develop and implement strategies that address adverse passage conditions for adult salmonids caused by altered river mouth dynamics.	3	20	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy						TBD	
GR-CCC-1.1.2	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics										
GR-CCC-1.1.2.1	Action Step	Estuary	Investigate the possibility of re-aligning the lower estuary channel from Minor Hole to the mouth in efforts to increase estuary depth and improve tidal wetlands.	2	10	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy						TBD	Cost accounted for above.
GR-CCC-1.1.2.2	Action Step	Estuary	If determined beneficial to estuary health and function, develop and implement a lower estuary channel re-alignment project.	2	10	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy						TBD	
GR-CCC-1.1.3	Recovery Action	Estuary	Increase the physical extent of estuarine habitat										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1.3.1	Action Step	Estuary	Investigate the extent of sedimentation within the estuary associated watershed legacy impacts (logging). Evaluate sediment transport within the estuary and determine if the estuary is "filling" with sediment or "flushing" sediment (recovering).	2	10	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	111.50	111.50				223	Cost for sediment assessment is estimated at $12.22/acre
GR-CCC-1.1.3.2	Action Step	Estuary	Investigate and determine the current vs. historical extent of the Garcia estuary. Include tracts of salt and freshwater marshes, sloughs, tidal channels, etc.	2	10	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy						TBD	Cost accounted for in above action steps.
GR-CCC-1.1.3.3	Action Step	Estuary	Evaluate, design, and implement strategies to enhance habitat conditions within Hathaway Creek and near its confluence with the Garcia River main stem. Consider thinning vegetation within lower Hathaway to increase hydrologic circulation. Optimize winter rearing habitat/refuge while considering upstream migration to upper Hathaway Creek if determined desirable.	2	10	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	25.00	25.00				50	Cost based on treating 1 mile of stream (assume 1 project/mile) at a rate of $25,000/mile.
GR-CCC-1.1.3.4	Action Step	Estuary	Evaluate, design, and implement rehabilitation projects targeting tidal sloughs and off-channel habitats impaired by cattle located within the historical extent of the Garcia River estuary.	2	5	BLM, CDFG, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy	273.00					273	Cost based on treating 10 acres (assume 10% of estuarine habitat) at a rate of $272,120/acre.
GR-CCC-1.1.3.5	Action Step	Estuary	Continue estuary rehabilitation efforts (public acquisition and easements, Bell 2003).	2	10-May	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy						TBD	
GR-CCC-1.1.4	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1.4.1	Action Step	Estuary	Increase the percentage of area containing high value habitat complexity elements and features (SAV, LWD, boulders, marshes, vegetation, pools > 2 meters).	2	10	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy						TBD	Cost likely accounted for in other action steps.
GR-CCC-1.1.4.2	Action Step	Estuary	Identify key locations to install LWD structures targeting increased pool depth and habitat conditions within the Garcia estuary.	2	10	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC							Cost accounted for in other action steps.
GR-CCC-1.1.4.3	Action Step	Estuary	Continue working with landowner and rehabilitating riparian conditions within the Garcia estuary.	2	50	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy						In-Kind	
GR-CCC-1.1.5	Recovery Action	Estuary	Improve estuarine freshwater inflow										
GR-CCC-1.1.5.1	Action Step	Estuary	Install a stream gauge immediately upstream of the estuary to monitor inflow conditions during the dry season.	2		CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, SWRCB, The Nature Conservancy						1,000	Cost for stream flow gauges estimated at $1000/gauge. Cost estimate does not account for maintenance or data management.
GR-CCC-1.1.5.2	Action Step	Estuary	Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions relative to juvenile salmonid estuarine summer rearing (osmo-regulating and non-osmoregulating).	2	10	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy						TBD	Cost accounted for in estuary use/residence timing monitoring.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1.5.3	Action Step	Estuary	Identify and implement a minimum freshwater inflow threshold to ensure optimal estuary health and function for rearing salmonids.	2	10	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NRCS, RCD, RWQCB, SWRCB, The Nature Conservancy	32.00	32.00				64	Cost for stream flow modeling estimated at $63,005/project.
GR-CCC-1.1.6	Recovery Action	Estuary	Improve estuarine water quality										
GR-CCC-1.1.6.1	Action Step	Estuary	Install continuous water quality monitoring stations throughout the Garcia estuary.	2	5	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	35.00					35	Cost for continuous water quality monitoring stations estimated at $5,000/station with a total of 7 gauges. Cost does not account for maintenance and data management.
GR-CCC-1.1.6.2	Action Step	Estuary	Identify and implement strategies to address point pollutant sources causing impairment to estuarine water quality conditions.	2	20	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NRCS, Private Landowners, RCD, The Nature Conservancy							Cost accounted for in other action steps.
GR-CCC-1.1.7	Recovery Action	Estuary	Enhance macro-invertebrate abundance and taxa richness										
GR-CCC-1.1.7.1	Action Step	Estuary	Investigate and identify prey items/availability for rearing salmonids and the associated water quality conditions they reside.	3	15	CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Consultants, RCD, RWQCB, The Nature Conservancy							Cost accounted for other action steps.
GR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
GR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Conduct a Lower Garcia River off-channel low gradient habitat assessment targeting juvenile coho salmon rearing requirements (biological performance criteria, i.e. reduced velocity targets relative to juvenile coho). Identify potential off-channel rehabilitation sites.	2	5	BLM, CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	207.00					207	Cost for wetland restoration assessment estimated at $206,493/project.
GR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Work with landowners and encourage rehabilitation activities within the lower Hathaway Creek area in efforts to enhance backwater/off-channel and floodplain habitat for winter rearing salmonids.	2	100	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy						In-Kind	
GR-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Identify, design, and implement rehabilitation projects that target winter rearing floodplain habitat within the lower reaches of the Garcia River.	2	5	CDFG, Mendocino Redwood Company, The Nature Conservancy	235.00					235	Cost based on treating 7 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
GR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)										
GR-CCC-3.1.1.1	Action Step	Habitat Complexity	Increase wood frequency in spawning and rearing areas to the extent that a minimum of six key LWD pieces exists every 100 meters in 0-10 meters BFW streams.	2	10	CDFG, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	125.00	125.00				250	Cost based on treating 10 miles of stream at a rate of $25,000/mile. If ELJ projects implemented, cost could be $1,011,200.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.1.2	Action Step	Habitat Complexity	Identify and install key LWD pieces in Rolling Brook to the extent that LWD frequency is optimized.	3	10	CDFG, NMFS HCD, NMFS PRD, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy							Cost accounted for in increase wood frequency in spawning in rearing habitat.
GR-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 10-100 meters)										
GR-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase wood frequency in seasonal habitat and migratory reaches to the extent that a minimum of 1.3 to 4 key LWD pieces exists every 100 meters in 10-100 meter BFW streams.	2	10	Board of Forestry, CalFire, CDFG, Conservation Fund, Friends of the Gualala River Watershed, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, Public, RCD, RWQCB, The Nature Conservancy	162.50	162.50				325	Cost based on treating 13 miles of stream at a rate of $25,000/mile. Cost to treat 13 miles of stream with ELJ would be $1,34,560.
GR-CCC-3.1.2.2	Action Step	Habitat Complexity	Target Signal Creek, North Fork Garcia, Rolling Brook, lower Mill Creek, Pardaloe, Blue Waterhole, Lanmour, and upper Mill Creek sub-basins as high priorities for LWD placement and rehabilitation work.	2	20	CDFG, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy							Cost accounted for in increase wood frequency in seasonal habitat.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.2.3	Action Step	Habitat Complexity	Evaluate and implement strategies to rehabilitate LWD frequency and natural recruitment within the Garcia River main stem.	2	20	CDFG, Conservation Fund, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, Public, RCD, RWQCB, The Nature Conservancy	18.00	18.00	18.00	18.00		72	Cost based on riparian restoration validation monitoring estimated at $71,426/project.
GR-CCC-3.1.2.4	Action Step	Habitat Complexity	Identify strategic locations to install key LWD features in the SF Garcia mainstem to the extent that habitat complexity is optimized.	2	20	CDFG, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, Railroad, RWQCB, The Nature Conservancy							Cost accounted for in increase wood frequency in seasonal habitat.
GR-CCC-3.1.2.5	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	100	CalFire, CDFG, Private Landowners						In-Kind	Cost will vary depending on number of projects.
GR-CCC-3.1.3	Recovery Action	Habitat Complexity	Increase primary pools frequency										
GR-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase the number of primary pools to the extent that more than 40% of summer rearing pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams.)	2	10	CDFG, Conservation Fund, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	162.50	162.50				325	Cost based on treating 13 miles (50% of High IP) at a rate of $25,000/mile. This may be combined with increasing LWD, reducing overall cost.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.3.2	Action Step	Habitat Complexity	Evaluate, develop, and implement strategies to increase primary pool frequency in high priority reaches within the following tributaries: Fleming Creek, Little SF Garcia, Signal Creek (and tribs).	2	20	CDFG, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, RCD, RWQCB, The Nature Conservancy							Cost accounted for in increase the number of primary pools.
GR-CCC-3.1.3.3	Action Step	Habitat Complexity	Maintain, install, and/or enhance LWD, boulders, and other channel forming features to improve pool frequency and depth. Use information from MRC Garcia Watershed Analysis, CDFG HAB-8, and TNC data to determine high priority reaches lacking adequate pool frequency and complexity relative to juvenile coho rearing requirements.	2	10	CDFG, NOAA RC, Private Landowners, RCD	125.00	125.00				250	Cost estimate for 10 LWD loading projects at $25,000 in four core area subbasins.
GR-CCC-3.1.4	Recovery Action	Habitat Complexity	Improve shelter										
GR-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase the number of pools that have a minimum shelter rating of 80 (See NMFS/CDFG criteria).	2	10	CDFG, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, RCD, The Nature Conservancy							Cost are likely associated with other recovery action such as increase LWD and increasing primary pools.
GR-CCC-3.1.4.2	Action Step	Habitat Complexity	Evaluate, identify, and improve shelter ratings in pools within the mainstem Garcia River and the following tributaries: Blue Waterhole, Fleming Creek, Graphite Creek, Inman Creek, Little SF Garcia, NF Garcia, and Signal Creek (and tribs).	2	10	CDFG, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB, The Nature Conservancy	162.50	162.50				325	Cost based on treating 13 miles (50% of High IP), assuming this recovery action is separate from increase large wood and primary pools, at a rate of $25,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.5	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
GR-CCC-3.1.5.1	Action Step	Habitat Complexity	Increase the frequencies of riffles in 75% of the streams within the watershed	2	30								Cost accounted for in above action steps (i.e. increase primary pool frequency and LWD).
GR-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
GR-CCC-4.1.1.1	Action Step	Hydrology	Map all water diversions (including illegal and legal) and upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	60	CDFG, CDFG Law Enforcement, NMFS, NMFS OLE, Private Landowners, SWRCB, The Nature Conservancy						TBD	Costs may be minimal due to the low number of diverters in this basin.
GR-CCC-4.1.1.2	Action Step	Hydrology	Monitor, identify problems, and prioritize needed changes to permitted water diversions on known or potential summer rearing coho streams.	2	10	BLM, CDFG, NMFS, Private Landowners, SWRCB							Cost likely accounted for in stream flow model.
GR-CCC-4.1.1.3	Action Step	Hydrology	Install and maintain stream gauges within the following tributaries that provide coldwater to the Garcia River mainstem: Hathaway, North Fork, Rolling Brook, Mill Creek (lower Garcia River), South Fork, Signal, Mill Creek (upper Garcia River).	2	10	CDFG, NMFS, Private Landowners, SWRCB, The Nature Conservancy	3.50	3.50				7	Cost for 7 stream flow gauges estimated at $1000/gauge. Cost does not account for maintenance or data management.
GR-CCC-4.1.1.4	Action Step	Hydrology	Identify strategic locations to install off-channel storage facilities to reduce impacts associated with water diversions (e.g. storage tanks for rural residential users).	2	30	CDFG, NMFS, NRCS, Private Landowners, RCD, SWRCB						TBD	Cost are difficult to determine because based on landowner participation and extent of off-channel storage facilities needed.
GR-CCC-4.1.1.5	Action Step	Hydrology	CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	2	60	CalFire, CalTrans, CDFG, Mendocino County Department of Public Works, Private Landowners, RWQCB						In-Kind	Most diversions in the Garcia for dust control are for timber management actions. Most of these diversion have a 1600 agreement with the Department of Fish and Game and are likely incorporated into existing operations.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-5.1.1	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										
GR-CCC-5.1.1.1	Action Step	Landscape Patterns	Consider developing and/or identifying Salmonid Preserves. Consider the Garcia River watershed as a Salmonid Preserve.	2	100	CDFG, Conservation Fund, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, State Parks, The Nature Conservancy, Trout Unlimited						In-Kind	
GR-CCC-5.1.1.2	Action Step	Landscape Patterns	Should large tracts of forestlands within the Garcia River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or Salmonid Preserve.	2	100	CDFG, Conservation Fund, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, State Parks, The Nature Conservancy, Trout Unlimited						TBD	Cost are difficult to determine because of fair market value and land use turnover.
GR-CCC-5.1.1.3	Action Step	Landscape Patterns	Discourage counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	2	100	CDFG, Mendocino County, NMFS HCD, NMFS PRD, Sonoma County						In-Kind	
GR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-6.1.1	Recovery Action	Passage	Modify or remove physical passage barriers	3	10-May	BLM, CDFG, Conservation Fund, Friends of the Garcia River, Mendocino Redwood Company, NMFS, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, Railroad, RCD, RWQCB, The Nature Conservancy							
GR-CCC-6.1.1.1	Action Step	Passage	Evaluate, design, and implement strategies to address potential impairment to passage due to vegetation encroachment or "choking" in Hathaway Creek. Ensure that winter rearing refuge for juvenile salmonids is optimize. Investigate habitat quality in upper Hathaway Creek.	2	5	BLM, CDFG, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy	52.00					52	Cost based on treating 8 acres at a rate of $6,400/acre.
GR-CCC-6.1.1.2	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Bridge at Highway 1 on Hathaway Creek (Gasker Slough) (See CALFISH: PAD_ID 716762; Passage ID 26883).	3	5	CalTrans, CDFG, NMFS, USACE	370.00					370	Cost based on treating passage for major 2 lane road at a rate of $367,732/unit.
GR-CCC-6.1.1.3	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713213; Passage ID 16601).	3	5	CDFG, Mendocino County, NMFS, NOAA RC, USACE	260.00					260	Cost based on treating minor 2 lane road at a rate of $254,065/unit.
GR-CCC-6.1.1.4	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Mill Creek (See CALFISH: PAD_ID 705892; Passage ID 7210)	3	5	CDFG, Mendocino County, NMFS, NOAA RC, Private Landowners, USACE	660					660	Cost based on providing passage for a small waterway at a rate of $653,406/unit.
GR-CCC-6.1.1.5	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Mill Creek (See CALFISH: PAD_ID 705893; Passage ID 7211).	3	5	CDFG, Mendocino County, NMFS, USACE	660					660	Cost based on providing passage for a small waterway at a rate of $653,406/unit.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-6.1.1.6	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713212; Passage ID 16600).	3	5	CDFG, Mendocino County, NMFS, Private Landowners, USACE	260.00					260	Cost based on treating a minor 2 lane road at a rate of $254,065/unit.
GR-CCC-6.1.1.7	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Mill Creek (See CALFISH: PAD_ID 713213; Passage ID 16601).	3	5	CDFG, Mendocino County, NMFS, Private Landowners, USACE	260.00					260	Cost based on treating a minor 2 lane road at a rate of $254,065/unit
GR-CCC-6.1.1.8	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at Fish Rock Road on Sled Creek (See CALFISH: PAD_ID 713211; Passage ID 16599)	3	5	CDFG, Mendocino County, USACE	660					660	Cost based on providing passage on a small waterway at a rate of $653,406/unit.
GR-CCC-6.1.1.9	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at private road crossing on Hathaway Creek (See CALFISH: PAD_ID 716763; Passage ID 26884).	3	5	CDFG, Mendocino County, NMFS, Private Landowners, USACE	260.00					260	Cost based on treating minor 2 lane road at a rate of $254,065/unit.
GR-CCC-6.1.1.10	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at culvert at mouth on SF Garcia River (See CALFISH: PAD_ID 712859; Passage ID 16063).	3	5	CalTrans, CDFG, Mendocino County, NMFS, NOAA RC, USACE	470.00					470	Cost based on treating major 2 lane road at a rate of $468,022/unit.
GR-CCC-6.1.1.11	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at culvert on Flemming Creek (See CALFISH: PAD_ID 723443; Passage ID 9525)	3	5	CDFG, Mendocino County, NMFS, Private Landowners, USACE	255.00					255	Cost based on treating minor 2 lane road at a rate of $254,065/unit
GR-CCC-6.1.1.12	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at unnamed tributary to SF Garcia River (See CALFISH: PAD_ID 723441; Passage ID 9523).	3	5	CDFG, Mendocino County, NMFS, Private Landowners, USACE	255.00					255	Cost base on treating minor 2 lane road at a rate of $254,065/unit.
GR-CCC-6.1.1.13	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at culvert on unnamed tributary to main stem Garcia River (See CALFISH: PAD_ID 723440; Passage ID 9522).	3	5	CDFG, Mendocino County, Private Landowners, USACE	255.00					255	Cost based on treating minor 2 lane road at a rate of $254,065/unit.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-6.1.1.14	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at identified logjams throughout the Garcia watershed (only if necessary).	3	20	CDFG, Mendocino County, Mendocino County Fish and Wildlife Advisory Board, Mendocino Redwood Company, NMFS, Private Landowners, USACE						In-Kind	Cost are anticipated to be minimal.
GR-CCC-6.1.1.15	Action Step	Passage	Identify and prioritize all logjams that are complete or partial barriers and indicate passage impairment to specific life stage (Bell 2006, as cited by KrisWeb 2011).	3	20							In-Kind	
GR-CCC-6.1.1.16	Action Step	Passage	Ensure that all logjams are carefully modified and that all LWD remains in the active stream channel (Monschke and Caldon 1992).	3	30							In-Kind	
GR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
GR-CCC-8.1.1.1	Action Step	Riparian	Increase the average stream canopy cover within all current and potential salmonid spawning and rearing reaches to a minimum of 80%.	2	20	Board of Forestry, CalFire, Conservation Fund, Mendocino Redwood Company, NMFS HCD, NMFS PRD, RWQCB, The Nature Conservancy	803	803	803	803		3,210	Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.
GR-CCC-8.1.1.2	Action Step	Riparian	Plant and protect riparian vegetation, including redwood, on the lower 7 mile reach (Eureka Hill Road Bridge and Windy Hollow Road) or where necessary to provide the following: shade and lower water temperatures, cover, protection for fish, bank protection from erosion, and large organic debris in the future for habitat (Bell 2003).	2	10-May	Board of Forestry, CalFire, CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB, The Nature Conservancy							Cost accounted for in increase average stream canopy.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-8.1.1.3	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy within the Blue Waterhole sub-basin.	2	20	Board of Forestry, CalFire, Conservation Fund, Mendocino Redwood Company, NMFS HCD, NMFS PRD, RWQCB, The Nature Conservancy							Cost accounted for in increase average stream canopy.
GR-CCC-8.1.1.4	Action Step	Riparian	Retain all existing native riparian vegetation where stream cover is provided.	2	20	Board of Forestry, CalFire, CDFG, Conservation Fund, NMFS HCD, NMFS PRD, RWQCB, The Nature Conservancy						In-Kind	
GR-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
GR-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	20	Board of Forestry, CalFire, Conservation Fund, NMFS HCD, NMFS PRD, RWQCB, The Nature Conservancy							Cost accounted for in increase canopy cover.
GR-CCC-8.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	Board of Forestry, CDFG, Conservation Fund, NMFS HCD, NMFS PRD, Private Landowners, RCD, RWQCB, The Nature Conservancy	227.50	227.50				455	Cost based on treating 4 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,422/acre.
GR-CCC-8.1.2.3	Action Step	Riparian	Develop a Large Wood Recruitment Plan that assesses instream wood needs, and sites potentially responsive to wood recruitment or placement, and develop a riparian strategy to ensure long term natural recruitment of wood via large tree retention.	3	2		80.00					80	Cost based on $20K in each Core area subbasin over a two year period.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-8.1.2.4	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Focus on partnerships with railroad and timber industry, as well as large private landowners.	3	20	CA Coastal Commission, California Coastal Conservancy, CDFG, Mendocino County, NMFS, NRCS, Private Landowners, RCD, Redwood Forest Foundation						TBD	Costs can not be determined without additional information on the potential projects within this basin.
GR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-9.1.1	Recovery Action	Sediment	Improve and expand instream gravel quantity										
GR-CCC-9.1.1.1	Action Step	Sediment	Increase the percentage of gravel quality embeddedness to values of 1s and 2s (See NMFS Conservation Action Planning Attribute Table Report) in all current and potential juvenile salmonid summer and seasonal (fall/winter/spring) rearing areas.	2	20	CDFG, Conservation Fund, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, RWQCB, The Nature Conservancy						TBD	A habitat survey assessment needs to be conducted to determine extent of embeddedness. Cost for habitat survey estimated at $353/IP km. Assume survey High IP, cost estimated at $15,000. This action step could be incorporated in other monitoring and assessment actions.
GR-CCC-9.1.1.2	Action Step	Sediment	Identify and implement strategies to treat landslides and old features such as stream side landings (Bell 2003).	3	10	CDFG, Conservation Fund, Friends of the Garcia River, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RWQCB, The Nature Conservancy							Cost should be accounted for in ESTUARY.
GR-CCC-9.1.1.3	Action Step	Sediment	Complete the remaining 25% of erosion control sites identified in the South Fork Garcia River by the Trout Unlimited North Coast Coho Project.	1	5	Mendocino Redwood Company, Trout Unlimited						TBD	Need cost estimates from project proponents.
GR-CCC-9.1.1.4	Action Step	Sediment	Treat high and medium priority sites that are identified in the MRC Garcia River Watershed Analysis, Garcia River Forest Integrated Resource Management Plan and other credible landowner assessments.	1	10	CDFG, NOAA RC, Private Consultants, Private Landowners, SWRCB	500	500				1,000	Based on $1 million estimate for Garcia river forest sites.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-9.1.1.5	Action Step	Sediment	Acquire funding for assessment and implementation of sediment reduction measures associated with the 2008 Jacks Fire which occurred in the North Fork Garcia River subbasin.	2	2	CalFire, NRCS, Private Landowners, RCD	200					200	Rough estimate for erosion control in affected area.
GR-CCC-9.1.1.6	Action Step	Sediment	Continue the implementation of the Garcia River TMDL and associated sediment reduction efforts.	1	20	Board of Forestry, CalFire, CDFG, NMFS HCD, NMFS PRD, NOAA RC, RWQCB, The Nature Conservancy							
GR-CCC-9.1.1.7	Action Step	Sediment	Develop and implement bank erosion prevention and riparian planting in Pardaloe Creek (Monschke and Caldon 1992).	2	10	CDFG, Conservation Fund, NMFS HCD, NMFS PRD, NOAA RC, RCD, RWQCB, The Nature Conservancy	11.50	11.50				23	Cost based on treating 0.5 mile of bank at a rate of $25,000/mile for bank erosion and $20,057/mile for riparian planting.
GR-CCC-10.1	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species continued existence**										
GR-CCC-10.1.1	Recovery Action	Viability	Increase spawner density										
GR-CCC-10.1.1.1	Action Step	Viability	Determine if there is a need for a conservation hatchery/supplementation/augmentation program. Assess the following prior to supplementation (Action Steps 2-7):	1	10	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC, RWQCB, The Nature Conservancy						TBD	
GR-CCC-10.1.1.2	Action Step	Viability	Determine the biological or DPS significance of the Garcia coho salmon population.	1	5	NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						TBD	
GR-CCC-10.1.1.3	Action Step	Viability	Investigate the population dynamics and viability status of coho salmon in the Garcia River watershed.	1	5	CDFG, Conservation Fund, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC, RWQCB, The Nature Conservancy						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-10.1.1.4	Action Step	Viability	Determine if the coho salmon population within the Garcia River watershed is at a short-term or immediate risk of extinction.	1	5	CDFG, Conservation Fund, NMFS HCD, NMFS PRD, NOAA SWFSC, RWQCB, The Nature Conservancy						TBD	
GR-CCC-10.1.1.5	Action Step	Viability	Identify population viability goals and the expectations of a conservation hatchery/supplementation/augmentation program.	1	5	CDFG, NMFS HCD, NMFS PRD, NOAA SWFSC, RWQCB, The Nature Conservancy						TBD	
GR-CCC-10.1.1.6	Action Step	Viability	Investigate the genetic diversity of coho salmon in the Garcia River.	1	5	NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						TBD	
GR-CCC-10.1.1.7	Action Step	Viability	If determine necessary, identify a source population (in or out of basin stock) that could be used to start a population augmentation/supplementation/broodstock program.	1	10	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC, RWQCB, The Nature Conservancy						TBD	
GR-CCC-10.1.2	Recovery Action	Viability	Increase spatial structure and diversity										
GR-CCC-10.1.2.1	Action Step	Viability	Conduct a comprehensive assessment of watershed processes (e.g., hydrology, geology, fluvial-geomorphology, water quality, and vegetation), instream habitat, and factors limiting coho salmon production (CDFG 2004). Use the watershed assessment template developed in portions of the watershed in Mendocino Redwood Company ownership, and apply to the rest of the Garcia River watershed.	2	10	CDFG, Conservation Fund, Mendocino Redwood Company, NMFS, NRCS, Private Consultants, Private Landowners, RCD, RWQCB, The Nature Conservancy							Cost of comprehensive assessment accounted for in fish/habitat monitoring and habitat survey monitoring.
GR-CCC-10.1.2.2	Action Step	Viability	Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.	2	10	CDFG, NMFS, Private Landowners, RCD	375.00	375.00				750	Annual cost for spawner ground surveys for N. Central Coast diversity stratum estimated at $16,650 and smolt outmigration at $58,404.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-10.1.3	Recovery Action	Viability	Increase abundance										
GR-CCC-10.1.3.1	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.	1	10							TBD	
GR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
GR-CCC-11.1.1.1	Action Step	Water Quality	Work with TNC and Stillwater Sciences to develop a "Basin Temp" model to aid in efforts to reduce stream temperatures between Signal and the Pardaloe/Mill creeks confluence.	2	10	CDFG, Conservation Fund, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RCD, RWQCB, The Nature Conservancy							Cost accounted for in development of stream flow model.
GR-CCC-11.1.1.2	Action Step	Water Quality	Work with landowners to plant riparian zones of Blue Waterhole, Inman Creek, and Pardaloe Creek with the goal of reducing instream water temperatures of the Garcia River main stem during the dry season.	2	10	CDFG, NOAA RC, Private Landowners						TBD	Cost will depend on the length of reaches identified for planting.
GR-CCC-11.1.1.3	Action Step	Water Quality	Identify and Implement actions to maintain and restore water temperatures to meet habitat requirements for CCC coho salmon in specific streams (CDFG 2004).	2									See Riparian section above.
GR-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
GR-CCC-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00(b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties. Discontinue using the Russian River at Guerneville gauging station for angling closures and use the Navarro River USGS gauging station (11468000) which better reflects hydrologic conditions in smaller unregulated coastal Sonoma/Mendocino streams.	2	30	CDFG, NMFS PRD						In-Kind	
GR-CCC-16.1.1.2	Action Step	Fishing/Collecting	Reduce poaching of adult coho salmon by increasing law enforcement.	1	100								
GR-CCC-16.1.1.3	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	2	100								

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-16.2	**Objective**	**Fishing/Collecting**	**Address other natural or manmade factors affecting the species' continued existence**										
GR-CCC-16.2.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
GR-CCC-16.2.1.1	Action Step	Fishing/Collecting	Investigate and work with local tribal officials in efforts to stop gill-netting in the Garcia River watershed.	1	30	CDFG, CDFG Law Enforcement, NMFS OLE, NMFS PRD						In-Kind	
GR-CCC-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-18.1.1	Recovery Action	Livestock	Prevent impairment to estuary quality and extent										
GR-CCC-18.1.1.1	Action Step	Livestock	Work with BLM to ensure that future cattle leasing agreements do not reduce potential rehabilitation of high value summer and winter juvenile salmonid rearing habitat within the lower Garcia River and estuary.	2	20	BLM, CDFG, NMFS HCD, NMFS PRD, NOAA RC						In-Kind	
GR-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
GR-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to water quality (instream water temperature)										
GR-CCC-19.1.1.1	Action Step	Logging	Protect current riparian zones in all summer salmonid rearing areas to the extent that they are able to mature, provide, and maintain a minimum of 80% canopy cover.	2	50	Board of Forestry, CalFire, CDFG, Conservation Fund, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RWQCB, The Nature Conservancy						In-Kind	
GR-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.1.2.1	Action Step	Logging	Ensure future forest management allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	2	100	CDFG, Conservation Fund, Mendocino Redwood Company, NMFS, RWQCB, The Nature Conservancy						In-Kind	
GR-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										
GR-CCC-19.1.3.1	Action Step	Logging	Develop and implement low impact timber and wood harvest techniques (e.g., full-suspension cable yarding) in efforts to reduce turbidity impacts in streams. Example: Parker Ranch in the Ten Mile River Basin (Bell 2003).	2	100	Board of Forestry, CDFG, Conservation Fund, Mendocino Redwood Company, Private Landowners, RWQCB, The Nature Conservancy						In-Kind	This recommendation should be considered standard practice.
GR-CCC-19.1.3.2	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	2	60	CalFire						In-Kind	
GR-CCC-19.1.3.3	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	2	20	CalFire, Mendocino Redwood Company, NOAA RC, Private Landowners						TBD	Cost will vary with THP development near streams with legacy roads.
GR-CCC-19.1.4	Recovery Action	Logging	Prevent increased landscape disturbance										
GR-CCC-19.1.4.1	Action Step	Logging	Areas adjacent to currently owned State parks or forestlands supporting Core, Phase I and Phase II priority areas should be considered for purchase (if feasible within the next 5 years).	2	50	CDFG, NMFS, Private Landowners, Redwood Forest Foundation, The Nature Conservancy, Trout Unlimited						TBD	Cost estimates are difficult to determine as this action step is driven by current market value and rate of turnover.
GR-CCC-19.1.4.2	Action Step	Logging	Should large tracts of forestlands within the Garcia River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or Salmonid Preserve.	2	50	CDFG, NMFS, Redwood Forest Foundation, RWQCB, The Nature Conservancy						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.1.4.3	Action Step	Logging	Continue the activities of the North Coast Watershed Assessment /Coastal Watershed Program.	2	20	CDFG, NMFS, Private Landowners						TBD	NCWP/Coastal Watershed Program needs to implement assessment in the Garcia River basin.
GR-CCC-19.1.4.4	Action Step	Logging	Maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture or other land uses.	2	20	Board of Forestry, CalFire, CDFG, NMFS, RWQCB						In-Kind	
GR-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
GR-CCC-19.2.1.1	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	20	Board of Forestry, CA Coastal Commission, CDFG, NMFS						In-Kind	Cost expected to be minimal to improve coordination with Mendocino County.
GR-CCC-19.2.1.2	Action Step	Logging	Work with the California Board of Forestry to design and implement a program of BMPs for logging areas that meets the approval of NMFS and CDFG.	3	20	Board of Forestry, CDFG, NMFS, RWQCB						In-Kind	
GR-CCC-19.2.1.3	Action Step	Logging	Conduct an assessment of the mechanisms driving forestland conversion and develop strategies to protect forestlands.	3	10	Board of Forestry, Mendocino County, NMFS PRD						TBD	
GR-CCC-19.2.1.4	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFG Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	2	20	Board of Forestry, CDFG, NMFS	25.00	25.00	25.00	25.00		100	Assumes data for the Garcia River portion of the database can be maintained for $5k per year.
GR-CCC-19.2.1.5	Action Step	Logging	Develop a framework similar to Washington State that establishes a scientific framework for monitoring the effectiveness of practices in meeting watershed process goals and a decision-making process that is adaptive to the new information.	1	30	Board of Forestry, CalFire, CDFG, Conservation Fund, Mendocino Redwood Company, NMFS, Private Landowners						In-Kind	
GR-CCC-19.2.1.6	Action Step	Logging	Provide information to BOF regarding CCC coho salmon priorities and recommend upgrading relevant forest practices.	1	2	CDFG, NMFS						In-Kind	This is underway.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.2.1.7	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CA Coastal Commission, CDFG, Mendocino County, NMFS						In-Kind	Need to determine the number of regulatory staff to control rural development in Mendocino County.
GR-CCC-19.2.1.8	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	1		Board of Forestry, CalFire, CDFG, NMFS						In-Kind	
GR-CCC-19.2.1.9	Action Step	Logging	Develop a California Forest Practice monitoring protocol to determine whether specific practices are effectively meeting intended objectives and are providing for the protection of CCC coho salmon.	3	20	Board of Forestry, CalFire, NMFS HCD, NMFS PRD, NRCS, RCD, RWQCB, The Nature Conservancy						In-Kind	
GR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										
GR-CCC-23.1.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	2	10	Board of Forestry, CalFire, Mendocino County, NMFS HCD, NMFS PRD, NOAA RC, RWQCB	495.00	495.00				990	Cost based on treating 82 miles of road network at a rate of $12,000/mile.
GR-CCC-23.1.1.2	Action Step	Roads/Railroads	Map and identify stream crossings with the intention of replacement or removal if they cannot pass the 100 year flow. Designs should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	20	CDFG, Mendocino County Department of Public Works, NOAA RC, NRCS, Private Landowners, RCD							Number of culverts and specific details to upgrade are needed to estimate cost.
GR-CCC-23.1.1.3	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	10	CalFire, CDFG, Mendocino County Department of Public Works, NRCS, Private Landowners						In-Kind	Ten year duration to accommodate changes in BMPs.

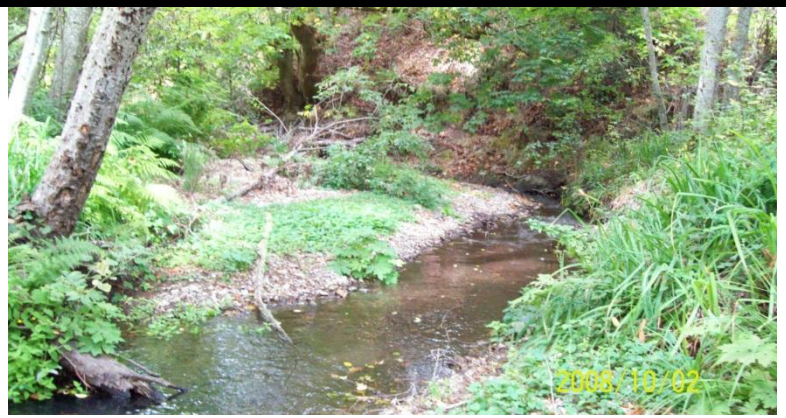
Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-23.1.1.4	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in Core areas should be considered an extremely high priority for funding (e.g., PCSRF). Where no Core areas are designated, apply this action to Phase I areas.	1	20	CDFG, NOAA RC, NRCS							Costs minimal to prioritize projects.
GR-CCC-23.1.1.5	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	1	20	CalFire, CDFG, NOAA RC, NRCS, Private Landowners, RCD	19.00	19.00	19.00	19.00		76	Cost based on decommissioning 6.2 miles of riparian roads at a rate of $12,000/mile. Cost may be less than other basins due to TMDLs in place since 1997.
GR-CCC-23.1.1.6	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	20	CalFire, CDFG, NOAA RC, NRCS, Private Landowners, RCD						In-Kind	Costs are related to maintenance and enforcement of gates and other closure techniques.
GR-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent alterations to sediment transport (road condition/density, dams, etc.)										
GR-CCC-23.1.2.1	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	3	5	CalFire, Mendocino County Department of Public Works, NMFS, Private Consultants, Private Landowners	50.00					50	Cost estimate for entire basin.
GR-CCC-23.1.2.2	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	2	10	CDFG, Mendocino County, NOAA RC, NRCS, Private Landowners						In-Kind	Cost estimate for Garcia watershed only.
GR-CCC-23.1.2.3	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	3	20	Mendocino County, NMFS HCD, NMFS PRD, NRCS, Private Landowners, RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-23.1.2.4	Action Step	Roads/Railroads	Evaluate existing and future stream crossings that impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	10	Board of Forestry, CalFire, CDFG, Friends of the Garcia River, Mendocino Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB	335.00	335.00				670	Cost based on replacing 3 stream crossings at a rate of $223,051/unit.
GR-CCC-23.1.2.5	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	5	CalFire, CalTrans, CDFG, NMFS, NRCS, Private Landowners	250.00					250	Based on approximately $50k to do inspections for a five year period.
GR-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
GR-CCC-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalTrans, Mendocino County Department of Public Works						In-Kind	
GR-CCC-23.1.3.2	Action Step	Roads/Railroads	Ensure that all future road or bridge repairs at stream crossing provide unimpaired fish passage for all salmonid life stages.	2	20	Mendocino County						In-Kind	
GR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (stream flow)										
GR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	20	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, RWQCB, SWRCB							Costs addressed in Hydrology section.
GR-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (stream flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	2	20	CDFG, NMFS HCD, NMFS PRD, SWRCB						TBD	Stream flow model should identify flow levels for coho salmon.
GR-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	2	20	CDFG, NOAA RC, Private Landowners, SWRCB						TBD	Cost will vary with the number of water rights holders willing to participate.
GR-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
GR-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Establish flow related adult and smolt migration thresholds prior to authorizing future water diversions.	2	20	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB						TBD	
GR-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (quality and extent)										
GR-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months (ECORP and Kamman Hydrology & Engineering 2005).	2	20	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB						In-Kind	
GR-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (instream temperature)										
GR-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure future water diversions do not impair instream water temperatures during the dry season.	2	50							In-Kind	
GR-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (stream flow)										
GR-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	10	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB						In-Kind	
GR-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	100	CDFG, NMFS, NRCS, SWRCB						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures.	2	50	CDFG, NMFS HCD, NMFS PRD, SWRCB						In-Kind	
GR-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	3	30	SWRCB						In-Kind	
GR-CCC-25.2.1.5	Action Step	Water Diversion/Impoundment	Improve compliance with existing water resource regulations via monitoring and enforcement.	2	20	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB						In-Kind	
GR-CCC-25.2.1.6	Action Step	Water Diversion/Impoundment	Support the SWRCB in regulating groundwater.	3	20	CDFG, NMFS, RWQCB						In-Kind	
GR-CCC-25.2.1.7	Action Step	Water Diversion/Impoundment	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	2	20	CDFG, NMFS, SWRCB						In-Kind	

Location	•San Mateo County
Watershed Area	•12.0 Square Miles
Potential Habitat	•7.1 Stream Miles
Vegetation	•73% Coniferous, 24% Shrubland
Erodability	•Moderate
Ownership Patterns	•79% Private; 21% Public
Dominant Land Uses	•Rural Residential, Timber, Recreation
Housing Density	•Low
TMDL Pollutants	•None



Gazos Creek
Photo Courtesy: San Mateo County Public Works

Gazos Creek Coho Salmon: Nearly Extirpated

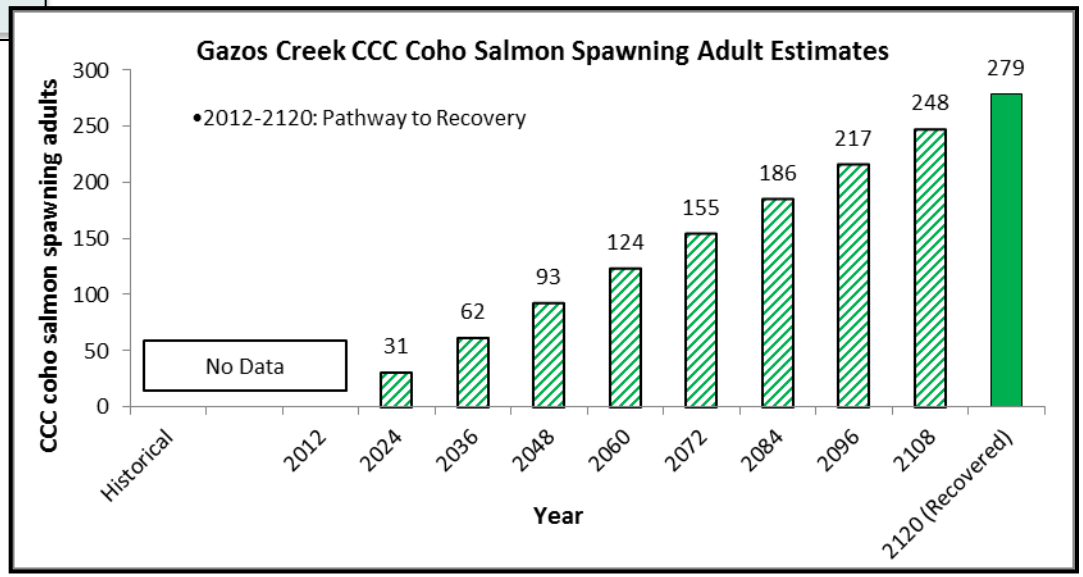
Recovery Goals
- ✓ Continue ongoing juvenile sampling efforts in the watershed
- ✓ Conduct periodic, standardized spawning surveys to estimate adult abundance

Gazos Creek
Adult Spawner Targets

Downlisting to Threatened
140

Recovery
279

STEELHEAD: YES
CHINOOK SALMON: NO



Gazos Creek

Potential Habitat: 7.1 miles
Recovery Target: 279 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	FAIR	FAIR	GOOD	FAIR	FAIR	GOOD	GOOD	FAIR	POOR	VERY GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth
- Educate landowners, land managers, and County and municipal staffs on the importance of LWD
- Re-establish a naturally reproducing run of coho salmon

Priority 2 & 3: Long-Term Restoration Actions

- Conduct annual surveys in Gazos Creek to ensure wood clusters do not create a complete barrier to adult passage
- Do not remove woody material from the stream channel
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal

County of San Mateo Founded 1856

San José State University

Recovery Partners

San Mateo RCD

Resources Agency California Department Fish & Game

California State Parks Since 1864

Photo courtesy from left to right: Josh Fuller, NMFS, David Hines, NMFS, Gualala River Watershed Council, City of Santa Rosa and Morgan Bond, SWFSC

Gazos Creek

Potential Habitat: 7.1 miles
Recovery Target: 279 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM	NA	NA	MEDIUM	NA	LOW	MEDIUM	HIGH	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Ensure current and future water diversions (surface and groundwater) do not impair water quality conditions for rearing juvenile salmonids
- Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures

Priority 2 & 3: Long-Term Threat Abatement Actions

- Evaluate and remove roadside berms that lead to increased runoff velocities and sediment discharge
- Conduct annual inspections of all roads prior to winter and correct conditions that are likely to deliver sediment to streams
- Encourage San Mateo Public Works develop a programmatic plan for stream and road maintenance actions

Road failure adjacent to Gazos Creek
Photo by Jerry Smith, SJSU

Conservation Highlights

- Annual juvenile abundance surveys conducted by San Jose State University faculty and students provides important population data on coho salmon in the Gazos Creek watershed.

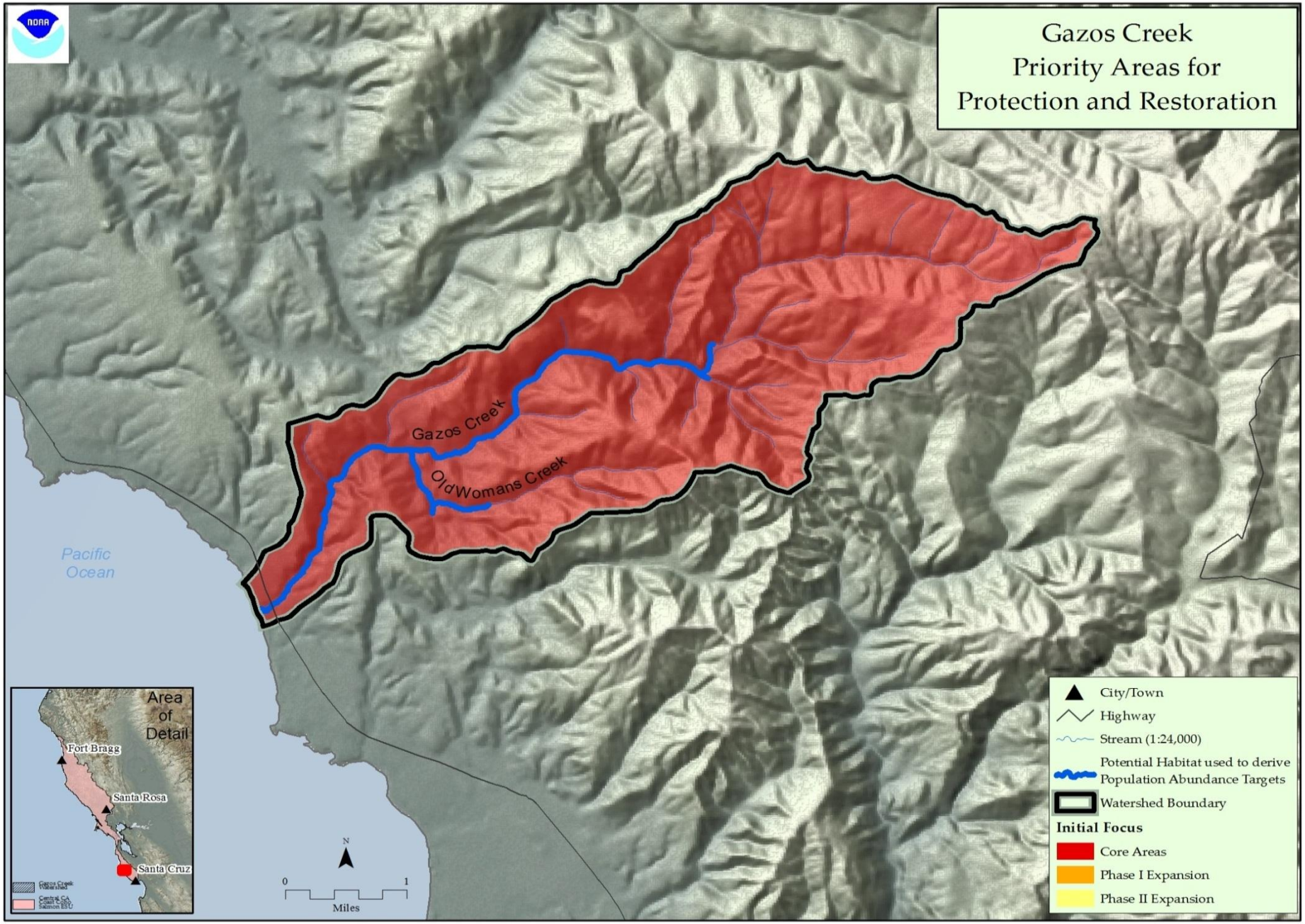


Figure 1: Map of Gazos Creek

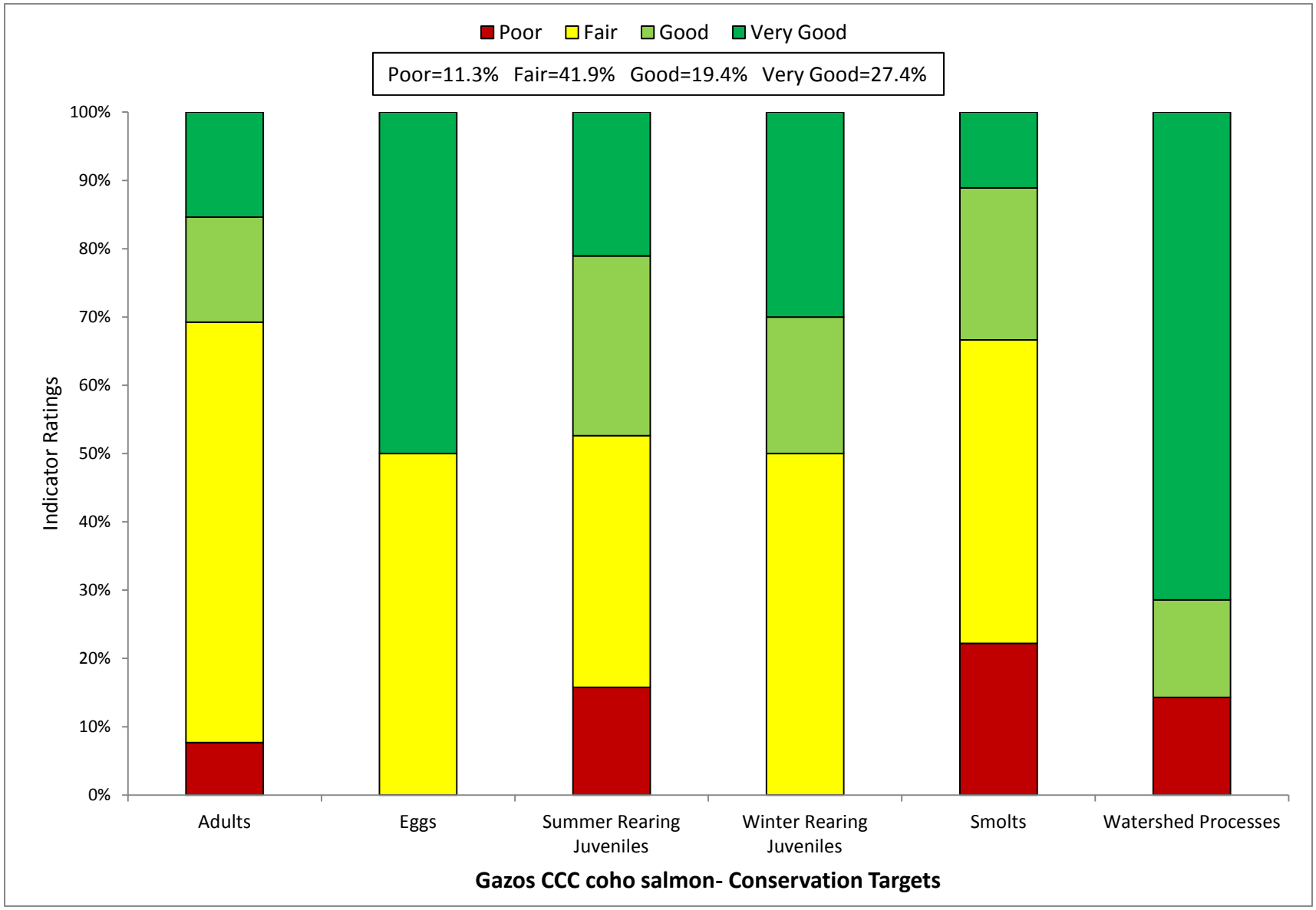


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Gazos Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**8.8 Key Pieces/100m**	Very Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**91% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**73% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**> 80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =67**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**100 of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**8.8 Key Pieces/100m**	Very Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**50 to 74% of streams/ IP-km (>49% of pools are primary pools)**	Fair	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Condition =42**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**17.16 Diversions/10 IP-km**	Poor	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**91% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**>90% of streams/IP with average canopy >85%**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**73% Density rating "D" across IP-km**	Fair	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**8.8 Key Pieces/100m**	Very Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**91% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**73% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**> 80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**17.16 Diversions/10 IP-km**	Poor	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =58**	Fair	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75 to 90 percent of IP/km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**>90% IP-km (>6 and <16 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-Km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density =0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.18% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**1.59% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**3% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**0% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**>75% Intact Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**2 Miles/Square Mile**	Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**3.7 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Gazos Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Medium	-	High	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Medium	Medium	High	Medium	Medium	Medium
5	Fishing and Collecting	Medium	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	-	-	-	-	-	-	-
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Low	Medium	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Medium	Low	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	High	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	Medium	High	High	Medium	Medium	High

Central CA Coast Coho Salmon ~ Gazos Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Reduce frequency of artificial breaching events

1.1.1.1. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

2. **Restoration- Floodplain Connectivity**

No species-specific actions were developed.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Improve frequency of primary pools

3.1.1.1. **Action Step:** After large floods, tree seedlings should be allowed to regenerate on exposed bars.

3.1.2. **Recovery Action:** Improve pool shelter rating

3.1.2.1. **Action Step:** Conduct annual surveys in Gazos to ensure wood clusters do not create a complete barrier to adult passage.

3.1.3. **Recovery Action:** Improve habitat complexity

3.1.3.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

3.1.3.2. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.3.3. **Action Step:** Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.

3.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

3.2.1. **Recovery Action:** Improve pool shelter rating

3.2.1.1. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.

3.2.1.2. **Action Step:** Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.

4. **Restoration- Hydrology**

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.1.1. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.

4.1.1.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

No species-specific actions were developed.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction of the species habitat or range

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.1.2.2. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase abundance

10.2.1.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.

10.2.1.2. **Action Step:** Measure or estimate response of key habitat attributes to recovery efforts across the watershed.

10.2.1.3. **Action Step:** Implement standardized watershed assessments to identify limiting factors specific to the watershed. Encourage all major landowners to adopt consistent assessment methods.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

14.1.1.1. **Action Step:** Remove invasive exotic vegetation from riparian zones.

14.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

14.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.2.1.1. **Action Step:** Implement regulatory, abatement, and education measures to prevent the invasion of exotic species, (including exotic plants).

14.2.1.2. **Action Step:** Work with landowners in the upper watershed to discontinue practice of stocking ponds with exotic and predator fish.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity

15.1.1.1. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.2.1. **Action Step:** Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.

15.2.1.2. **Action Step:** Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.

15.2.1.3. **Action Step:** Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.

15.2.1.4. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.

15.2.1.5. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.1.1. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.2. **Recovery Action:** Prevent impairment to passage and migration

23.1.2.1. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.3.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.3.2. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.3.3. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.

23.1.3.4. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.

23.1.3.5. **Action Step:** Encourage County to continue implementation of the San Mateo County Road Maintenance Manual.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.

23.2.1.2. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

23.2.1.3. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.2.1.4. **Action Step:** Encourage San Mateo Public Works develop a programmatic plan for stream and road maintenance actions.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

24. Threat- Severe Weather Patterns

No species-specific actions were developed.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

25.1.1. **Recovery Action:** Prevent impacts from future water development

25.1.1.1. **Action Step:** Avoid new or increased summer diversions.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

25.1.2.2. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

25.1.2.3. **Action Step:** Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures.

25.2.1.2. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.3. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Gazos Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GaC-CCC-1.1.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
GaC-CCC-1.1.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	10	IWRP, State Parks	1.50	1.50				3	Signage could also be placed along the parking lot which provides the public beach access. Cost for signage vary widely based on materials and content. Assume a minimum of 3 signs at a rate of $1,000/sign.
GaC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
GaC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools										
GaC-CCC-3.1.1.1	Action Step	Habitat Complexity	After large floods, tree seedlings should be allowed to regenerate on exposed bars.	2	100	Private Landowners, San Mateo County, State Parks						In-Kind	
GaC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve pool shelter rating										
GaC-CCC-3.1.2.1	Action Step	Habitat Complexity	Conduct annual surveys in Gazos to ensure wood clusters do not create a complete barrier to adult passage.	2		CDFG, San Mateo County, State Parks						127,000	Cost for fish/habitat restoration monitoring are estimated at $126,758.
GaC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve habitat complexity										
GaC-CCC-3.1.3.1	Action Step	Habitat Complexity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, NOAA RC, Private Landowners, San Mateo RCD, State Parks, USACE	21.50	21.50				43	Cost based on treating 1.5 miles (assume 1 project/mile in 50% High IP) at a rate of $28,500/mile. If ELJ used, cost are $172,914.
GaC-CCC-3.1.3.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFG, NMFS, Private Landowners, San Mateo County, San Mateo RCD, State Parks, USACE						In-Kind	No cost are associated with this recommendation if habitat features are passively maintained.
GaC-CCC-3.1.3.3	Action Step	Habitat Complexity	Conserve and manage forestlands and riparian corridors to retain shade and provide sources of LWD.	3	100	San Mateo County, State Parks, USACE, USFWS						In-Kind	Wood supply from upslope sources is better in Gazos Creek than many nearby watersheds in the Diversity Stratum.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-3.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**										
GaC-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve pool shelter rating										
GaC-CCC-3.2.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.	2	10	CDFG, IWRP, PG&E, Private Landowners, Public, San Mateo County, San Mateo RCD, State Parks						In-Kind	
GaC-CCC-3.2.1.2	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	2	100	CDFG, NMFS PRD, Private Consultants						In-Kind	This recommendation should be considered standard practice.
GaC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GaC-CCC-4.1.1	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
GaC-CCC-4.1.1.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	10	CDFG, Farm Bureau, Private Landowners, San Mateo County, SWRCB						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.
GaC-CCC-4.1.1.2	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon	2	10		36.00	36.00				72	Cost for stream flow monitoring estimated at $72,000
GaC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction of the species habitat or range**										
GaC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-10.1.1.1	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	2	20	CDFG, NOAA SWFSC, Private Consultants, State Parks	4.75	4.75	4.75	4.75		19	Continuous juvenile sampling has been conducted in Gazos Creek since 1992, providing the one of the longest continuous monitoring effort in the County. Sampling should continue. Cost for juvenile sampling/reporting is estimated at an annual rate of $18,823/year for the Santa Cruz Mtns. diversity stratum.
GaC-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.	1	10	CDFG, Monterey Bay Salmon and Trout Project, NMFS PRD, NOAA SWFSC, San Mateo County						TBD	Since 2006, researchers have failed to detect coho salmon rearing in Gazos Creek. Coho salmon appear to be extirpated. Suitable conditions for coho salmon are present in portions of the watershed and it should be considered as a higher priority for reintroduction efforts. Consultation with the SWFSC should ensue prior to reintroduction efforts to ensure the most appropriate genetic stocks are used. Cost will be determined by adequate site location and number of coho needed to repopulate watershed.
GaC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
GaC-CCC-10.1.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20	CDFG, San Mateo County	57.00	57.00	57.00	57.00		228	Cost for annual spawner surveys for Santa Cruz Diversity Stratum estimated at $56,470.
GaC-CCC-10.1.2.2	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	10		41.00	41.00				82	Cost based on riparian restoration at a cost of $81,437.
GaC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
GaC-CCC-10.2.1	Recovery Action	Viability	Increase abundance										
GaC-CCC-10.2.1.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed.	3	20	CDFG, NOAA SWFSC	14.25	14.25	14.25	14.25		57	Cost for spawning surveys are estimated at $56,470/year for Santa Cruz Mtns. diversity stratum.
GaC-CCC-10.2.1.2	Action Step	Viability	Measure or estimate response of key habitat attributes to recovery efforts across the watershed.	3	10	CDFG, IWRP, San Mateo RCD							Cost accounted for in HABITAT COMPLEXITY.
GaC-CCC-10.2.1.3	Action Step	Viability	Implement standardized watershed assessments to identify limiting factors specific to the watershed. Encourage all major landowners to adopt consistent assessment methods.	3	10	CDFG, NOAA RC, NOAA SWFSC, NRCS, Private Consultants, RWQCB, San Mateo County, San Mateo RCD							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-14.1	**Objective**	**Disease/Predation/ Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
GaC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
GaC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Remove invasive exotic vegetation from riparian zones.	3	20	California Coastal Conservancy, CDFG, IWRP, Private Landowners, San Mateo County, State Parks	32.50	32.50	32.50	32.50		130	Assess riparian canopy and impacts of exotic vegetation (e.g., ivy, eucalyptus, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (DFG 2004). Cost based on treating 1 mile (assume 80 acres/mile in 15% High IP with 1 mile minimum) at a rate of $1,621/acre.
GaC-CCC-14.2	**Objective**	**Disease/Predation/ Competition**	**Address the inadequacy of existing regulatory mechanisms**										
GaC-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
GaC-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Implement regulatory, abatement, and education measures to prevent the invasion of exotic species, (including exotic plants).	3	20	CalFire, California Coastal Conservancy, CDFG, Private Landowners, San Mateo County, San Mateo RCD						In-Kind	
GaC-CCC-14.2.1.2	Action Step	Disease/Predation/Competition	Work with landowners in the upper watershed to discontinue practice of stocking ponds with exotic and predator fish .	3	100	CDFG, NMFS, Private Landowners, Public, State Parks						In-Kind	Green sunfish and largemouth bass are present in the pond at the Mountain Camp. Green sunfish have been captured during in Gazos Creek during juvenile salmonid surveys. The fish should be removed from the pond.
GaC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GaC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity										
GaC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2		CalFire, CDFG, NRCS, RWQCB						In-Kind	
GaC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3		CalFire, CDFG, NMFS, Private Landowners, SWRCB							Require contract specifications that water trucks/tenders be fitted with CDFG and NMFS approved fish screens when drafting from fish bearing streams.
GaC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										
GaC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
GaC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.			CalFire, CDFG, RWQCB, USEPA						In-Kind	
GaC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.	2	100	CalFire, CDFG, RWQCB, USEPA						In-Kind	
GaC-CCC-15.2.1.3	Action Step	Fire/Fuel Management	Develop guidance that directs CalFire and other agencies and organizations using fire retardants to conduct an assessment of site conditions following wildfire where fire retardants have entered waterways, to evaluate the changes to on site water quality and the structure of the biological community.	3	10	CalFire, NMFS, RWQCB						In-Kind	
GaC-CCC-15.2.1.4	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	2	CalFire, NMFS PRD, Private Landowners, RWQCB, San Mateo County, USACE, USEPA							
GaC-CCC-15.2.1.5	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	3	100	CalFire, NMFS PRD, USFWS						In-Kind	
GaC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GaC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-23.1.1.1	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	30	CalFire, California Geological Survey, CDFG, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, USACE	9.17	9.17	9.17	9.17	9.17	55	Riparian roads in Gazos are the ultimate cause of many problems in the instream environment. Decommissioning high risk road segments would help to restore watershed processes. The paved County road has narrowed the floodplain upstream of Old Woman's Creek and decommissioning this road, although beneficial to watershed processes, is highly unlikely. Upgrading the road to reduce risk of episodic sediment input would be beneficial. Cost based on decommissioning 4 miles of riparian road network at a rate of $13,680/mile.
GaC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
GaC-CCC-23.1.2.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, RWQCB, San Mateo RCD, Santa Cruz County, State Parks						In-kind	Replacement of culverts/bridges to NMFS standards will result in increased cost for materials and construction, but will likely result in structures that can withstand large storm events better than existing structures. Long term durability and stability will result in long-term cost savings in many circumstances. This recommendation should be considered standard practice.
GaC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
GaC-CCC-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, IWRP, Private Consultants, Private Landowners, San Mateo County, San Mateo RCD, State Parks							
GaC-CCC-23.1.3.2	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	10	CDFG, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, State Parks	15.00	15.00				30	A road inventory needs to be completed to determine the extent of roadside berms increasing runoff within the road network. Cost for a road inventory assessment $29,568 at a rate of $1,056/mile.
GaC-CCC-23.1.3.3	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	10	CalFire, CalTrans, CDFG, Private Landowners, San Mateo County, San Mateo RCD, State Parks						TBD	Cost cannot be determined without identifying need and location for spoils storage sites first.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-23.1.3.4	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	10	CalFire, CDFG, NMFS, RWQCB, San Mateo County, San Mateo RCD, State Parks	275.00	275.00				550	Initial efforts should be directed at the road system in Old Woman's Creek. The road system is located on erosive soils and is poorly located and poorly maintained. Sediment from the road system directly enters Old Woman's Creek at numerous locations. This creek is highly incised and nearly completely sandy-bed dominated. Downstream of the Gazos/Old Woman's Creek confluence, due to high rates of sediment input, coho spawning and rearing habitats are limited. Cost based on decommissioning 4 miles of road network at a rate of $13,680/mile.
GaC-CCC-23.1.3.5	Action Step	Roads/Railroads	Encourage County to continue implementation of the San Mateo County Road Maintenance Manual.	2	100	San Mateo County							
GaC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
GaC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
GaC-CCC-23.2.1.1	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	2	100	CalTrans, County of San Mateo, Private Landowners, San Mateo County, San Mateo RCD, State Parks						In-Kind	
GaC-CCC-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, Private Landowners, RWQCB, San Mateo County						In-Kind	This recommendation should be considered standard practice.
GaC-CCC-23.2.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, NRCS, POST, Private Landowners, Public, RWQCB, State Parks							Cost accounted for in remove roadside berms assuming road inventory will address winter road use.
GaC-CCC-23.2.1.4	Action Step	Roads/Railroads	Encourage San Mateo Public Works develop a programmatic plan for stream and road maintenance actions.	2	5	NMFS, San Mateo County, USACE, USFWS						In-Kind	
GaC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-23.2.2.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	100	CalFire, CalTrans, RWQCB, San Mateo County, San Mateo RCD, State Parks						In-Kind	
GaC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
GaC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impacts from future water development										
GaC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Avoid new or increased summer diversions.	1	100	Private Landowners, San Mateo County, State Parks, SWRCB						In-Kind	
GaC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
GaC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	10	CDFG, NMFS, Private Landowners, San Mateo County, SWRCB						In-Kind	Costs cannot be estimated until an overall strategy to address diversions and their relative impact to salmonids is developed. This effort should focus on lower reaches in the watershed where the majority of problematic diversions are located.
GaC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	3	100	CDFG, IWRP, NMFS, NRCS, State Parks, SWRCB						TBD	Costs will vary depending on diversion strategy, infrastructure constraints, and landowner participation.
GaC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	1	100	CDFG, San Mateo County, State Parks, SWRCB							
GaC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
GaC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	10	CDFG, NMFS, Private Landowners, SWRCB						In-Kind.	All authorized surface water diverters should be notified of fish screen obligations. Notification should be followed by site visits within one year by DFG and SWRCB staff to ensure diversion are in compliance. This recommendation should be considered standard practice.
GaC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GaC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
GaC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures.	1	100	CDFG, NMFS HCD, Private Landowners, RWQCB, San Mateo County, SWRCB						In-Kind	
GaC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	1	100	CDFG						In-Kind	
GaC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).			NMFS, San Mateo County, SWRCB						In-Kind	

Gualala River

Location	•Mendocino County
Watershed Area	•298.0 Square Miles
Potential Habitat	•266.6 Stream Miles
Vegetation	•52% Coniferous, 31% Montane Hardwood, 16% Grassland
Erodability	•Low (29%) to High (71%)
Ownership Patterns	•99% Private
Dominant Land Uses	•Timber, Agriculture, Gravel Mining
Housing Density	•Moderate
TMDL Pollutants	•Sediment, Temperature

Gualala River estuary. *Photo by Bob Coey, NMFS.*

Gualala River Coho Salmon: Persistent – Low Abundance

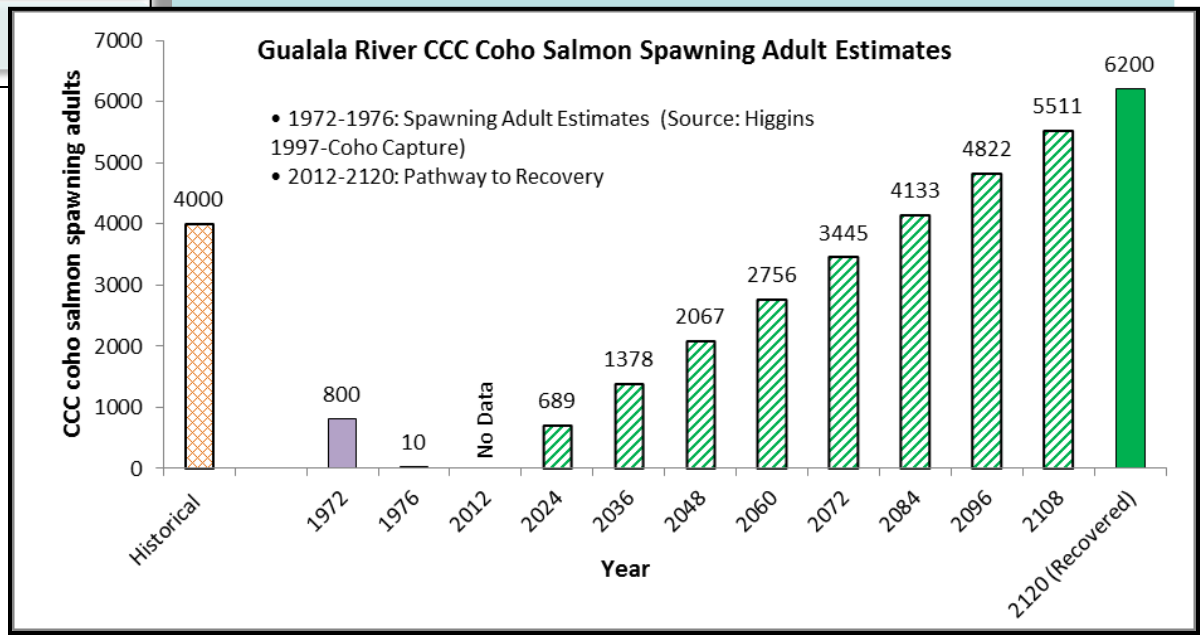
Recovery Goals

✓ Conduct monitoring to track population response to recovery action implementation

Gualala River Adult Spawner Targets

Downlisting to Threatened
3,100

Recovery
6,200



STEELHEAD: YES
CHINOOK SALMON: NO

Gualala River

Potential Habitat: 266.6 miles
Recovery Target: 6,200 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	GOOD	FAIR	FAIR	FAIR	FAIR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Treat high priority slides and landings
- Develop critical flow values that are the basis for minimum bypass flow requirements to support summer rearing

Priority 2 & 3: Long-Term Restoration Actions

- Monitor water quality in the Gualala estuary during the summer months
- Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions
- Monitor, identify problems, and prioritize needed changes to permitted water diversions
- Upgrade water rights information system and promote off channel storage
- Increase frequency of LWD and other complex habitat structures in seasonal habitat and migratory reaches
- Improve passage conditions

SOTOYOME RESOURCE CONSERVATION DISTRICT

Recovery Partners

Gualala River Watershed Council, Gualala Redwood Company

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH & GAME

Photo courtesy from left to right: Campbell Timberland, Campbell Timberland, KRIS Information System, City of Santa Rosa and Morgan Bond, SWFSC

Gualala River

Potential Habitat: 266.6 miles
Recovery Target: 6,200 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
HIGH	MEDIUM	LOW	LOW	MEDIUM	NA	MEDIUM	HIGH	MEDIUM	LOW	LOW	HIGH	MEDIUM	HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage forest-to-vineyard land conversions
- Decommission or upgrade roads
- Reduce road density by 10 percent of the next 10 years
- Ensure current and future water diversions do not impair summer rearing

Priority 2 & 3: Long-Term Threat Abatement Actions

- Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land
- Identify and eliminate depletion of summer base flows
- Evaluate and avoid impacts to off channel habitat in timber harvest
- Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment
- Conserve and manage forestlands for older forest stages
- Conduct inspections and correct conditions of all roads prior to winter
- Ensure all future road or bridge repairs at stream crossings provide unimpaired fish passage for all salmonid life stages

Wide and shallow riffle in the Gualala River
Photo provided by KRIS Information System, and is used with permission

Conservation Highlights

- The Gualala River Watershed Council (GRWC) has worked with landowners to conduct sediment reduction projects that have prevented more than 15,000 dump truck loads of sediment from polluting streams.
- GRWC has installed 70 stream temperature monitoring stations throughout the watershed. They conduct annual surveys of fish and aquatic and riparian habitat, and completed the first scientific study of the Gualala River Estuary.
- Gualala Redwood Company has installed many instream LWD structures on the North Fork Gualala River

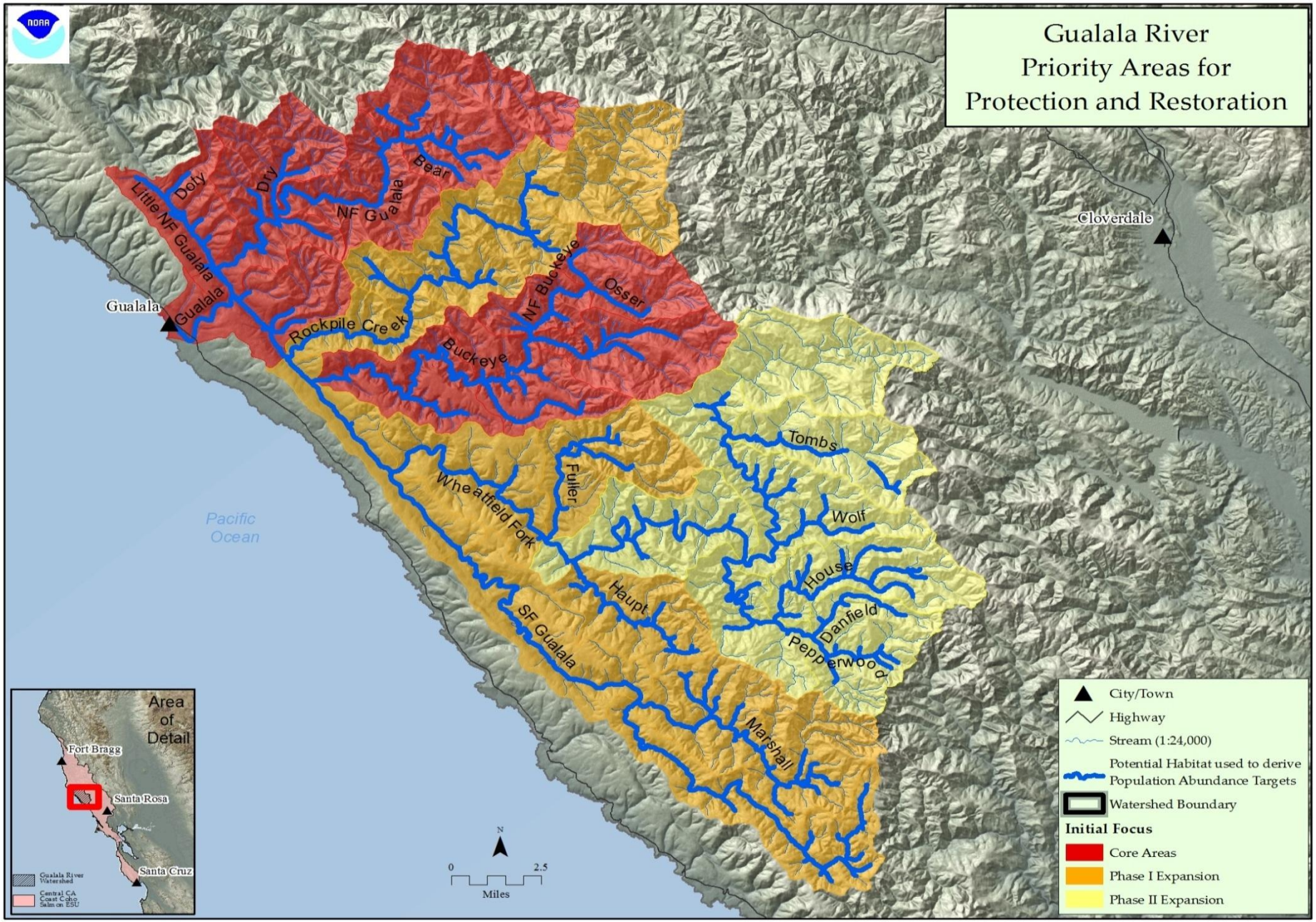


Figure 1: Map of Gualala River

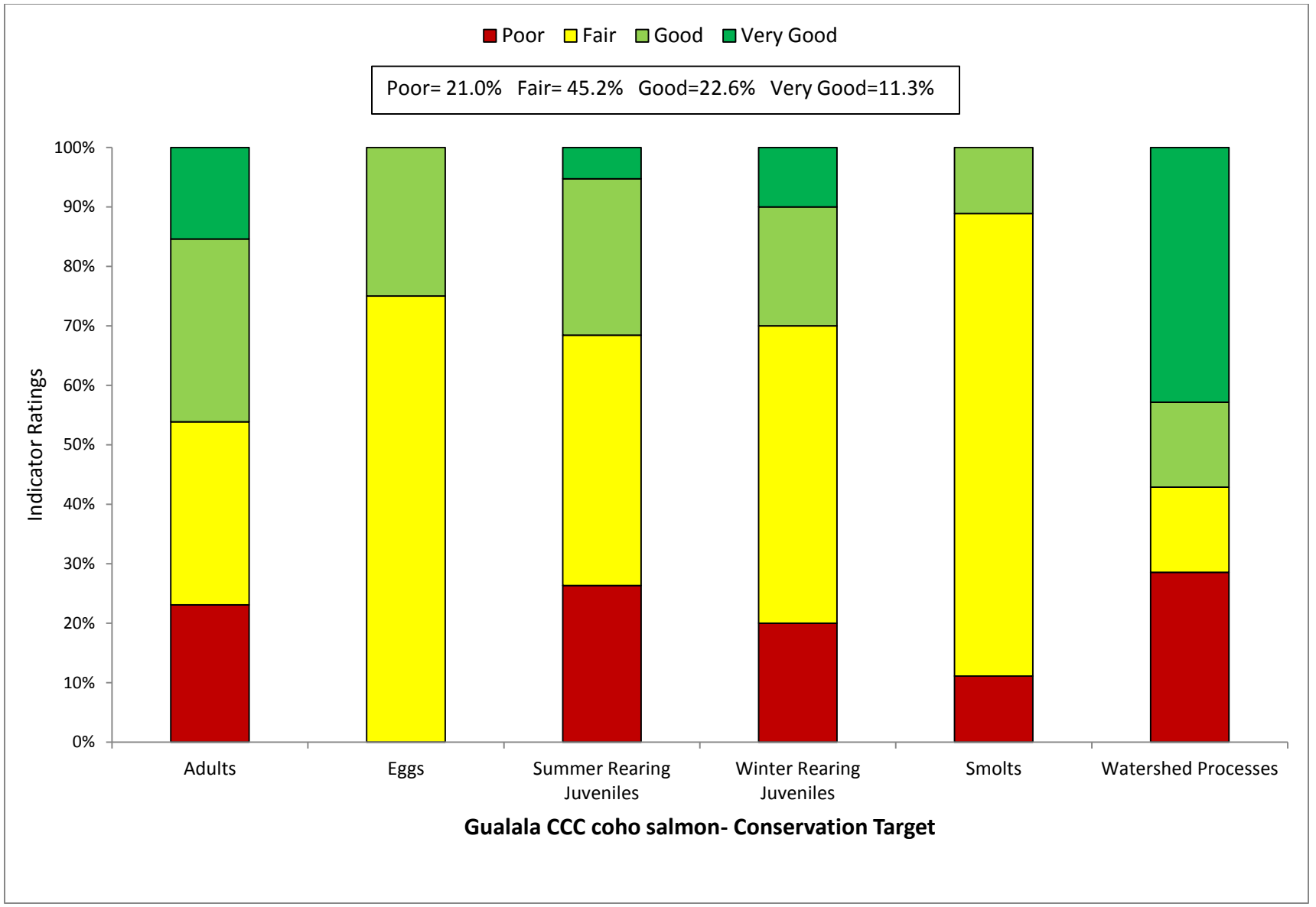


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Gualala River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**9.25 Key Pieces/100m**	Good	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**2.15 Key Pieces/100m**	Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**48% streams 37% IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**8% streams 2% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**0**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =67**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**12-14% (0.85mm) and <30% (6.4mm)**	Good	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**66% streams 69% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**9.25 Key Pieces/100m**	Good	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**2.15 Key Pieces/100m**	Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**24% streams 29% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**45% streams 33% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**8% streams 3% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =75**	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = 51-75**	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.15 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**50% streams 14% IP-km (>85% average stream canopy)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**0**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**63% streams 70% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP-km (<20 C MWMT; <16 C MWMT where coho IP overlaps)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**9.25 Key Pieces/100m**	Good	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**2.15 Key Pieces/100m**	Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**48% streams 37% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**8% streams 2% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**0**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**63% streams 70% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**8% streams 2% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.24 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =51-75**	Fair	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**50-74% IP-km (>6 and <14 C)**	Fair	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces moderate risk spawner density**	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.101% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.548% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**26-35% of Watershed in Timber Harvest**	Fair	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**2% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**4.8 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.1 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Gualala River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Medium	High	Medium	Medium	Medium	High
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	High	-	Low	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Medium	Low	Medium	Low	Medium	Low	Medium
8	Logging and Wood Harvesting	Medium	High	High	High	High	High	High
9	Mining	Medium	Low	Medium	Medium	Medium	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	High	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Low	Medium	Low	Medium
14	Water Diversion and Impoundments	Medium	Medium	High	Medium	High	Medium	High
Threat Status for Targets and Project		High	High	High	High	High	High	High

Central CA Coast Coho Salmon ~ Gualala River

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase the physical extent of estuarine habitat

1.1.1.1. **Action Step:** Investigate the extent of sedimentation within the estuary/lagoon associated with watershed legacy impacts (logging). Evaluate sediment transport within the estuary and determine if the estuary is "filling" with sediment or "flushing" sediment (recovering).

1.1.1.2. **Action Step:** Identify past mechanical fill sites (inside of Mill Bend (?)) and develop strategies targeting the re-establishment of wetland marsh habitat (if feasible).

1.1.1.3. **Action Step:** Develop and implement rehabilitation projects designed to increase the physical extent of high quality habitat for rearing juvenile salmonids within the Gualala River estuary.

1.1.2. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.2.1. **Action Step:** Increase the percentage of area containing high value habitat complexity elements and features (SAV, LWD, boulders, marshes, vegetation, pools > 2 meters).

1.1.2.2. **Action Step:** Identify strategic locations to install LWD structures designed to increased pool depth and habitat conditions within the Gualala River estuary.

1.1.3. **Recovery Action:** Improve the quality of freshwater lagoon habitat

1.1.3.1. **Action Step:** Install continuous water quality monitoring stations in the Gualala estuary during the summer months. Monitor at a minimum temperature, dissolved oxygen, and salinity.

1.1.4. **Recovery Action:** Improve freshwater inflow

1.1.4.1. **Action Step:** Install a stream gauge immediately upstream of the estuary/lagoon to monitor inflow conditions during the dry season.

1.1.4.2. **Action Step:** Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions relative to juvenile salmonid estuarine summer rearing (osmo-regulating and non-osmoregulating).

1.1.4.3. **Action Step:** Identify and implement minimum freshwater inflow thresholds to ensure optimal estuary health and function.

2. **Restoration- Floodplain Connectivity**

No species-specific actions were developed.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Increase large wood frequency (BFW 0-10 meters)

3.1.1.1. **Action Step:** Increase wood frequency in salmonid spawning and rearing areas to the extent that a minimum of 6 key LWD pieces exists every 100 meters in 0-10 meter BFW streams.

3.1.1.2. **Action Step:** Design and install LWD structures in McKenzie and Wild Hog creeks, and the SF sub-basin to the extent that optimal LWD frequency is achieved at strategic locations.

3.1.2. **Recovery Action:** Increase large wood frequency (BFW 10-100 meters)

3.1.2.1. **Action Step:** Increase wood frequency in seasonal habitat and migratory reaches to the extent that a minimum of 1.3 to 4 key LWD pieces exists every 100 meters in 10-100 meter BFW streams.

3.1.2.2. **Action Step:** Design and implement a SF Gualala mainstem migration project. Focus should include a higher frequency of significantly large wood structures to enhance staging pool development.

3.1.2.3. **Action Step:** Evaluate, design, and implement salmonid habitat improvement structures as appropriate to the stream channel type and hydrologic conditions within the Rockpile Sub-basin

3.1.2.4. **Action Step:** Evaluate, design, and implement salmonid habitat improvement structures as appropriate to the stream channel type and hydrologic conditions within the Buckeye Sub-basin.

3.1.3. **Recovery Action:** Improve pool shelter rating

3.1.3.1. **Action Step:** Evaluate, design, and implement strategies to improve shelter pools ratings within the Rockpile and Buckeye sub-basins and the following tributaries: Boyd, Buckeye, Camper, Carson, Danfield, Doty, Dry, Franchini, Fuller, Grasshopper, Groshong Gulch, House, Little NF GR, Log Cabin, Marshall, McGann, McKenzie, NF Fuller, Lower NF GR, Palmer Canyon, Pepperwood, Rockpile, SF Fuller, Sullivan, Tombs, Wheatfield Fork, and Wild Hog creeks.

3.1.4. **Recovery Action:** Increase primary pools frequency

3.1.4.1. **Action Step:** Evaluate, develop, and implement strategies to increase primary pool frequency in high priority reaches within the following tributaries: Boyd, Doty, Dry, Fuller, Little NF GR, Log Cabin, Marshall, McGann, McKenzie, Palmer, Robinson, Tombs, and West Fork Fuller.

3.1.4.2. **Action Step:** Identify historic CCC coho salmon habitats lacking in channel complexity and implement restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.

3.1.4.3. **Action Step:** Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).

3.1.4.4. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.4.5. **Action Step:** Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.5. **Recovery Action:** Improve pool/riffle/flatwater ratios (hydraulic diversity)

3.1.5.1. **Action Step:** Increase the frequencies to 75% of the streams within the watershed

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Continue to work with the North Gualala Water Company on water right Permit 14853. Ensure that the Site-specific Study Plan prepared for the NGWC by Stillwater Sciences (11 October 2011) is completed within the next 3-yrs. Implement recommendations within the next 5-years. Ensure salmonid life history requirements targeted in the proposal are evaluate under a range of water year types (dry - wet). Evaluate potential impacts to dry season estuary water quality conditions associated with Permit 14853.

4.1.1.2. **Action Step:** Map all water diversions and upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.

4.1.1.3. **Action Step:** Monitor, identify problems, and prioritize needed changes to permitted water diversions on current or potential coho salmon streams.

4.1.1.4. **Action Step:** Install and maintain a gauging station immediately upstream of the estuary to monitor freshwater inflow during the dry season.

4.1.1.5. **Action Step:** Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the dry season. Focus on core coho salmon areas initially.

4.1.1.6. **Action Step:** Install and maintain a stream gauge at an appropriate location near the base of Rockpile Creek.

4.1.1.7. **Action Step:** Install and maintain a stream gauge at an appropriate location near the base of Buckeye Creek.

4.1.1.8. **Action Step:** Install and maintain a stream gauge at an appropriate location immediately downstream of the SF Gualala and Wheatfield Fork confluence.

4.1.1.9. **Action Step:** Evaluate and implement off-channel storage facilities to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the NF Gualala and Wheatfield sub-watersheds.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Prevent increased landscape disturbance

5.1.1.1. **Action Step:** Consider developing and/or identifying Salmonid Preserves. Consider the Gualala River watershed as a Salmonid Preserve.

5.1.1.2. **Action Step:** Should large tracts of forestlands within the Gualala River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or Salmonid Preserve.

5.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.2.1. **Recovery Action:** Prevent increased landscape disturbance

5.2.1.1. **Action Step:** Discourage counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

5.2.1.2. **Action Step:** Discourage any forestland to agricultural and/or rural/urban development.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Modify or remove physical passage barriers

6.1.1.1. **Action Step:** Evaluate, design, and implement appropriate fish passage at South Beach Road Crossing on Fuller Creek (Wheatfield Fork sub-basin; See CALFISH: PAD_ID 736904; Passage ID 13268)

6.1.1.2. **Action Step:** Evaluate, design, and implement appropriate fish passage designs in Palmer Canyon and McKenzie creeks (Wheatfield Fork sub-basin; Klamt et al. 2003).

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.

8.1.1.2. **Action Step:** Prioritize large tree retention along the SF Gualala River.

8.1.1.3. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

8.1.2. **Recovery Action:** Improve canopy cover

8.1.2.1. **Action Step:** Increase the average stream canopy cover within potential spawning and rearing reaches to a minimum of 80%.

8.1.2.2. **Action Step:** Evaluate buffers width and/or timber harvest in terms of light penetration and potential changes to micro-climate conditions along the SF Gualala River.

8.1.2.3. **Action Step:** Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the NF Gualala sub-basin: upper reaches of Dry Creek, Robinson Creek, the central and higher reaches of the mainstem, and the lower reaches of Bear and Stewart Creeks (Klamt et al. 2003).

8.1.2.4. **Action Step:** Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the Rockpile sub-basin: mainstem Rockpile Creek, Red Rock Creek, and Horsetheif (Klamt et al. 2003).

8.1.2.5. **Action Step:** Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the Buckeye sub-basin: upper reaches of Buckeye Creek, Franchini, Grasshopper, and Soda Springs creeks (Klamt et al. 2003).

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Treat high priority slides and landings identified in credible landowner assessments.

9.1.1.2. **Action Step:** Continue efforts such as erosion proofing, improvements, and decommissioning, through the Rockpile sub-basin to reduce sediment delivery to central Rockpile Creeks and Rockpile tributaries.

10. Restoration- Viability

10.1. **Objective:** Address other natural or manmade factors affecting the species continued existence

10.1.1. **Recovery Action:** Increase spawner density

10.1.1.1. **Action Step:** Determine if there is a need for a conservation hatchery/supplementation/augmentation program. Assess the following prior to supplementation (Action Steps 2-7):

10.1.1.2. **Action Step:** Determine the biological or DPS significance of the Gualala coho salmon population.

10.1.1.3. **Action Step:** Investigate the population dynamics and viability status of coho salmon in the Gualala River watershed.

10.1.1.4. **Action Step:** Determine if the coho salmon population within the Gualala River watershed is at a short-term or immediate risk of extinction.

10.1.1.5. **Action Step:** Identify population viability goals and the expectations of a conservation hatchery/supplementation/augmentation program.

10.1.1.6. **Action Step:** Investigate the genetic diversity of coho salmon in the Gualala River.

10.1.1.7. **Action Step:** If determine necessary, identify a source population (in or out of basin stock) that could be used to start a population augmentation/supplementation/ broodstock program.

10.1.2. **Recovery Action:** Increase spatial structure and diversity

10.1.2.1. **Action Step:** Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Expand continuous temperature monitoring efforts into the upper sub-basins and tributaries that provide summer rearing for salmonids. Investigate canopy composition and monitoring air temperature to examine the relationship between canopy, temperature, and other micro-climate effects on water temperature (Klamt et al. 2003).

11.1.1.2. **Action Step:** Evaluate the current adequacy of buffer zones in recently logged areas and ensure stream temperatures have not increased due to these activities.

11.1.1.3. **Action Step:** Implement actions to maintain and restore water temperatures to meet habitat requirements for CCC coho salmon in specific streams (CDFG 2004).

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

12.1.1. **Recovery Action:** Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)

12.1.1.1. **Action Step:** Discourage forest-to-vineyard land conversions or other agricultural activities that may impact natural stream channel morphology.

12.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

12.1.2.1. **Action Step:** Address sources from agricultural activities that deliver sediment and runoff to stream channels.

12.1.2.2. **Action Step:** Work with vineyard owners to assess the effectiveness of erosion control measures throughout the winter period.

12.1.2.3. **Action Step:** Encourage and assist the NRCS and RCD to increase the number of landowners participating in sediment reduction planning and implementation.

12.1.2.4. **Action Step:** Establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.

12.1.3. **Recovery Action:** Prevent impairment to water quality (instream water temperature)

12.1.3.1. **Action Step:** Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land activities.

12.1.4. **Recovery Action:** Prevent impairment to watershed hydrology

12.1.4.1. **Action Step:** Promote off-channel storage facilities (e.g. winter diversion ponds) in efforts to reduce in-stream flow impacts associated with agricultural water use.

12.1.5. **Recovery Action:** Prevent increased landscape disturbance

12.1.5.1. **Action Step:** Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.

12.1.5.2. **Action Step:** Improve education and awareness to agencies, landowners, and the general public regarding salmonid recovery and habitat requirements.

12.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.2.1. **Recovery Action:** Prevent increased landscape disturbance

12.2.1.1. **Action Step:** Coordinate with regulatory agencies authorizing/permitting forestland-to-agriculture conversions to ensure consistency with salmonid recovery goals.

12.2.1.2. **Action Step:** Streamline permit processing where landowners are conducting actions aligned with recovery priorities.

12.2.1.3. **Action Step:** Technical support to counties by NMFS staff should be conducted to encourage county general plan updates that include measures to conserve and protect salmonids and their habitats.

12.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

12.2.2.1. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water users.

12.2.2.2. **Action Step:** Develop legislation to fund county planning for environmentally sound agricultural growth and water supply.

13. **Threat- Channel Modification**

No species-specific actions were developed.

14. **Threat- Disease/Predation/Competition**

No species-specific actions were developed.

15. **Threat- Fire/Fuel Management**

No species-specific actions were developed.

16. **Threat- Fishing/Collecting**

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Work with CDFG to modify Section 8.00(b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties. Discontinue using the Russian River at Guerneville gauging station for angling closures and use the Navarro River USGS gauging station (11468000) which better reflects hydrologic conditions in smaller unregulated coastal Sonoma/Mendocino streams.

17. **Threat- Hatcheries**

No species-specific actions were developed.

18. **Threat- Livestock**

18.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

18.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.1.1.1. **Action Step:** Reduce livestock and feral pig access to the riparian zone to encourage bank stabilization and re-vegetation of riparian areas within the following sub-basins: Gualala Main stem/ SF Garcia, Wheatfield Fork, Rockpile (Klamt et al. 2003).

19. **Threat- Logging**

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid impacts to off channel habitat, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

19.1.2.1. **Action Step:** Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.

19.1.2.2. **Action Step:** Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.

19.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

19.1.3.1. **Action Step:** Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.

19.1.3.2. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

19.1.3.3. **Action Step:** Establish equipment limitation zones on headwater streams and swales.

19.1.3.4. **Action Step:** Decommissioning legacy roads, upgrading road networks, and other rehabilitation work targeting reductions in fine sediment inputs to stream networks.

19.1.4. **Recovery Action:** Prevent impairment to water quality (instream water temperature)

19.1.4.1. **Action Step:** Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.

19.1.4.2. **Action Step:** Protect current riparian zones in all summer salmonid rearing areas to the extent that they are able to mature, provide, and maintain a minimum of 80% canopy cover.

19.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.5.1. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.5.2. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.6. **Recovery Action:** Prevent increased landscape disturbance

19.1.6.1. **Action Step:** Consider the development of a Watershed Database (similar to the CDFG Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.

19.1.6.2. **Action Step:** Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations

19.1.6.3. **Action Step:** Provide for properly functioning watershed processes (e.g., cycles of wood, water and sediment) by promoting long term sustainable forestry practices that support coho salmon habitats.

19.1.6.4. **Action Step:** Should large tracts of forestlands within the Gualala River watershed identified as a Core or Phase I in this recovery plan become available for purchase, the State of California or other entities should consider purchasing the area as a Demonstration Forest or State Park.

19.1.6.5. **Action Step:** Forestlands supporting Core, Phase I and Phase II priority areas should be considered for purchase (if feasible within the next 5 years).

19.1.6.6. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

19.1.6.7. **Action Step:** Maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture or other land uses.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Work with Sonoma county planning staff to minimize rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.2. **Action Step:** Coordinate with regulatory agencies to minimize conversions in key watersheds and discourage forestland conversions.

19.2.1.3. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.

19.2.1.4. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).

19.2.1.5. **Action Step:** Require tree retention on the axis of headwall swales Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.2.1.6. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

19.2.1.7. **Action Step:** Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through Section 10(a)(1)(B).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

23.1.1.1. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.1.2. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.3. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.1.4. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.1.1.5. **Action Step:** Encourage, when necessary and appropriate, restricted access to unpaved roads in winter to reduce road degradation and sediment release. Where restricted access is not feasible, encourage measures such as rocking to prevent sediment from reaching streams with coho salmon (CDFG 2004).

23.1.1.6. **Action Step:** Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following Gualala mainstem/ SF Gualala Subbasin tributaries: McKenzie Creek, Marchall Creek, Palmer Canyon Creek, Wild Hog Creek, South Fork, and Marshall Creek.

23.1.1.7. **Action Step:** Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following Wheatfield Fork sub-basin tributary reaches: Lower reaches of Haupt and Tabacco Creeks; Lower to middle reaches of Tombs, Wolf, and Elk creeks, and unnamed trib to the mainstem Wheatfield Fork upstream from Tombs Creek, to Elk Creek, and flanked by Bear and Gibson ridges; larger watercourses to the lower reaches of House Creek; middle to higher reaches of House, Pepperwood, Danfield, and Cedar creeks (Klamt et al. 2003).

23.1.1.8. **Action Step:** Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following North Fork sub-basin tributaries: Stewart, Dry, Upper Billings, upper Robinson, Doty, Log Cabin creeks, and McGann Gulch (Klamt et al. 2003).

23.1.1.9. **Action Step:** Use appropriately sized culverts in steep terrain to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure in the Buckeye sub-basin (GRWA 2003).

23.1.2. **Recovery Action:** Prevent impairment to passage and migration

23.1.2.1. **Action Step:** Prevent future barriers on newly constructed roads utilizing NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a)

23.1.2.2. **Action Step:** Ensure that all future road or bridge repairs at stream crossing provide unimpaired fish passage for all salmonid life stages.

23.1.3. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.1.3.1. **Action Step:** Design new roads that avoid riparian areas and are hydrologically disconnected from the stream network.

23.1.4. **Recovery Action:** Prevent increased landscape disturbance

23.1.4.1. **Action Step:** Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.4.2. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.

23.1.4.3. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.

23.1.4.4. **Action Step:** Develop a Salmon Certification Program for road maintenance staff.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology (stream flow)

24.1.1.1. **Action Step:** Use the emergency drought operations center (EDOC) or other similar group to oversee implementation of water conservation measures and alternatives.

24.1.1.2. **Action Step:** Work with CDFG, Counties, other agencies, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.

24.1.1.3. **Action Step:** Impose mandatory conservation measures to maintain instream flow needs of CCC coho salmon.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (stream flow)

25.1.1.1. **Action Step:** Ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer rearing reaches.

25.1.1.2. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.1.3. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and §1707 (CDFG 2004).

25.1.2. **Recovery Action:** Prevent impairment to passage and migration

25.1.2.1. **Action Step:** Establish flow related adult and smolt migration thresholds for prior to authorizing future water diversions.

25.1.3. **Recovery Action:** Prevent impairment to the estuary (quality and extent)

25.1.3.1. **Action Step:** Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months (ECORP and Kamman Hydrology & Engineering 2005).

25.1.3.2. **Action Step:** Develop and implement Estuary Inflow Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.

25.1.4. **Recovery Action:** Prevent impairment to water quality (instream temperature)

25.1.4.1. **Action Step:** Ensure future water diversions do not impair instream water temperatures during the dry season.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (stream flow)

25.2.1.1. **Action Step:** Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures.

25.2.1.2. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.3. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Gualala River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-1.1.1	Recovery Action	Estuary	Increase the physical extent of estuarine habitat										
GR-CCC-1.1.1.1	Action Step	Estuary	Investigate the extent of sedimentation within the estuary/lagoon associated with watershed legacy impacts (logging). Evaluate sediment transport within the estuary and determine if the estuary is "filling" with sediment or "flushing" sediment (recovering).	3	10	CDFG, NMFS HCD, NOAA RC, NRCS, RCD, RWQCB	117.00	117.00				234	Cost based on sediment assessment estimated at $12.22/acre. Assume 10% of total watershed acres.
GR-CCC-1.1.1.2	Action Step	Estuary	Identify past mechanical fill sites (inside of Mill Bend (?)) and develop strategies targeting the re-establishment of wetland marsh habitat (if feasible).	3	10	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD						TBD	Cost accounted for in other action steps. Feasibility of re-establishing wetland marsh habitat should be identified in estuary monitoring.
GR-CCC-1.1.1.3	Action Step	Estuary	Develop and implement rehabilitation projects designed to increase the physical extent of high quality habitat for rearing juvenile salmonids within the Gualala River estuary.	3	10	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners	680	680				1,360	Cost based on treating 5 acres (assume 5% of total estuarine habitat) at a rate of $272,120/acre.
GR-CCC-1.1.2	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
GR-CCC-1.1.2.1	Action Step	Estuary	Increase the percentage of area containing high value habitat complexity elements and features (SAV, LWD, boulders, marshes, vegetation, pools > 2 meters).	2								101,000	Cost based on stream complexity recovery action at $101,120/mile from estuary mouth to Highway 1 bridge.
GR-CCC-1.1.2.2	Action Step	Estuary	Identify strategic locations to install LWD structures designed to increased pool depth and habitat conditions within the Gualala River estuary.	2	10								Costs associated with installation of LWD would be encompassed by increasing the percentage of area high value habitat.
GR-CCC-1.1.3	Recovery Action	Estuary	Improve the quality of freshwater lagoon habitat										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1.3.1	Action Step	Estuary	Install continuous water quality monitoring stations in the Gualala estuary during the summer months. Monitor at a minimum temperature, dissolved oxygen, and salinity.	2	5	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, RCD, RWQCB	15.00					15	Cost based on continuous monitoring gauges estimated at $5,000/unit. Assume a minimum of 3 for lagoon. Cost does not account for maintenance or data management.
GR-CCC-1.1.4	Recovery Action	Estuary	Improve freshwater inflow										
GR-CCC-1.1.4.1	Action Step	Estuary	Install a stream gauge immediately upstream of the estuary/lagoon to monitor inflow conditions during the dry season.	2	5	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RWQCB	1.00					1	Cost based on stream gauges estimated at $1,000/gauge. Cost does not account for maintenance or data management.
GR-CCC-1.1.4.2	Action Step	Estuary	Investigate the hydrodynamics of freshwater inflow and estuary water quality conditions relative to juvenile salmonid estuarine summer rearing (osmo-regulating and non-osmoregulating).	2	10	CDFG, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Consultants, Private Landowners, RCD, RWQCB, SWRCB	136.61	136.61				273	Cost based estuary use estimated at $273,217/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-1.1.4.3	Action Step	Estuary	Identify and implement minimum freshwater inflow thresholds to ensure optimal estuary health and function.	2	5	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Consultants, RWQCB, SWRCB	63.01					63	Cost based on stream flow model estimated at $63,005/project.
GR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
GR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)										
GR-CCC-3.1.1.1	Action Step	Habitat Complexity	Increase wood frequency in salmonid spawning and rearing areas to the extent that a minimum of 6 key LWD pieces exists every 100 meters in 0-10 meter BFW streams.	2	10	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RCD	350.00	350.00				700	Cost based on treating 28 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.1.2	Action Step	Habitat Complexity	Design and install LWD structures in McKenzie and Wild Hog creeks, and the SF sub-basin to the extent that optimal LWD frequency is achieved at strategic locations.	2	20	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RWQCB							Cost accounted for in above.
GR-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 10-100 meters)										
GR-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase wood frequency in seasonal habitat and migratory reaches to the extent that a minimum of 1.3 to 4 key LWD pieces exists every 100 meters in 10-100 meter BFW streams.	2	10	CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, RCD, RWQCB	125.00	125.00				250	Cost based on treating 10 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.2.2	Action Step	Habitat Complexity	Design and implement a SF Gualala mainstem migration project. Focus should include a higher frequency of significantly large wood structures to enhance staging pool development.	2		CDFG, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, RCD							
GR-CCC-3.1.2.3	Action Step	Habitat Complexity	Evaluate, design, and implement salmonid habitat improvement structures as appropriate to the stream channel type and hydrologic conditions within the Rockpile Sub-basin	2		Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, Public, RCD, The Nature Conservancy							
GR-CCC-3.1.2.4	Action Step	Habitat Complexity	Evaluate, design, and implement salmonid habitat improvement structures as appropriate to the stream channel type and hydrologic conditions within the Buckeye Sub-basin.	2		CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, Public, RCD, RWQCB							
GR-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool shelter rating										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.3.1	Action Step	Habitat Complexity	Evaluate, design, and implement strategies to improve shelter pools ratings within the Rockpile and Buckeye sub-basins and the following tributaries: Boyd, Buckeye, Camper, Carson, Danfield, Doty, Dry, Franchini, Fuller, Grasshopper, Groshong Gulch, House, Little NF GR, Log Cabin, Marshall, McGann, McKenzie, NF Fuller, Lower NF GR, Palmer Canyon, Pepperwood, Rockpile, SF Fuller, Sullivan, Tombs, Wheatfield Fork, and Wild Hog creeks.	2	20	CDFG, Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, RCD, The Nature Conservancy	175.00	175.00	175.00	175.00		700	Cost based on treating 28 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile. This action step should be in concert with increasing LWD frequency and therefore cost could be lower.
GR-CCC-3.1.4	Recovery Action	Habitat Complexity	Increase primary pools frequency										
GR-CCC-3.1.4.1	Action Step	Habitat Complexity	Evaluate, develop, and implement strategies to increase primary pool frequency in high priority reaches within the following tributaries: Boyd, Doty, Dry, Fuller, Little NF GR, Log Cabin, Marshall, McGann, McKenzie, Palmer, Robinson, Tombs, and West Fork Fuller.	2	20	CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public, RCD							Cost accounted for in other action steps.
GR-CCC-3.1.4.2	Action Step	Habitat Complexity	Identify historic CCC coho salmon habitats lacking in channel complexity and implement restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.	2	20	CDFG, NOAA RC, Private Landowners						TBD	Continue current restoration projects in progress.
GR-CCC-3.1.4.3	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	2	20	CalFire, CDFG, NOAA RC, Private Landowners						In-Kind	Cost to coordinate projects is expected to be low.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-3.1.4.4	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	60	CDFG, NOAA RC, Private Landowners						In-Kind	Minimal cost expected.
GR-CCC-3.1.4.5	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	60	CDFG, NMFS, NRCS, Private Landowners						In-Kind	Cost to maintain LWD is expected to be minimal.
GR-CCC-3.1.5	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
GR-CCC-3.1.5.1	Action Step	Habitat Complexity	Increase the frequencies to 75% of the streams within the watershed	2	20							TBD	Cost should be accounted for in increase LWD frequency and primary pools.
GR-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
GR-CCC-4.1.1.1	Action Step	Hydrology	Continue to work with the North Gualala Water Company on water right Permit 14853. Ensure that the Site-specific Study Plan prepared for the NGWC by Stillwater Sciences (11 October 2011) is completed within the next 3-yrs. Implement recommendations within the next 5-years. Ensure salmonid life history requirements targeted in the proposal are evaluate under a range of water year types (dry - wet). Evaluate potential impacts to dry season estuary water quality conditions associated with Permit 14853.	2	20	CDFG, CDFG Law Enforcement, Gualala Watershed Council, NMFS HCD, NMFS OLE, NMFS PRD, North Gualala Water Company, SWRCB						In-Kind	
GR-CCC-4.1.1.2	Action Step	Hydrology	Map all water diversions and upgrade the existing water rights information system so that water allocations can be readily quantified by watershed.	2	60	CDFG, NMFS, North Gualala Water Company, Private Landowners, Sea Ranch, SWRCB						TBD	Costs may be minimal due to the low number of diverters in this basin.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-4.1.1.3	Action Step	Hydrology	Monitor, identify problems, and prioritize needed changes to permitted water diversions on current or potential coho salmon streams.	2	10	BLM, CDFG, NMFS, North Gualala Water Company, Private Landowners, Sea Ranch, SWRCB						TBD	Problems should be identified through mapping diversion and developing stream flow model.
GR-CCC-4.1.1.4	Action Step	Hydrology	Install and maintain a gauging station immediately upstream of the estuary to monitor freshwater inflow during the dry season.	2	10	CDFG, NMFS, USGS	0.50	0.50				1	Provide consistent funding for the North Fork Gualala River and possible funding for the Wheatfield Forks of the Gualala River. Cost of installing stream gage is $1000/unit. Cost does not account for maintenance or data management.
GR-CCC-4.1.1.5	Action Step	Hydrology	Develop critical flow values that are the basis for minimum bypass flow requirements to support juvenile rearing habitat conditions during the dry season. Focus on core coho salmon areas initially.	1	5	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, North Gualala Water Company, NRCS, Private Landowners, RCD, RWQCB, Sea Ranch, SWRCB							Cost accounted for in stream flow model.
GR-CCC-4.1.1.6	Action Step	Hydrology	Install and maintain a stream gauge at an appropriate location near the base of Rockpile Creek.	3	10	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RWQCB, SWRCB	0.50	0.50				1	Cost based on stream gauge estimated at $1,000/gauge. Cost does not account for maintenance or data management.
GR-CCC-4.1.1.7	Action Step	Hydrology	Install and maintain a stream gauge at an appropriate location near the base of Buckeye Creek.	3	indefinitely	CDFG, NMFS HCD, NMFS PRD, NRCS, Private Landowners, RCD, SWRCB							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-4.1.1.8	Action Step	Hydrology	Install and maintain a stream gauge at an appropriate location immediately downstream of the SF Gualala and Wheatfield Fork confluence.	3	10	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, NRCS, Private Landowners, RCD, Sea Ranch, SWRCB	0.50	0.50				1	Cost based on stream flow gauge estimated at $1,000/gauge. Cost does not account for maintenance or data management.
GR-CCC-4.1.1.9	Action Step	Hydrology	Evaluate and implement off-channel storage facilities to reduce impacts of water diversion (storage tanks for rural residential users). Focus efforts in the NF Gualala and Wheatfield sub-watersheds.	2	20	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, North Gualala Water Company, NRCS, SWRCB						TBD	Cost difficult to estimated because of participation of landowners and feasibility of off-channel storage facilities.
GR-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-5.1.1	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										
GR-CCC-5.1.1.1	Action Step	Landscape Patterns	Consider developing and/or identifying Salmonid Preserves. Consider the Gualala River watershed as a Salmonid Preserve.	2	100	CDFG, NMFS, NMFS HCD, NMFS PRD, NOAA RC							
GR-CCC-5.1.1.2	Action Step	Landscape Patterns	Should large tracts of forestlands within the Gualala River watershed become available for purchase, the State of California and/or the Federal Government should consider purchasing the area as a Demonstration Forest, State Park, or Salmonid Preserve.	2	50	CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD, NOAA RC						TBD	Cost difficult to estimate because of fair market value and land use turnover.
GR-CCC-5.2	**Objective**	**Landscape Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-5.2.1	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-5.2.1.1	Action Step	Landscape Patterns	Discourage counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, North Gualala Water Company, NRCS, RCD, Sea Ranch, Sonoma County, SWRCB						In-Kind	
GR-CCC-5.2.1.2	Action Step	Landscape Patterns	Discourage any forestland to agricultural and/or rural/urban development.	1	100	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, Gualala Watershed Council, NMFS, NMFS HCD, NMFS PRD, North Gualala Water Company, NRCS, Private Landowners, Public, RCD, Sea Ranch, Sonoma County, SWRCB						In-Kind	
GR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-6.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-6.1.1.1	Action Step	Passage	Evaluate, design, and implement appropriate fish passage at South Beach Road Crossing on Fuller Creek (Wheatfield Fork sub-basin; See CALFISH: PAD_ID 736904; Passage ID 13268)	2	10	CDFG, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD	31.50	31.50				63	Cost based on stream crossing at $63,000/unit.
GR-CCC-6.1.1.2	Action Step	Passage	Evaluate, design, and implement appropriate fish passage designs in Palmer Canyon and McKenzie creeks (Wheatfield Fork sub-basin; Klamt et al. 2003).	2	10	CDFG, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD	950	950				1,900	Cost based on implementing two fish passage facilities at a rate of $961,000/unit.
GR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter										
GR-CCC-8.1.1.1	Action Step	Riparian	Increase tree diameter to a minimum of 80% CWHR density rating "D" across all current and potential spawning and juvenile rearing areas.	2	20	Board of Forestry, CalFire, CDFG, Conservation Fund, Gualala Redwood Company, NMFS HCD, NMFS PRD, The Nature Conservancy	1,205	1,205	1,205	1,205		4,820	Cost based on treating 3 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-8.1.1.2	Action Step	Riparian	Prioritize large tree retention along the SF Gualala River.	2	50	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD						In-Kind	
GR-CCC-8.1.1.3	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD, NRCS, RCD	550	550				1,100	Cost based on treating 9 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,422/acre.
GR-CCC-8.1.2	Recovery Action	Riparian	Improve canopy cover										
GR-CCC-8.1.2.1	Action Step	Riparian	Increase the average stream canopy cover within potential spawning and rearing reaches to a minimum of 80%.	2	20	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, The Nature Conservancy	1,205	1,205	1,205	1,205		4,820	Cost based on treating 3 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre. This action step should be in concert with increasing tree diameter to a minimum of 80% CWHR.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-8.1.2.2	Action Step	Riparian	Evaluate buffers width and/or timber harvest in terms of light penetration and potential changes to micro-climate conditions along the SF Gualala River.	2	50	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD						In-Kind	
GR-CCC-8.1.2.3	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the NF Gualala sub-basin: upper reaches of Dry Creek, Robinson Creek, the central and higher reaches of the mainstem, and the lower reaches of Bear and Stewart Creeks (Klamt et al. 2003).	2	20	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD						TBD	Cost likely accounted for in above action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-8.1.2.4	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the Rockpile sub-basin: mainstem Rockpile Creek, Red Rock Creek, and Horsetheif (Klamt et al. 2003).	2	20	Board of Forestry, CalFire, CDFG, Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, The Nature Conservancy						TBD	Cost likely accounted for in above action steps.
GR-CCC-8.1.2.5	Action Step	Riparian	Identify and implement riparian enhancement projects where current canopy density and diversity are inadequate and site conditions are appropriate to: initiate tree planting, thinning, and other vegetation management to encourage the development of a denser more extensive riparian canopy in the following reaches and tributaries of the Buckeye sub-basin: upper reaches of Buckeye Creek, Franchini, Grasshopper, and Soda Springs creeks (Klamt et al. 2003).	2	20	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD						TBD	Cost likely accounted for in above action steps.
GR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-9.1.1.1	Action Step	Sediment	Treat high priority slides and landings identified in credible landowner assessments.	1	20	CDFG, NOAA RC, Private Landowners						TBD	Site specific information needed for a accurate cost estimate.
GR-CCC-9.1.1.2	Action Step	Sediment	Continue efforts such as erosion proofing, improvements, and decommissioning, through the Rockpile sub-basin to reduce sediment delivery to central Rockpile Creeks and Rockpile tributaries.	2	10	Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD	30.00	30.00				60	Cost based on decommissioning 5 miles of road network at a rate of $12,000/mile.
GR-CCC-10.1	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species continued existence**										
GR-CCC-10.1.1	Recovery Action	Viability	Increase spawner density										
GR-CCC-10.1.1.1	Action Step	Viability	Determine if there is a need for a conservation hatchery/supplementation/augmentation program. Assess the following prior to supplementation (Action Steps 2-7):	1	12	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						In-Kind	This recommendation will determine cost for action steps below
GR-CCC-10.1.1.2	Action Step	Viability	Determine the biological or DPS significance of the Gualala coho salmon population.	1	20	CDFG, NMFS, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						In-Kind	
GR-CCC-10.1.1.3	Action Step	Viability	Investigate the population dynamics and viability status of coho salmon in the Gualala River watershed.	1	10	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC	65.00	65.00				130	Cost based on abundance and distribution monitoring estimated at $129,391/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-10.1.1.4	Action Step	Viability	Determine if the coho salmon population within the Gualala River watershed is at a short-term or immediate risk of extinction.	1	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						In-Kind	
GR-CCC-10.1.1.5	Action Step	Viability	Identify population viability goals and the expectations of a conservation hatchery/supplementation/augmentation program.	1	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						In-Kind	
GR-CCC-10.1.1.6	Action Step	Viability	Investigate the genetic diversity of coho salmon in the Gualala River.	1	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						In-Kind	
GR-CCC-10.1.1.7	Action Step	Viability	If determine necessary, identify a source population (in or out of basin stock) that could be used to start a population augmentation/supplementation/ broodstock program.	1	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NOAA SWFSC						In-Kind	
GR-CCC-10.1.2	Recovery Action	Viability	Increase spatial structure and diversity										
GR-CCC-10.1.2.1	Action Step	Viability	Continue and expand upon biological monitoring activities to determine salmonid population and productivity trends at the watershed and sub-watershed scales. Information regarding spawner escapement and smolt production are the highest priorities.	2	10	CDFG, NMFS, Private Landowners, RCD	115.00	115.00				230	Cost based on annual spawner ground estimated at $64,040/year and smolt outmigration surveys $50,030/year for Central Coastal diversity stratum.
GR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-11.1.1.1	Action Step	Water Quality	Expand continuous temperature monitoring efforts into the upper sub-basins and tributaries that provide summer rearing for salmonids. Investigate canopy composition and monitoring air temperature to examine the relationship between canopy, temperature, and other micro-climate effects on water temperature (Klamt et al. 2003).	2		CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC							
GR-CCC-11.1.1.2	Action Step	Water Quality	Evaluate the current adequacy of buffer zones in recently logged areas and ensure stream temperatures have not increased due to these activities.	2		Board of Forestry, CalFire, CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, Private Landowners, RCD							
GR-CCC-11.1.1.3	Action Step	Water Quality	Implement actions to maintain and restore water temperatures to meet habitat requirements for CCC coho salmon in specific streams (CDFG 2004).	2		CDFG, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NRCS, Private Landowners							
GR-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-12.1.1.1	Action Step	Agricultural Practices	Discourage forest-to-vineyard land conversions or other agricultural activities that may impact natural stream channel morphology.	1	30	Board of Forestry, CalFire, CDFG, NMFS, Sonoma County						In-Kind	This action is considered part of doing business with regulatory agencies and stakeholders.
GR-CCC-12.1.2	Recovery Action	Agricultural Practices	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										
GR-CCC-12.1.2.1	Action Step	Agricultural Practices	Address sources from agricultural activities that deliver sediment and runoff to stream channels.	3		CA Coastal Commission, CDFG, DWR, NOAA RC, NRCS, Private Landowners, RCD							
GR-CCC-12.1.2.2	Action Step	Agricultural Practices	Work with vineyard owners to assess the effectiveness of erosion control measures throughout the winter period.	3	5	CalFire, CDFG, NMFS, RWQCB, Sonoma County	50.00					50	Cost estimate for field work by agency or other staff.
GR-CCC-12.1.2.3	Action Step	Agricultural Practices	Encourage and assist the NRCS and RCD to increase the number of landowners participating in sediment reduction planning and implementation.	3		CDFG, NMFS, NOAA RC, Private Landowners							
GR-CCC-12.1.2.4	Action Step	Agricultural Practices	Establish appropriately sized and properly functioning riparian buffers adjacent to watercourses that have a potential to deliver sediment to spawning and rearing habitat.	3		NRCS, Private Landowners, RCD							
GR-CCC-12.1.3	Recovery Action	Agricultural Practices	Prevent impairment to water quality (instream water temperature)										
GR-CCC-12.1.3.1	Action Step	Agricultural Practices	Maintain functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land activities.	2	20	FishNet 4C, NOAA RC, Private Landowners, Sonoma County						TBD	Additional information needed on the size and scope of projects in order to estimate cost.
GR-CCC-12.1.4	Recovery Action	Agricultural Practices	Prevent impairment to watershed hydrology										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-12.1.4.1	Action Step	Agricultural Practices	Promote off-channel storage facilities (e.g. winter diversion ponds) in efforts to reduce in-stream flow impacts associated with agricultural water use.	2	10	CalFire, CDFG, NMFS, NMFS OLE, Private Landowners, Sonoma County, SWRCB						TBD	Low cost to promote. Implementation likely 1-2 million based on recent Russian River costs to develop off-channel storage.
GR-CCC-12.1.5	Recovery Action	Agricultural Practices	Prevent increased landscape disturbance										
GR-CCC-12.1.5.1	Action Step	Agricultural Practices	Work within the agricultural community to educate landowners and enhance practices that provide for functional watershed processes.	3	20	Farm Bureau, FishNet 4C, Private Landowners, Sonoma County						0	Relatively low cost is expected to work with agricultural community.
GR-CCC-12.1.5.2	Action Step	Agricultural Practices	Improve education and awareness to agencies, landowners, and the general public regarding salmonid recovery and habitat requirements.	3		NMFS, NOAA RC, NRCS, Private Landowners, Public, RCD							
GR-CCC-12.2	**Objective**	**Agricultural Practices**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-12.2.1	Recovery Action	Agricultural Practices	Prevent increased landscape disturbance										
GR-CCC-12.2.1.1	Action Step	Agricultural Practices	Coordinate with regulatory agencies authorizing/permitting forestland-to-agriculture conversions to ensure consistency with salmonid recovery goals.	1		CalFire, CDFG, NMFS HCD, NMFS PRD, Sonoma County							
GR-CCC-12.2.1.2	Action Step	Agricultural Practices	Streamline permit processing where landowners are conducting actions aligned with recovery priorities.	2		CDFG, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RCD							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-12.2.1.3	Action Step	Agricultural Practices	Technical support to counties by NMFS staff should be conducted to encourage county general plan updates that include measures to conserve and protect salmonids and their habitats.	3		NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, Public Works, RCD, Sonoma County							
GR-CCC-12.2.2	Recovery Action	Agricultural Practices	Prevent impairment to watershed hydrology										
GR-CCC-12.2.2.1	Action Step	Agricultural Practices	Identify and eliminate depletion of summer base flows from unauthorized water users.	2	20	CDFG, NMFS HCD, NMFS OLE, NMFS PRD, NOAA RC, North Gualala Water Company, SWRCB						TBD	Development of stream flow model will identify summer base flow levels.
GR-CCC-12.2.2.2	Action Step	Agricultural Practices	Develop legislation to fund county planning for environmentally sound agricultural growth and water supply.	2	30	CDFG, NMFS HCD, NMFS PRD, Sonoma County, SWRCB						In-Kind	
GR-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
GR-CCC-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00(b)(1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties. Discontinue using the Russian River at Guerneville gauging station for angling closures and use the Navarro River USGS gauging station (11468000) which better reflects hydrologic conditions in smaller unregulated coastal Sonoma/Mendocino streams.	2	100	CDFG, NMFS						In-Kind	
GR-CCC-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-18.1.1	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
GR-CCC-18.1.1.1	Action Step	Livestock	Reduce livestock and feral pig access to the riparian zone to encourage bank stabilization and re-vegetation of riparian areas within the following sub-basins: Gualala Main stem/ SF Garcia, Wheatfield Fork, Rockpile (Klamt et al. 2003).	3		CDFG, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD							
GR-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (quality & extent)										
GR-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid impacts to off channel habitat, floodplains, ponds, and oxbows.	2	50	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD, NRCS, RCD						In-Kind	
GR-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										
GR-CCC-19.1.2.1	Action Step	Logging	Encourage coordination of LWD placement projects in streams (as necessary) as part of logging operations.	3	30	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, RCD						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.1.2.2	Action Step	Logging	Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	2	100	Board of Forestry, CalFire, Gualala Redwood Company, NMFS HCD, NMFS PRD, NRCS, RCD						In-Kind	
GR-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										
GR-CCC-19.1.3.1	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	60	CalFire, Private Landowners						TBD	See Roads section.
GR-CCC-19.1.3.2	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	3	20	CalFire, California Geological Survey, Private Consultants, Private Landowners, RWQCB						TBD	Cost expected to be low because much of this mapping has been completed.
GR-CCC-19.1.3.3	Action Step	Logging	Establish equipment limitation zones on headwater streams and swales.	3	50	Board of Forestry, CalFire, CDFG, NMFS HCD, NMFS PRD, NRCS, RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.1.3.4	Action Step	Logging	Decommissioning legacy roads, upgrading road networks, and other rehabilitation work targeting reductions in fine sediment inputs to stream networks.	2	20	Board of Forestry, CalFire, CDFG, Conservation Fund, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, Private Landowners, RCD	137.50	137.50	137.50	137.50		550	Cost to decommission 40 miles (assume 10% of road network) at a rate of $12,000/mile.
GR-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to water quality (instream water temperature)										
GR-CCC-19.1.4.1	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	30	Board of Forestry, CalFire, Friends of the Gualala River Watershed, Gualala Redwood Company, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD						In-Kind	
GR-CCC-19.1.4.2	Action Step	Logging	Protect current riparian zones in all summer salmonid rearing areas to the extent that they are able to mature, provide, and maintain a minimum of 80% canopy cover.	2	100	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD, Private Landowners, RCD						In-Kind	
GR-CCC-19.1.5	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.1.5.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	Board of Forestry, CalFire, CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD						In-Kind	
GR-CCC-19.1.5.2	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	60	Board of Forestry, CalFire, CDFG, NMFS						TBD	Cost of reducing timber available in riparian areas needs to be calculated for estimating cost of this action.
GR-CCC-19.1.6	Recovery Action	Logging	Prevent increased landscape disturbance										
GR-CCC-19.1.6.1	Action Step	Logging	Consider the development of a Watershed Database (similar to the CDFG Northern Spotted Owl database) for salmonids that provides watershed data and information in a consistent fashion to all foresters for consideration in their harvest plans.	3	20	Board of Forestry, CDFG, NMFS HCD, NMFS PRD						TBD	
GR-CCC-19.1.6.2	Action Step	Logging	Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations	2	30	CDFG, NMFS, NMFS HCD, NMFS PRD, NOAA RC						TBD	Cost are difficult to estimate because of fair market value and rate of turnover.
GR-CCC-19.1.6.3	Action Step	Logging	Provide for properly functioning watershed processes (e.g., cycles of wood, water and sediment) by promoting long term sustainable forestry practices that support coho salmon habitats.	2	100	Board of Forestry, CalFire, CDFG, NMFS HCD, NMFS PRD, RWQCB						In-Kind	
GR-CCC-19.1.6.4	Action Step	Logging	Should large tracts of forestlands within the Gualala River watershed identified as a Core or Phase I in this recovery plan become available for purchase, the State of California or other entities should consider purchasing the area as a Demonstration Forest or State Park.	2	20	BLM, CalFire, California Coastal Conservancy, CDFG, Conservation Fund, NMFS, Private Landowners, Sonoma County, State Parks, The Nature Conservancy						TBD	Not able to estimate cost at this time.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.1.6.5	Action Step	Logging	Forestlands supporting Core, Phase I and Phase II priority areas should be considered for purchase (if feasible within the next 5 years).	2	50	CDFG, NMFS HCD, NMFS PRD, NOAA RC							
GR-CCC-19.1.6.6	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	3	60	CalFire, CDFG, NMFS, Private Landowners, Sonoma County						TBD	Costs may be low if conducted with existing federal, state and county staff.
GR-CCC-19.1.6.7	Action Step	Logging	Maintain and expand California's working forestlands and forestlands held by the State, and prevent future conversion of forestlands to agriculture or other land uses.	2	50	Board of Forestry, CalFire, CDFG, NMFS						In-Kind	
GR-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
GR-CCC-19.2.1.1	Action Step	Logging	Work with Sonoma county planning staff to minimize rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	60	CalFire, NMFS HCD, Sonoma County						0	Cost low if conducted with current regulatory and County staff.
GR-CCC-19.2.1.2	Action Step	Logging	Coordinate with regulatory agencies to minimize conversions in key watersheds and discourage forestland conversions.	1		Board of Forestry, CalFire, CDFG, NMFS HCD, NMFS PRD							
GR-CCC-19.2.1.3	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.	2		Board of Forestry, CalFire, CDFG, NMFS HCD, NMFS PRD, RWQCB							
GR-CCC-19.2.1.4	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	1	10	CalFire, NMFS							The recovery action is considered in-kind and part of conducting business.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-19.2.1.5	Action Step	Logging	Require tree retention on the axis of headwall swales Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	60	CalFire, California Geological Survey, CDFG, NMFS PRD, Private Consultants, Private Landowners, RWQCB						TBD	Cost can not be determined without information on the number of acres and cost of merchantable timber retention.
GR-CCC-19.2.1.6	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	2	10	CalFire, CDFG, NMFS PRD, Private Landowners, RWQCB							
GR-CCC-19.2.1.7	Action Step	Logging	Investigate opportunities to programmatically permit the forest certification program to authorize incidental take for landowners through Section 10(a)(1)(B).	3		Board of Forestry, CalFire, CDFG, NMFS PRD							
GR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
GR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										
GR-CCC-23.1.1.1	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	1	10	CDFG, NOAA RC, Private Landowners, RCD, Sonoma County	300.00	300.00				600	Based on remaining number of miles of roads that have not been upgraded (500 miles) in Core and Phase I recovery areas. Cost to decommission roads based on $12,000/mile for 500 miles. If roads were upgraded, costs would be $21,000/mile for an estimated total of $1,050,000.
GR-CCC-23.1.1.2	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	60	Private Landowners, RCD, Sonoma County						TBD	Cost of maintaining upgraded roads will depend on severity of previous winter.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-23.1.1.3	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	5	NRCS, Private Consultants, Private Landowners, RCD						TBD	Cost expected to be low because most areas have been surveyed.
GR-CCC-23.1.1.4	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	5	CDFG, Private Consultants, Private Landowners, RWQCB						TBD	Five years may be sufficient to determine problem segments that would be strormproofed.
GR-CCC-23.1.1.5	Action Step	Roads/Railroads	Encourage, when necessary and appropriate, restricted access to unpaved roads in winter to reduce road degradation and sediment release. Where restricted access is not feasible, encourage measures such as rocking to prevent sediment from reaching streams with coho salmon (CDFG 2004).	2	20	Private Landowners						TBD	Twenty years is suggested to institutionalize these practices.
GR-CCC-23.1.1.6	Action Step	Roads/Railroads	Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following Gualala mainstem/ SF Gualala Subbasin tributaries: McKenzie Creek, Marchall Creek, Palmer Canyon Creek, Wild Hog Creek, South Fork, and Marshall Creek.	2	20	CDFG, Gualala Redwood Company, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB						TBD	Cost likely accounted for in other action steps.
GR-CCC-23.1.1.7	Action Step	Roads/Railroads	Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following Wheatfield Fork sub-basin tributary reaches: Lower reaches of Haupt and Tabacco Creeks; Lower to middle reaches of Tombs, Wolf, and Elk creeks, and unnamed trib to the mainstem Wheatfield Fork upstream from Tombs Creek, to Elk Creek, and flanked by Bear and Gibson ridges; larger watercourses to the lower reaches of House Creek; middle to higher reaches of House, Pepperwood, Danfield, and Cedar creeks (Klamt et al. 2003).	2	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB						TBD	Cost likely accounted for in other action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-23.1.1.8	Action Step	Roads/Railroads	Evaluate, develop, and implement strategies to address decommissioning old roads, maintaining existing roads, and constructing new roads in the following North Fork sub-basin tributaries: Stewart, Dry, Upper Billings, upper Robinson, Doty, Log Cabin creeks, and McGann Gulch (Klamt et al. 2003).	2	20	CDFG, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB						TBD	Cost likely accounted for in other action steps.
GR-CCC-23.1.1.9	Action Step	Roads/Railroads	Use appropriately sized culverts in steep terrain to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure in the Buckeye sub-basin (GRWA 2003).	2	50	CDFG, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB						In-Kind	This recommendation should be considered standard practice.
GR-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
GR-CCC-23.1.2.1	Action Step	Roads/Railroads	Prevent future barriers on newly constructed roads utilizing NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a)	2	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, Private Landowners, RCD, RWQCB						In-Kind	
GR-CCC-23.1.2.2	Action Step	Roads/Railroads	Ensure that all future road or bridge repairs at stream crossing provide unimpaired fish passage for all salmonid life stages.	2	20	CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB						In-Kind	
GR-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
GR-CCC-23.1.3.1	Action Step	Roads/Railroads	Design new roads that avoid riparian areas and are hydrologically disconnected from the stream network.	2	60	Private Consultants, Private Landowners, Sonoma County						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent increased landscape disturbance										
GR-CCC-23.1.4.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	1	10	FishNet 4C, Private Landowners, RCD	1,100	1,100				2,200	Cost based on decommissioning 176 miles of road at a cost of $12,000/mile. Recovery action related to prevent impairment to instream substrate by decommissioning riparian roads.
GR-CCC-23.1.4.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	3	5	Board of Forestry, CDFG, NMFS HCD, NMFS PRD, NRCS, RCD, RWQCB							
GR-CCC-23.1.4.3	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	3	30	Board of Forestry, CDFG, NMFS HCD, NMFS PRD, NOAA RC, NRCS, RCD, RWQCB						In-Kind	
GR-CCC-23.1.4.4	Action Step	Roads/Railroads	Develop a Salmon Certification Program for road maintenance staff.	2	10							In-Kind	
GR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
GR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (stream flow)										
GR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Use the emergency drought operations center (EDOC) or other similar group to oversee implementation of water conservation measures and alternatives.	2	60	CDFG, CDFG Law Enforcement, NMFS OLE, North Gualala Water Company, Private Landowners, Public, Sea Ranch, Sonoma County						TBD	Need additional analysis to estimate cost which will vary with drought frequency.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Work with CDFG, Counties, other agencies, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.	2	10	CDFG, NMFS HCD, North Gualala Water Company, Sea Ranch, Sonoma County Water Agency, SWRCB						0	Cost expected to be low if conducted by existing agency staff.
GR-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Impose mandatory conservation measures to maintain instream flow needs of CCC coho salmon.	3	10	CDFG, NMFS						0	Prioritizing existing funding mechanisms is not expected to add additional cost to the process.
GR-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
GR-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (stream flow)										
GR-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure that current and future water diversions (surface or groundwater) do not impair water quality conditions in summer rearing reaches.	1		CDFG, CDFG Law Enforcement, Friends of the Gualala River Watershed, Gualala Watershed Council, NMFS HCD, NMFS OLE, NMFS PRD, NOAA RC, SWRCB							
GR-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1		CDFG, CDFG Law Enforcement, NMFS HCD, NMFS PRD, SWRCB							
GR-CCC-25.1.1.3	Action Step	Water Diversion/Impoundment	Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and §1707 (CDFG 2004).	2		CDFG, NMFS HCD, NMFS PRD, SWRCB							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
GR-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Establish flow related adult and smolt migration thresholds for prior to authorizing future water diversions.	1	5	CDFG, NMFS HCD, NMFS PRD, North Gualala Water Company, SWRCB							
GR-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (quality and extent)										
GR-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Discourage the development of any surface water diversions in the watershed that independently or cumulatively have significant impact on reducing inflow to the estuary during spring/summer/fall months (ECORP and Kamman Hydrology & Engineering 2005).	1	5	CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, North Gualala Water Company, SWRCB							
GR-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Develop and implement Estuary Inflow Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.	1		CDFG, NMFS HCD, NMFS PRD, SWRCB							
GR-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (instream temperature)										
GR-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure future water diversions do not impair instream water temperatures during the dry season.	1		CDFG, Gualala Watershed Council, NMFS HCD, NMFS PRD, North Gualala Water Company, NRCS, RCD, Sea Ranch, SWRCB							
GR-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
GR-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (stream flow)										
GR-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Ensure all water diversions and impoundments are complaint with AB2121 or other appropriate protective measures.	1		CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB							
GR-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1		CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB							
GR-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	2		CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, NMFS PRD, SWRCB							

Lagunitas Creek

Location	•Marin County
Watershed Area	•109.0 Square Miles
Potential Habitat	•64.5 Stream Miles
Vegetation	•22% Conifer, 28% Riparian or Montane Forest, 35% Grassland
Erodability	•Moderate
Ownership Patterns	•52% Private, 48% Public
Dominant Land Uses	•Water Supply, Agriculture, Rural Residential
Housing Density	•Moderate
TMDL Pollutants	•Sediment, Nutrients, Pathogens

Giacomini Wetlands Project
Photo provided by Robert Campbell

Lagunitas Creek Coho Salmon: Persistent – Moderate Abundance

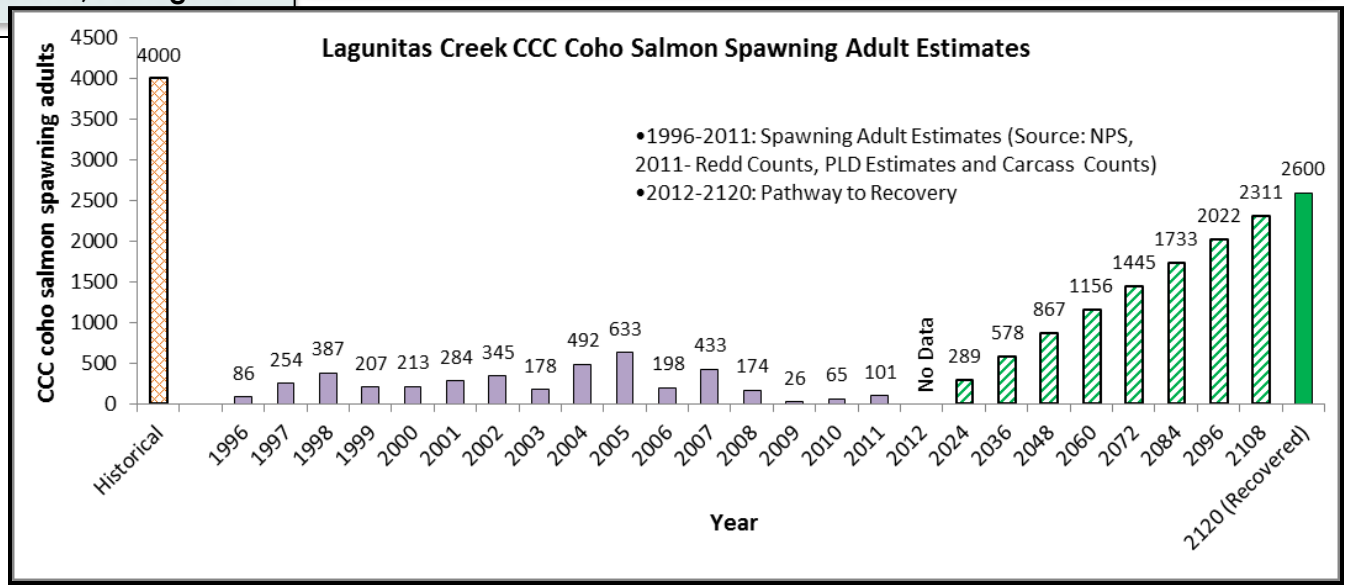
Recovery Goals
- ✓ Establish life cycle monitoring, including operation of outmigrant traps
- ✓ Expand fish and habitat monitoring programs, including the estuary

Lagunitas Creek Adult Spawner Targets

Downlisting to Threatened
1,300

Recovery
2,600

STEELHEAD: YES
CHINOOK SALMON: NO



Lagunitas Creek

Potential Habitat: 64.5 miles
Recovery Target: 2,600 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	GOOD	POOR	FAIR	FAIR	POOR	GOOD	FAIR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Conduct a salmonid limiting factors assessment in Keys Estero and Tomales Bay
- Continue riparian protection and enhancement and sediment control projects
- Restore channel complexity and increase pool frequency; retain, recruit and actively input large wood into stream
- Develop cooperative projects with private landowners to conserve summer flows
- Develop floodplain enhancement in modified and incised channels
- Restore fish passage throughout the watershed for all life stages

Priority 2 & 3: Long-Term Restoration Actions

- Evaluate alterations to diking and leveeing to increase shoreline complexity and natural function
- Evaluate undeveloped and developed floodplain property for potential function and acquisition potential
- Evaluate potential of modification to the Olema Ranch Campground to improve floodplain function
- Implement Marin County Flood Zone activities for the improvement of coho salmon habitat
- Fully implement practices consistent with the SFRWQCB pathogen and sediment TMDLs.

Recovery Partners

Photo courtesy from left to right: Campbell Timberland, Gualala River Watershed Council, Campbell Timberland, KRIS Information System and Eli Asarian

Lagunitas Creek

Potential Habitat: 64.5 miles
Recovery Target: 2,600 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	HIGH	MEDIUM	MEDIUM	LOW	LOW	HIGH	MEDIUM	MEDIUM	MEDIUM	VERY HIGH	HIGH	HIGH	HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Provide funding assistance to landowners willing to fence livestock out of riparian and other sensitive areas
- Implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate sediment sources
- Avoid reductions of flow <8 cfs below major dams in the summer
- Provide consistent fishery flows below Peter's Dam by improving gauging at SP Taylor Park
- Discourage the transfer of water from Nicasio Reservoir to Kent Lake which could degrade water quality releases into Lagunitas Creek
- Discourage the proposed water diversion through Groundwater Well by North Marin Water District

Priority 2 & 3: Long-Term Threat Abatement Actions

- Promote bio-engineering solutions as appropriate
- Implement rotational grazing strategies
- Conserve and manage forestlands for older forest stages
- Address failing or inadequate septic systems in rural areas
- Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input
- Develop riffles and/or spawning channels below Kent Dam to increase spawner distribution and success

Streambank restoration on Walker Creek
Photo by Bob Coey, NMFS

Conservation Highlights

- Extensive monitoring activities are conducted in Lagunitas by Marin Municipal Water District, SPAWN, and the National Park Service. Lagunitas has one of the most robust data sets for CCC coho salmon.
- The County of Marin and the NPS have remediated several passage barriers in the Lagunitas Creek watershed.
- SPAWN is also involved in sediment remediation activities.

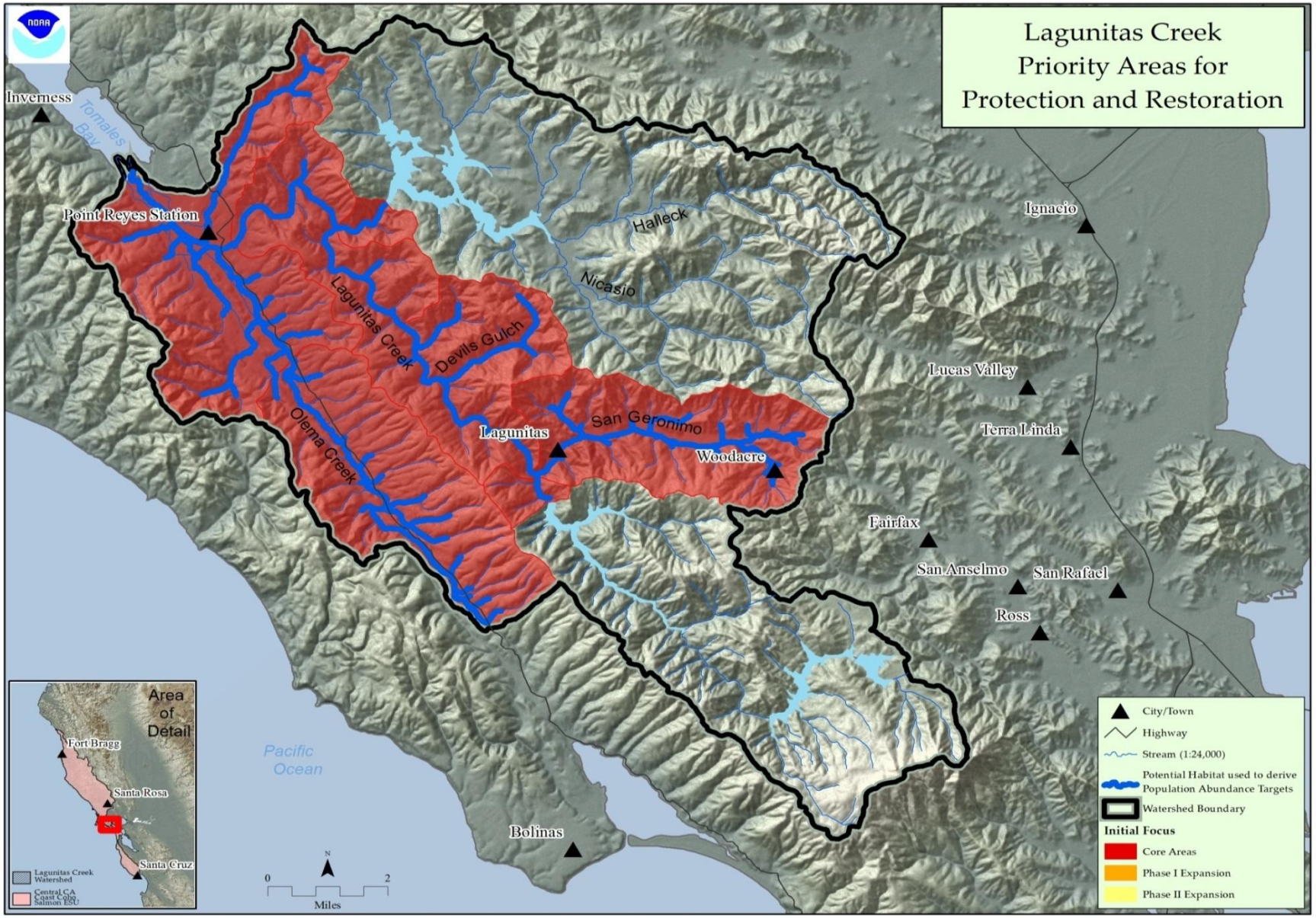


Figure 1: Map of Lagunitas Creek

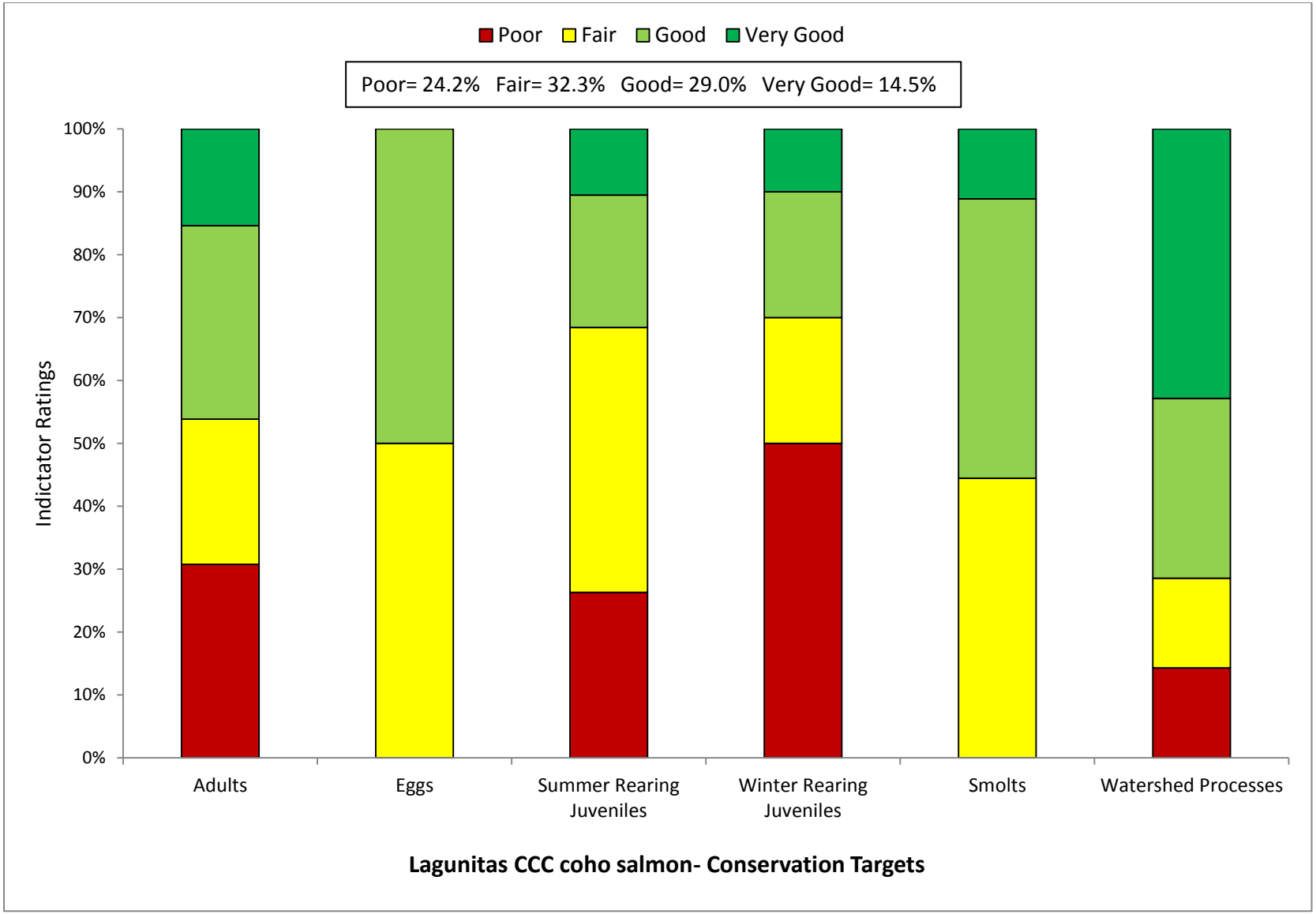


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Lagunitas Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**2.99 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<50% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =33**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**91.88 of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**na**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75 to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**>1 spawner per IP-km to < low risk spawner density per Spence (2008)**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**12-14% (0.85mm) and <30% (6.4mm)**	Good	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**50% streams 46% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**2.99 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**50% streams 73% IP**	Fair	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<50% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams 0% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =67**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.7 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**91.88 of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**50% to 74% of streams/ IP-km (>85% average stream canopy)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**na**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% streams 46% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP-km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**>90% of streams/ IP-km maintains severity score of 3 or lower**	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**2.99 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<50% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams 0% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**91.88 of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**na**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% streams 46% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**75 to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.7 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =33**	Very Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**75 to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces moderate risk spawner density per Spence (2008)**	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.432% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.33% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**<15% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**9% of watershed >1 unit/20 acres**	Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**25-50% Historical Species Composition**	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**2.2 Miles/Square Mile**	Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**2.9 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Lagunitas Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Medium	Medium	Medium	Low	High	Medium
2	Channel Modification	High	Medium	Medium	High	Medium	High	High
3	Disease, Predation and Competition	Low	-	Medium	Medium	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Medium	Low	Medium	Medium
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	Low	-	-	-	-	-	Low
7	Livestock Farming and Ranching	Medium	Medium	High	Medium	Medium	Medium	High
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Low	Medium	Medium
9	Mining	Low	Low	Medium	Medium	Low	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Medium	Low	Low	Medium
11	Residential and Commercial Development	Medium	Medium	High	Very High	Medium	Very High	Very High
12	Roads and Railroads	Medium	High	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	High	Very High	Medium	High	High
14	Water Diversion and Impoundments	Medium	Low	Very High	Medium	Medium	Medium	High
Threat Status for Targets and Project		High	High	Very High	Very High	Medium	Very High	Very High

Central CA Coast Coho Salmon ~ Lagunitas Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.1.1. **Recovery Action:** Improve estuarine freshwater inflow

1.1.1.1. **Action Step:** Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary

1.1.1.2. **Action Step:** Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen)

1.1.2. **Recovery Action:** Reduce extent of estuarine shoreline development

1.1.2.1. **Action Step:** Evaluate alterations to diking and leveeing which has reduced shoreline complexity and natural function

1.1.2.2. **Action Step:** Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements

1.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.2.1. **Recovery Action:** Increase the extent of estuarine habitat

1.2.1.1. **Action Step:** Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary

1.2.1.2. **Action Step:** Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay (CDFG 2004).

1.2.1.3. **Action Step:** Per a completed limiting factors assessment, and utilizing adaptive management guidelines, develop restoration projects in areas which have high value physical and chemical properties for rearing salmonids

1.2.2. **Recovery Action:** Increase and enhance habitat complexity features

1.2.2.1. **Action Step:** Restore estuarine wetlands and sloughs, develop floodplain and backwater habitat projects, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Evaluate potential acquisition of easements to protect floodplain function on lower Lagunitas Creek.

2.1.1.2. **Action Step:** Where existing infrastructure exists within historical floodplains or offchannel habitats, and where restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.

2.1.1.3. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and acquisition potential.

2.1.1.4. **Action Step:** Evaluate potential of modification to the Olema Ranch Campground to accommodate improved floodplain function on Olema Creek.

2.1.1.5. **Action Step:** Evaluate existing road and transportation networks and identify measures to reduce interaction of transportation infrastructure on tributary, mainstem and estuarine floodplain process.

2.1.1.6. **Action Step:** Implement Marin County Flood Zone activities for the improvement of coho salmon habitat

2.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

2.2.1. **Recovery Action:** Increase and enhance velocity refuge

2.2.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.2.1.2. **Action Step:** Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).

2.2.1.3. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.2.1.4. **Action Step:** Evaluate the acquisition of easements for the improvement of refuge habitat

2.2.2. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.2.2.1. **Action Step:** Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.

2.2.2.2. **Action Step:** Target habitat restoration and enhancement projects that will function between winter base flow and flood stage.

2.2.2.3. **Action Step:** Identify areas where floodplain connectivity can be re-established in low gradient response reaches (e.g. Olema Ranch Campground). Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity, develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Improve pool shelter rating

3.1.1.1. **Action Step:** Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.1.1.2. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) by installing multiple log structures in select reaches of Larsen, San Geronimo, Woodacre, and Olema Creeks

3.1.1.3. **Action Step:** Focus efforts to restore channel complexity in the Tocaloma reach of the Lagunitas mainstem to improve smolt survival.

3.1.2. **Recovery Action:** Increase frequency of primary pools

3.1.2.1. **Action Step:** Increase pool frequency in 25% of streams within the watershed to improve conditions for adults, and summer/winter juveniles

3.1.2.2. **Action Step:** Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Olema, Woodacre and San Geronimo Creeks

3.1.2.3. **Action Step:** Hold restoration workshops to specifically focus on restoration techniques that promote winter rearing juvenile habitat complexity in the Tocaloma reach of the lower Lagunitas mainstem. In addition, focus on restoration techniques that specifically address declining pool frequency and shelter ratings for summer rearing juveniles.

3.1.2.4. **Action Step:** Analyze whether summertime low-flow pools (perceived to be a limiting factor) are filling up with fine sediment from San Geronimo Creek between flow events that have enough power to scour the pools. This could be examined by surveying selected pools in detail several times a year (long enough to cover several potential scour and fill events), as was conducted in 1981.

3.1.3. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.3.1. **Action Step:** Increase riffle frequency in 25% of streams within the watershed to improve conditions for spawning adults

3.1.3.2. **Action Step:** Increase riffle frequency to achieve optimal conditions (20% riffles) by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of San Geronimo Creek

3.1.3.3. **Action Step:** In the San Geronimo Creek sub-watershed, continue public outreach and education for private landowners, residents, commercial, public utility and county workers regarding best management practices to control erosion, protect riparian vegetation, retain LWD, and minimize disturbance to coho salmon from domestic animals.

3.1.4. **Recovery Action:** Increase large wood frequency

3.1.4.1. **Action Step:** Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.1.4.2. **Action Step:** Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in select reaches of Olema Creek

3.1.4.3. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Larsen, Woodacre, San Geronimo, and Devils Gulch Creeks

3.1.4.4. **Action Step:** Expand on the efforts of the Regional Water Quality Control Board and Marin Municipal Water District efforts retain LWD.

3.1.4.5. **Action Step:** Install structures with multiple logs and root balls because they are more effective than structures with only one log.

3.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

3.2.1. **Recovery Action:** Improve habitat complexity

3.2.1.1. **Action Step:** Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations

4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

4.1.1.2. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.2.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.2.1.1. **Action Step:** Develop rearing habitat curves to identify optimal base flow conditions

4.2.1.2. **Action Step:** Continue to support efforts to model flows and water usage

4.2.1.3. **Action Step:** Develop cooperative projects with private landowners to conserve summer flows

4.2.2. **Recovery Action:** Minimize redd scour

4.2.2.1. **Action Step:** Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries including San Geronimo Creek

4.2.2.2. **Action Step:** Manage riparian areas for their site potential composition and structure.

4.2.2.3. **Action Step:** Improve spawning success and egg survival through improving channel configuration, sediment dynamics, and channel roughness and stability

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

5.1.1.1. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.

5.1.1.2. **Action Step:** Conserve water resources by implementing Water Diversion Recommendations

5.1.2. **Recovery Action:** Prevent increased landscape disturbance

5.1.2.1. **Action Step:** Decommission and or re-locate riparian roads upslope to achieve desirable riparian road density criteria (<0.1 to 0.4 Miles/Square Mile)

5.1.2.2. **Action Step:** Improve sediment transport by implementing Road Recommendations

5.1.2.3. **Action Step:** Implement DS level recommendations

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Improve access of spawning adults and juveniles

6.1.1.1. **Action Step:** Restore fish passage at Roy's Pools to facilitate unimpeded passage for all life stages into the San Geronimo Creek

6.1.1.2. **Action Step:** Remove all barriers in the Woodacre, Arroyo, Larsen and Montezuma and San Geronimo subwatersheds

6.1.1.3. **Action Step:** Removal all remaining barriers in the Cheda, Devil's Gulch and Olema subwatersheds.

6.1.1.4. **Action Step:** Work with MMWD to evaluate alternatives/feasibility to provide passage over Seeger Dam (Nicasio Reservoir).

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects on State and Federal park and private lands (e.g., Devil's Gulch).

8.1.1.2. **Action Step:** Plant native riparian species and native conifers/hardwoods in the riparian zone within the central portion of the watershed (Olema and lower Lagunitas Creek mainstem) to increase overall tree diameter

8.1.1.3. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Implement the SGVSEP to protect riparian integrity in San Geronimo Creek

8.1.2.3. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)

9.1.1.2. **Action Step:** Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations

9.1.1.3. **Action Step:** Implement recommendations of completed sediment source surveys (See ROADS for specific actions)

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Implement recovery actions where indicators rated poor or fair in high potential value areas.

10.1.1.2. **Action Step:** Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions

10.1.1.3. **Action Step:** Operation of the Lagunitas life cycle station should continue (Gallagher and Gallagher 2005).

10.1.2. **Recovery Action:** Increase spatial structure and diversity

10.1.2.1. **Action Step:** Continue to work with existing permitees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.2.2. **Action Step:** Annually capture or retain (during rescue efforts) - adequate numbers of fish from streams in Marin County for purposes of broodstock

10.1.2.3. **Action Step:** Utilize captured fish in a within-basin program for an immediate short term augmentation strategy at established facility(s), for release as adults, to avoid near term extinction (within 6 years).

10.1.2.4. **Action Step:** Support operation of outmigrant traps

10.1.3. **Recovery Action:** Increase spawner density

10.1.3.1. **Action Step:** Pursue longer term intervention strategies through establishing a river specific facility if populations do not rebound within six years, to avoid extinction and ensure long-term genetic diversity within the population.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Determine site-specific recommendations, including incentives, to remedy high temperatures and implement accordingly (CDFG 2004) .

11.1.1.2. **Action Step:** Focus on restoration efforts that deal with riparian canopy, shelter ratings and any other impaired key habitat attribute indicator that relates specifically to instream temperature.

11.1.2. **Recovery Action:** Improve stream water quality conditions

11.1.2.1. **Action Step:** Fully implement practices consistent with the SFRWQCB pathogen and sediment TMDLs.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

12.1.1.1. **Action Step:** Assist in the development and support implementation of sediment TMDL to assure water quality conditions for coho salmon are improved and fine sediment loads are decreased to baseline conditions.

12.1.2. **Recovery Action:** Prevent impairment to riparian species and composition

12.1.2.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

12.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

12.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

12.2.1.1. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels (see Roads for specific actions/areas)

12.2.2. **Recovery Action:** Prevent impairment to riparian

12.2.2.1. **Action Step:** Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

12.2.2.2. **Action Step:** Keep agricultural activities from within 100 feet of the edge of the stream

12.2.3. **Recovery Action:** Prevent impairment to habitat complexity

12.2.3.1. **Action Step:** Avoid the removal of large wood and other shelter components from the stream system

12.2.4. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

12.2.4.1. **Action Step:** Complete Farm Conservation Plans (through the SRCD, NRCS, or Fish Friendly Farming programs) to reduce sediment sources and restore riparian habitat and forest health

12.2.5. **Recovery Action:** Prevent impairment to hydrology

12.2.5.1. **Action Step:** Work with the agricultural community to develop water conservation strategies protective of salmonids while allowing ongoing agricultural land uses (i.e., off-channel storage ponds).

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment to habitat complexity

13.1.1.1. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.

13.1.1.2. **Action Step:** Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.(Evaluate the Tocaloma reach of the lower Lagunitas mainstem)

13.1.1.3. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.

13.1.1.4. **Action Step:** Implement DS level recommendations

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

18.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

18.1.1.1. **Action Step:** Establish conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.

18.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.2.1.1. **Action Step:** Exclude livestock from riparian areas, specifically on State and Federal Park and private lands (e.g. Devils Gulch).

18.2.1.2. **Action Step:** Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.

18.2.1.3. **Action Step:** Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.

18.2.1.4. **Action Step:** Manage rotational grazing to aid in the reduction of noxious weeds.

18.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

18.2.2.1. **Action Step:** Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.

18.2.2.2. **Action Step:** Implement DS level recommendations

18.2.3. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

18.2.3.1. **Action Step:** To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes

18.2.3.2. **Action Step:** Where necessary, establish predetermined stream crossings when herding cattle between pastures.

18.2.4. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

18.2.4.1. **Action Step:** Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.

18.2.4.2. **Action Step:** Aid landowners willing to fence off riparian areas with development of offstream alternative water sources

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to RIPARIAN

19.1.1.1. **Action Step:** Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations

19.1.1.2. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.1.3. **Action Step:** Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels

19.1.1.4. **Action Step:** Implement DS level recommendations

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.1.1. **Recovery Action:** Prevent impairment to riparian species and composition

22.1.1.1. **Action Step:** Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating CCC coho salmon.

22.1.1.2. **Action Step:** Support the Marin County Streamside Conservation Area Ordinance. Evaluate current moratorium in San Geronimo Valley for pertinent action items.

22.1.1.3. **Action Step:** Enforce existing building permit programs to minimize unpermitted construction.

22.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

22.2.1.1. **Action Step:** Address failing septic systems in rural areas

22.2.1.2. **Action Step:** Improve water quality where necessary by addressing residential and commercial pollutant sources.

22.2.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.2.2.1. **Action Step:** See WATER DIVERSIONS for specific actions and areas

22.2.2.2. **Action Step:** Encourage the use and provide incentives for rooftop water storage and other conservation devices

22.2.3. **Recovery Action:** Prevent impairment to riparian species and composition

22.2.3.1. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.

22.2.3.2. **Action Step:** Encourage FishNet 4C to facilitate instream and riparian restoration and management workshops with a specific focus on problems and opportunities in the Lagunitas Watershed.

22.2.3.3. **Action Step:** Work with private landowners to promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

22.2.3.4. **Action Step:** Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the inadequacy of existing regulatory mechanism

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.1.1.2. **Action Step:** Support the MMWD in their efforts to reduce sedimentation from lands in the Lagunitas Creek watershed. MMWD will also coordinate with the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to make sure that educational materials about non-point source pollution are available to homeowners in the San Geronimo Valley.

23.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.2.1.2. **Action Step:** In the Olema Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources.

23.2.1.3. **Action Step:** In the Lagunitas Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsloping roads, ditch relief culverts, and installing rolling dips.

23.2.1.4. **Action Step:** Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.2.1.5. **Action Step:** Decommission or treat the road sites on the priority list of 20 road sites within the San Geronimo subwatershed based on amount of sediment discharge.

23.2.1.6. **Action Step:** Implement DS level recommendations

23.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.2.2.1. **Action Step:** Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.2.3. **Recovery Action:** Prevent impairment to riparian species and composition

23.2.3.1. **Action Step:** Evaluate the potential of road widening projects (e.g. Sir Francis Drake Rd) on riparian corridors, and discourage encroachment into riparian zone.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.

24.1.1.2. **Action Step:** Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.

24.1.1.3. **Action Step:** See WATER DIVERSIONS for other specific actions/areas

24.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.2.1. **Recovery Action:** Prevent impairment to hydrology

24.2.1.1. **Action Step:** Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.

24.2.1.2. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

24.2.1.3. **Action Step:** Dedicate appropriative water rights to instream flow in Olema Creek watershed (NPS is currently evaluating opportunities in this watershed).

24.2.1.4. **Action Step:** Evaluate and assess impacts of local groundwater withdrawals in San Geronimo Creek watershed.

24.2.1.5. **Action Step:** Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).

24.2.1.6. **Action Step:** Avoid reductions of flow <8 cfs below major dams in the summer

24.2.1.7. **Action Step:** Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

24.2.1.8. **Action Step:** See DS level Recovery Actions

24.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

24.2.2.1. **Action Step:** Evaluate and implement rainfall capture from impervious surfaces for irrigation use to protect water quality and reduce water demand in summer.

24.2.3. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.2.3.1. **Action Step:** Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Avoid reductions of flow <8 cfs below major dams in the summer

25.1.1.2. **Action Step:** Provide consistent fishery flows below Peter's Dam by improving gauging at SP Taylor Park

25.1.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.2.1. **Action Step:** Encourage enforcement of SWRCB Order 95-17 (specifically in the warm summer months)

25.1.2.2. **Action Step:** Discourage the transfer of water from Nicasio Reservoir to Kent Lake which could degrade water quality releases into Lagunitas Creek

25.1.2.3. **Action Step:** Discourage the proposed water diversion through Groundwater Well by North Marin Water District which could adversely affect stream flows

25.1.3. **Recovery Action:** Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)

25.1.3.1. **Action Step:** Develop riffles and/or spawning channels below Kent Dam to increase spawner distribution and success

25.1.4. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.4.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Minimize take attributable to diversion of stream flow through alternatives such as: the operation of off-stream reservoirs, development of infrastructure necessary for conjunctive use of stream flow, and use of reclaimed water.

25.2.1.2. **Action Step:** Implement DS level recommendations.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Lagunitas Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-1.1	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-1.1.1	Recovery Action	Estuary	Improve estuarine freshwater inflow										
LaC-CCC-1.1.1.1	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	2	10	RWQCB, SWRCB, Water Agencies	7.50	7.50				15	Cost for continuous water quality monitoring gauges estimated at $5,000/unit. Assume minimum of 3 for lagoon. Cost does not account for maintenance or data management.
LaC-CCC-1.1.1.2	Action Step	Estuary	Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen)	2	12	CDFG, County Planning, NMFS, RWQCB, Tomales Bay Watershed Council, USACE						TBD	
LaC-CCC-1.1.2	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										
LaC-CCC-1.1.2.1	Action Step	Estuary	Evaluate alterations to diking and leveeing which has reduced shoreline complexity and natural function	3	10	California Coastal Conservancy, CDFG, County Planning, NMFS HCD, Tomales Bay Watershed Council, USACE	137.00	137.00				274	Cost based on estuary use monitoring estimated at $273,212
LaC-CCC-1.1.2.2	Action Step	Estuary	Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements	3	10	CA Coastal Commission, California Coastal Conservancy, CDFG						TBD	Costs associated with removal of structures will depend on the number and type of structures identified and cannot be accurately determined at this time.
LaC-CCC-1.2	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-1.2.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
LaC-CCC-1.2.1.1	Action Step	Estuary	Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary	3	50	CDFG, County Planning, RWQCB, USACE						In-Kind	
LaC-CCC-1.2.1.2	Action Step	Estuary	Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay (CDFG 2004).	3	10	MMWD, Tomales Bay Watershed Council						In-Kind	Cost likely accounted for in estuary monitoring.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-1.2.1.3	Action Step	Estuary	Per a completed limiting factors assessment, and utilizing adaptive management guidelines, develop restoration projects in areas which have high value physical and chemical properties for rearing salmonids	2	15	California Coastal Conservancy, CDFG, NMFS, Private Consultants, Tomales Bay Watershed Council						TBD	
LaC-CCC-1.2.2	Recovery Action	Estuary	Increase and enhance habitat complexity features										
LaC-CCC-1.2.2.1	Action Step	Estuary	Restore estuarine wetlands and sloughs, develop floodplain and backwater habitat projects, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.	2	10	CA Coastal Commission, California Coastal Conservancy, CDFG, Private Landowners	625	625				1,250	Cost based on treating 5% of total estuarine habitat at a rate of $272,120/acre.
LaC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
LaC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Evaluate potential acquisition of easements to protect floodplain function on lower Lagunitas Creek.	3	5	NPS, Private Landowners							
LaC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Where existing infrastructure exists within historical floodplains or offchannel habitats, and where restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	25							TBD	Conservation easements can be a powerful tool for conservation. Associated costs per acre can be highly variable. Costs for timberlands ranged from $54 to $279 per acre (DFG 2004). Costs in Marin County are likely much higher and cannot be accurately determined at this time.
LaC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Evaluate undeveloped and developed floodplain property for potential function and acquisition potential.	3	3	MMWD, NPS, SPAWN							
LaC-CCC-2.1.1.4	Action Step	Floodplain Connectivity	Evaluate potential of modification to the Olema Ranch Campground to accommodate improved floodplain function on Olema Creek.	3	10	NPS, Private Landowners, State Parks						In-Kind	
LaC-CCC-2.1.1.5	Action Step	Floodplain Connectivity	Evaluate existing road and transportation networks and identify measures to reduce interaction of transportation infrastructure on tributary, mainstem and estuarine floodplain process.	3	5	Marin County, MMWD, NPS, State Parks							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-2.1.1.6	Action Step	Floodplain Connectivity	Implement Marin County Flood Zone activities for the improvement of coho salmon habitat	3	-1	Marin County, MMWD						0	Implementation of existing program activities are unlikely to increase costs associated with recovery.
LaC-CCC-2.2	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
LaC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	5	Marin County, MMWD, NPS, State Parks	40.00					40	This is a GIS exercise with ground truthing, and costs are expected to be fairly low.
LaC-CCC-2.2.1.2	Action Step	Floodplain Connectivity	Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).	2	10	Private Consultants, Private Landowners, Sonoma County	56.00	56.00				112	Cost for fish/habitat monitoring estimated at $111,192/project.
LaC-CCC-2.2.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	60	CDFG, Marin County, MMWD, NMFS, NPS, State Parks						TBD	Costs to promote and support restoration efforts (e.g. technical assistance) depend on level of technical assistance provided and the types of projects proposed.
LaC-CCC-2.2.1.4	Action Step	Floodplain Connectivity	Evaluate the acquisition of easements for the improvement of refuge habitat	3		Marin County, Marin RCD							
LaC-CCC-2.2.2	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
LaC-CCC-2.2.2.1	Action Step	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest, or remove or setback levees, and use streamway concept where appropriate.	2	10	Marin County, Marin RCD, MMWD, NPS, State Parks	270.00	270.00				540	Cost based on treating 22 miles (assume 1 project/mile in 25% High IP) at a rate of $25,000/mile.
LaC-CCC-2.2.2.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement projects that will function between winter base flow and flood stage.	2	60	Marin County, MMWD, NMFS, NPS, State Parks						TBD	Cost accounted for in above action steps. Costs depend on level of technical assistance required and types of projects proposed. Many salmon recovery efforts and management programs are currently ongoing by a variety of agencies and stakeholders. It is possible that there could be additional salmon restoration costs identified; however, at this time we do not have sufficient information to estimate those potential costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-2.2.2.3	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches (e.g. Olema Ranch Campground). Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity, develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats.	2	50	Farm Bureau, NMFS HCD, Public Works, RCD						TBD	
LaC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve pool shelter rating										
LaC-CCC-3.1.1.1	Action Step	Habitat Complexity	Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	10		540	540				1,079	Cost based on placing LWD for 43 miles of stream (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.
LaC-CCC-3.1.1.2	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) by installing multiple log structures in select reaches of Larsen, San Geronimo, Woodacre, and Olema Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited							Cost accounted for in increase shelter ratings in 75% of streams.
LaC-CCC-3.1.1.3	Action Step	Habitat Complexity	Focus efforts to restore channel complexity in the Tocaloma reach of the Lagunitas mainstem to improve smolt survival.	2	10	MMWD, NPS						0	Costs are expected to be included in implementation of LWD placements actions.
LaC-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
LaC-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase pool frequency in 25% of streams within the watershed to improve conditions for adults, and summer/winter juveniles	2	10		270.00	270.00				540	Cost based on treating 22 miles (assume 1 project/mile of 25% High IP) at a rate of $25,000/mile. Cost may vary if ELJ or placement of boulders is preferred.
LaC-CCC-3.1.2.2	Action Step	Habitat Complexity	Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Olema, Woodacre and San Geronimo Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						TBD	Cost accounted for in increase pool frequency in 25 % of streams.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-3.1.2.3	Action Step	Habitat Complexity	Hold restoration workshops to specifically focus on restoration techniques that promote winter rearing juvenile habitat complexity in the Tocaloma reach of the lower Lagunitas mainstem. In addition, focus on restoration techniques that specifically address declining pool frequency and shelter ratings for summer rearing juveniles.	3	20	Marin County, Marin RCD, NOAA RC, SPAWN						In-Kind	
LaC-CCC-3.1.2.4	Action Step	Habitat Complexity	Analyze whether summertime low-flow pools (perceived to be a limiting factor) are filling up with fine sediment from San Geronimo Creek between flow events that have enough power to scour the pools. This could be examined by surveying selected pools in detail several times a year (long enough to cover several potential scour and fill events), as was conducted in 1981.	3	10	MMWD, NPS, SPAWN						TBD	Cost accounted for in fish/habitat monitoring.
LaC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
LaC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase riffle frequency in 25% of streams within the watershed to improve conditions for spawning adults	2	10								Cost accounted for as part of increase frequency of primary pools.
LaC-CCC-3.1.3.2	Action Step	Habitat Complexity	Increase riffle frequency to achieve optimal conditions (20% riffles) by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of San Geronimo Creek	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners						TBD	Cost accounted for as part of increase pool frequency.
LaC-CCC-3.1.3.3	Action Step	Habitat Complexity	In the San Geronimo Creek sub-watershed, continue public outreach and education for private landowners, residents, commercial, public utility and county workers regarding best management practices to control erosion, protect riparian vegetation, retain LWD, and minimize disturbance to coho salmon from domestic animals.	3	5	Marin County, SPAWN							Continue ongoing efforts.
LaC-CCC-3.1.4	Recovery Action	Habitat Complexity	Increase large wood frequency										
LaC-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase large wood frequency throughout the watershed to improve conditions for adults, and winter/summer rearing juveniles	2									Cost accounted for in previous action steps.
LaC-CCC-3.1.4.2	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in select reaches of Olema Creek	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners						TBD	Cost likely accounted for in other action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-3.1.4.3	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Larsen, Woodacre, San Geronimo, and Devils Gulch Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						TBD	Cost likely accounted for in other action steps.
LaC-CCC-3.1.4.4	Action Step	Habitat Complexity	Expand on the efforts of the Regional Water Quality Control Board and Marin Municipal Water District efforts retain LWD.	2	10	MMWD, RWQCB, SPAWN, Trout Unlimited						In-Kind	Cost to maintain LWD is expected to be minimal.
LaC-CCC-3.1.4.5	Action Step	Habitat Complexity	Install structures with multiple logs and root balls because they are more effective than structures with only one log.	3	10	CDFG, Marin County, MMWD, NPS, SPAWN						TBD	Cost likely accounted for in other action steps.
LaC-CCC-3.2	**Objective**	**Habitat Complexity**	**Address other natural or manmade factors affecting the species' continued existence**										
LaC-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve habitat complexity										
LaC-CCC-3.2.1.1	Action Step	Habitat Complexity	Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations	2	5		10.00					10	Cost based on beaver reintroduction estimated at $10,000/beaver family translocation.
LaC-CCC-4.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
LaC-CCC-4.1.1.1	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	60	CDFG, Gold Ridge RCD, Marin County, Marin RCD, MMWD, NMFS						In-Kind	Technical assistance is ongoing.
LaC-CCC-4.1.1.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	2	10	DWR, Marin County, NMFS, SWRCB						TBD	
LaC-CCC-4.2	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
LaC-CCC-4.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
LaC-CCC-4.2.1.1	Action Step	Hydrology	Develop rearing habitat curves to identify optimal base flow conditions	3	10	CDFG, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-4.2.1.2	Action Step	Hydrology	Continue to support efforts to model flows and water usage	3	5	CDFG, NMFS HCD, Private Consultants, Private Landowners, RCD, UC Extension						TBD	
LaC-CCC-4.2.1.3	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	2	5	CDFG, NMFS HCD, Private Consultants, Private Landowners, RCD						In-Kind	
LaC-CCC-4.2.2	Recovery Action	Hydrology	Minimize redd scour										
LaC-CCC-4.2.2.1	Action Step	Hydrology	Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries including San Geronimo Creek	2	10	California Conservations Corps, CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						tbd	Cost accounted for in other recovery actions. See habitat complexity and floodplain connectivity.
LaC-CCC-4.2.2.2	Action Step	Hydrology	Manage riparian areas for their site potential composition and structure.	3	60	Marin County, MMWD, Tomalis Bay Watershed Council						In-Kind	
LaC-CCC-4.2.2.3	Action Step	Hydrology	Improve spawning success and egg survival through improving channel configuration, sediment dynamics, and channel roughness and stability	2	20								Cost accounted for in fish/habitat monitoring.
LaC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-5.1.1	Recovery Action	Landscape Patterns	Prevent impairment to watershed hydrology										
LaC-CCC-5.1.1.1	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.	3	100							In-Kind	
LaC-CCC-5.1.1.2	Action Step	Landscape Patterns	Conserve water resources by implementing Water Diversion Recommendations	2	100							In-Kind	
LaC-CCC-5.1.2	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-5.1.2.1	Action Step	Landscape Patterns	Decommission and or re-locate riparian roads upslope to achieve desirable riparian road density criteria (<0.1 to 0.4 Miles/Square Mile)	2	10	Private Landowners, RCD	200.00	200.00				400	Cost based on decommissioning 33 miles of riparian road network at a rate of $12,000/mile.
LaC-CCC-5.1.2.2	Action Step	Landscape Patterns	Improve sediment transport by implementing Road Recommendations	2									
LaC-CCC-5.1.2.3	Action Step	Landscape Patterns	Implement DS level recommendations	3									
LaC-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
LaC-CCC-6.1.1	Recovery Action	Passage	Improve access of spawning adults and juveniles										
LaC-CCC-6.1.1.1	Action Step	Passage	Restore fish passage at Roy's Pools to facilitate unimpeded passage for all life stages into the San Geronimo Creek	2	5	SPAWN	800					800	This action would provide access to the San Geronimo Valley Core area for all lifestages.
LaC-CCC-6.1.1.2	Action Step	Passage	Remove all barriers in the Woodacre, Arroyo, Larsen and Montezuma and San Geronimo subwatersheds	2	10	Marin County, SPAWN, Trout Unlimited	750	750				1,500	Cost based on treating 25% of remaining structures assuming 1 barrier/5 miles High IP at a rate of $367,732/unit. This action would provide access to the most productive subwatershed in this system. Many barriers have been addressed, however some continue to limit access to habitat.
LaC-CCC-6.1.1.3	Action Step	Passage	Removal all remaining barriers in the Cheda, Devil's Gulch and Olema subwatersheds.	2	10	Marin County, MMWD, NPS, State Parks							Cost accounted for as part of remove all barriers assuming 1 barrier/5 miles of High IP.
LaC-CCC-6.1.1.4	Action Step	Passage	Work with MMWD to evaluate alternatives/feasibility to provide passage over Seeger Dam (Nicasio Reservoir).	3	30	CDFG, Marin County, NMFS OLE						TBD	Cannot determine at this time. Cost will depend on method of passage.
LaC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
LaC-CCC-8.1.1.1	Action Step	Riparian	Continue riparian protection and sediment control projects with a focus on working with landowners to manage livestock to protect riparian areas, and to implement erosion control projects on State and Federal park and private lands (e.g., Devil's Gulch).	2	10	Marin County, Marin RCD, MMWD, NPS, SPAWN, State Parks						In-Kind	Livestock damage has severe effects in the Olema Core area, but is less of an issue in the other areas of the watershed.
LaC-CCC-8.1.1.2	Action Step	Riparian	Plant native riparian species and native conifers/hardwoods in the riparian zone within the central portion of the watershed (Olema and lower Lagunitas Creek mainstem) to increase overall tree diameter	2	20	CDFG, NOAA RC, Private Consultants, Private Landowners, RCD	603	603	603	603		2,410	Cost based on treating 1.5 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-8.1.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).	3	50	City Planning, Land Trusts, Sonoma County						In-Kind	
LaC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
LaC-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	20		10.25	10.25	10.25	10.25		41	Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of $20,058/mile. Cost may be lower if overlapped with improved canopy cover.
LaC-CCC-8.1.2.2	Action Step	Riparian	Implement the SGVSEP to protect riparian integrity in San Geronimo Creek	2	20	Marin County, Private Landowners						In-Kind	
LaC-CCC-8.1.2.3	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	3	10	Board of Forestry, Private Consultants, Private Landowners	18.50	18.50				37	Cost based on treating 13 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,422/mile.
LaC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										
LaC-CCC-9.1.1.1	Action Step	Sediment	Reduce embeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)	2	50							TBD	Fish/habitat monitoring should identify areas with increased embeddness levels.
LaC-CCC-9.1.1.2	Action Step	Sediment	Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations	3	10	Private Consultants, Private Landowners, RCD, Tomales Bay Watershed Council	106.50	106.50				213	Cost for erosion assessment (assume 25% of total watershed acres) estimated at $12./acre.
LaC-CCC-9.1.1.3	Action Step	Sediment	Implement recommendations of completed sediment source surveys (See ROADS for specific actions)	2	5	CDFG, Private Landowners, Public Works, RCD, Tomales Bay Watershed Council, Trout Unlimited						TBD	
LaC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
LaC-CCC-10.1.1.1	Action Step	Viability	Implement recovery actions where indicators rated poor or fair in high potential value areas.	2	50								
LaC-CCC-10.1.1.2	Action Step	Viability	Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions	3	10	NMFS						TBD	
LaC-CCC-10.1.1.3	Action Step	Viability	Operation of the Lagunitas life cycle station should continue (Gallagher and Gallagher 2005).	3	10	CDFG, Marin County, MMWD, NMFS, NPS, SPAWN, State Parks	375.00	375.00				750	Includes juvenile surveys, smolt outmigration, and adult carcass surveys at 75k per year for 10 years.
LaC-CCC-10.1.2	Recovery Action	Viability	Increase spatial structure and diversity										
LaC-CCC-10.1.2.1	Action Step	Viability	Continue to work with existing permitees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, MMWD, NMFS, NPS, SPAWN, State Parks							Existing operations
LaC-CCC-10.1.2.2	Action Step	Viability	Annually capture or retain (during rescue efforts) - adequate numbers of fish from streams in Marin County for purposes of broodstock	1	10	CDFG, MMWD, NMFS, NPS, SPAWN							existing operations
LaC-CCC-10.1.2.3	Action Step	Viability	Utilize captured fish in a within-basin program for an immediate short term augmentation strategy at established facility(s), for release as adults, to avoid near term extinction (within 6 years).	1	6	CDFG, MMWD, NMFS, NPS, USACE						TBD	Costs estimated for these activities are not high and are being absorbed through the implementation of other programs and existing staff resources.
LaC-CCC-10.1.2.4	Action Step	Viability	Support operation of outmigrant traps	3	20	CDFG, NMFS, Trout Unlimited, UC Extension						TBD	Costs estimated for these activities are not high and are being absorbed through the implementation of other programs and existing staff resources.
LaC-CCC-10.1.3	Recovery Action	Viability	Increase spawner density										
LaC-CCC-10.1.3.1	Action Step	Viability	Pursue longer term intervention strategies through establishing a river specific facility if populations do not rebound within six years, to avoid extinction and ensure long-term genetic diversity within the population.	1	12	CDFG, MMWD, NMFS, NPS, USACE						TBD	Cost cannot be determined at this time. More specific methods in development will determine cost.
LaC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-11.1.1.1	Action Step	Water Quality	Determine site-specific recommendations, including incentives, to remedy high temperatures and implement accordingly (CDFG 2004) .	2	5	Marin County, MMWD, NPS, State Parks						TBD	Existing programs could be copied for implementation, so costs are expected to be minimal.
LaC-CCC-11.1.1.2	Action Step	Water Quality	Focus on restoration efforts that deal with riparian canopy, shelter ratings and any other impaired key habitat attribute indicator that relates specifically to instream temperature.	2	5	Marin County, MMWD, NPS, State Parks						TBD	Existing programs could be copied for implementation, so costs are expected to be minimal.
LaC-CCC-11.1.2	Recovery Action	Water Quality	Improve stream water quality conditions										
LaC-CCC-11.1.2.1	Action Step	Water Quality	Fully implement practices consistent with the SFRWQCB pathogen and sediment TMDLs.	3	10	Marin County, MMWD, NPS, RWQCB, State Parks						0	Implementation of the TMDL is mandated by the Clean Water Act, and additional costs associated with recovery are not expected.
LaC-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-12.1.1.1	Action Step	Agricultural Practices	Assist in the development and support implementation of sediment TMDL to assure water quality conditions for coho salmon are improved and fine sediment loads are decreased to baseline conditions.	3	5							In-Kind	Costs are expected to be minimal, however technical assistance from several agencies will be needed.
LaC-CCC-12.1.2	Recovery Action	Agricultural Practices	Prevent impairment to riparian species and composition										
LaC-CCC-12.1.2.1	Action Step	Agricultural Practices	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2	50	City Planning, County Planning, RWQCB						In-Kind	site specific
LaC-CCC-12.2	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
LaC-CCC-12.2.1	Recovery Action	Agricultural Practices	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-12.2.1.1	Action Step	Agricultural Practices	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels (see Roads for specific actions/areas)	2	60	County Planning, Private Landowners, RCD, USACE						In-Kind	Stringent review by permitting agencies is expected to reduce costs associated with poorly planned and poorly located developments.
LaC-CCC-12.2.2	Recovery Action	Agricultural Practices	Prevent impairment to riparian										
LaC-CCC-12.2.2.1	Action Step	Agricultural Practices	Implement programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	3	30	County Planning, Land Trusts						TBD	Cost difficult to determine because of fair market value and rate of turnover.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-12.2.2.2	Action Step	Agricultural Practices	Keep agricultural activities from within 100 feet of the edge of the stream	3	5	CDFG, NMFS, NRCS, RCD, SWRCB, USACE						In-Kind	Streamlining permit processing is not expected to cost much, and may save money through future efficiencies.
LaC-CCC-12.2.3	Recovery Action	Agricultural Practices	Prevent impairment to habitat complexity										
LaC-CCC-12.2.3.1	Action Step	Agricultural Practices	Avoid the removal of large wood and other shelter components from the stream system	3	50							In-Kind	
LaC-CCC-12.2.4	Recovery Action	Agricultural Practices	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-12.2.4.1	Action Step	Agricultural Practices	Complete Farm Conservation Plans (through the SRCD, NRCS, or Fish Friendly Farming programs) to reduce sediment sources and restore riparian habitat and forest health	3	10	CDFG, Farm Bureau, NMFS, Private Landowners, RCD						TBD	Cost is TBD since the vagaries of the plan are unknown at this time.
LaC-CCC-12.2.5	Recovery Action	Agricultural Practices	Prevent impairment to hydrology										
LaC-CCC-12.2.5.1	Action Step	Agricultural Practices	Work with the agricultural community to develop water conservation strategies protective of salmonids while allowing ongoing agricultural land uses (i.e., off-channel storage ponds).	3	10	CDFG, Farm Bureau, NMFS, NRCS, Private Landowners, RCD						In-Kind	Soliciting cooperation not expected to cost much outside of already existing federal and state and local salaries.
LaC-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to habitat complexity										
LaC-CCC-13.1.1.1	Action Step	Channel Modification	Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.	3	50	County Planning, RCD						TBD	
LaC-CCC-13.1.1.2	Action Step	Channel Modification	Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.(Evaluate the Tocaloma reach of the lower Lagunitas mainstem)	2	10	CDFG, County Planning, NOAA RC, NRCS, Private Landowners, USACE	390.00	390.00				780	Cost based on treating 22 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
LaC-CCC-13.1.1.3	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.	3	50	CDFG, NMFS PRD, USACE						In-Kind	
LaC-CCC-13.1.1.4	Action Step	Channel Modification	Implement DS level recommendations	3									
LaC-CCC-18.1	**Objective**	**Livestock**	**Address the inadequacy of existing regulatory mechanisms**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-18.1.1	Recovery Action	Livestock	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-18.1.1.1	Action Step	Livestock	Establish conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.	3	50	NRCS, RCD						In-Kind	
LaC-CCC-18.2	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-18.2.1	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
LaC-CCC-18.2.1.1	Action Step	Livestock	Exclude livestock from riparian areas, specifically on State and Federal Park and private lands (e.g. Devils Gulch).	2	50							In-Kind	This recommendation should be considered standard practice.
LaC-CCC-18.2.1.2	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	60	NRCS, RCD						TBD	
LaC-CCC-18.2.1.3	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	2	30	NRCS, RCD						In-Kind	
LaC-CCC-18.2.1.4	Action Step	Livestock	Manage rotational grazing to aid in the reduction of noxious weeds.	3	60	NRCS, RCD						TBD	
LaC-CCC-18.2.2	Recovery Action	Livestock	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-18.2.2.1	Action Step	Livestock	Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.	3	60	NRCS, RCD						In-Kind	
LaC-CCC-18.2.2.2	Action Step	Livestock	Implement DS level recommendations	3									
LaC-CCC-18.2.3	Recovery Action	Livestock	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-18.2.3.1	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes	2	60	NRCS, RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-18.2.3.2	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	60	NRCS, RCD						TBD	
LaC-CCC-18.2.4	Recovery Action	Livestock	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-18.2.4.1	Action Step	Livestock	Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.	2	10	Marin RCD, NPS, Private Landowners, State Parks						TBD	Costs for required infrastructure (e.g. mobile water trailers, tanks, etc.) will be the responsibility of individual landowners or supporting agencies, but cannot be determined at this time.
LaC-CCC-18.2.4.2	Action Step	Livestock	Aid landowners willing to fence off riparian areas with development of offstream alternative water sources	3	30	NRCS, RCD						TBD	
LaC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
LaC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to RIPARIAN										
LaC-CCC-19.1.1.1	Action Step	Logging	Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations	3	60	CDFG, NMFS, RCD, State Parks						TBD	Impossible to anticipate where and how much land will come available for purchase in the future.
LaC-CCC-19.1.1.2	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	60	Board of Forestry, CDFG, County Planning, NMFS, State Parks, USEPA						In-Kind	Costs cannot be determined at this time, due to an unknown number of variables and research priorities.
LaC-CCC-19.1.1.3	Action Step	Logging	Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	3	60	Board of Forestry, County Planning, NMFS, Private Landowners, State Parks, US EPA						In-Kind	Recruitment of LWD to the stream is critical. This action is mainly a policy issue, with little or no direct costs.
LaC-CCC-19.1.1.4	Action Step	Logging	Implement DS level recommendations	3									
LaC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating CCC coho salmon.	3	20	Marin County, MMWD, NPS, State Parks						TBD	Costs may vary with methods and extent of assessments and actions taken to address impacts, and cannot be determined at this time.
LaC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Support the Marin County Streamside Conservation Area Ordinance. Evaluate current moratorium in San Geronimo Valley for pertinent action items.	3a	10	CDFG, Marin County, NPS, SPAWN, State Parks						0	Costs associated with support and evaluation are expected to be minimal.
LaC-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	20	Marin County, USACE						In-Kind	Additional costs associated with recovery are not expected.
LaC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
LaC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
LaC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Address failing septic systems in rural areas	3	10	City Planning, County Planning, RWQCB						TBD	
LaC-CCC-22.2.1.2	Action Step	Residential/Commercial Development	Improve water quality where necessary by addressing residential and commercial pollutant sources.	2	10	Private Landowners, Public Works, RCD, RWQCB						TBD	Cost accounted for in water quality monitoring. If additional sites are needed, cost will increase. It is anticipated Marin County would know of current pollutant sources.
LaC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	See WATER DIVERSIONS for specific actions and areas	3									
LaC-CCC-22.2.2.2	Action Step	Residential/Commercial Development	Encourage the use and provide incentives for rooftop water storage and other conservation devices	2		County Planning, Private Consultants, Private Landowners						TBD	
LaC-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										
LaC-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	3	60	Marin RCD, MMWD, NPS, Private Landowners, State Parks						In-Kind	It is possible that there could be additional salmon restoration costs identified based on recovery needs of the species; however, at this time NMFS does not have sufficient information to estimate those potential costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-22.2.3.2	Action Step	Residential/Commercial Development	Encourage FishNet 4C to facilitate instream and riparian restoration and management workshops with a specific focus on problems and opportunities in the Lagunitas Watershed.	3	5	CDFG, FishNet 4C, Marin County, MMWD, NMFS, NPS, SPAWN, State Parks							
LaC-CCC-22.2.3.3	Action Step	Residential/Commercial Development	Work with private landowners to promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	3	60	CDFG, Marin RCD, NPS, Private Landowners, State Parks						In-Kind	Costs depend on level of technical assistance provided and the types of projects proposed.
LaC-CCC-22.2.3.4	Action Step	Residential/Commercial Development	Educate county and city public works departments, flood control districts, and planning departments, etc., on the critical importance of maintaining riparian vegetation, instream LWD, and LWD recruitment.	3									
LaC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										
LaC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-23.1.1.1	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	3	20	Marin County, USACE						In-Kind	Existing authorities of permitting agencies facilitate implementation at minimal costs.
LaC-CCC-23.1.1.2	Action Step	Roads/Railroads	Support the MMWD in their efforts to reduce sedimentation from lands in the Lagunitas Creek watershed. MMWD will also coordinate with the Marin County Stormwater Pollution Prevention Program (MCSTOPPP) to make sure that educational materials about non-point source pollution are available to homeowners in the San Geronimo Valley.	3b	10	Marin RCD, MMWD, RWQCB						In-Kind	Outreach and education are ongoing, and additional costs are expected to be minimal.
LaC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
LaC-CCC-23.2.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	10	CalTrans, Marin County						TBD	Costs associated with assessment and redesign cannot be determined at this time, however some assessment has already been conducted.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-23.2.1.2	Action Step	Roads/Railroads	In the Olema Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources.	2	20	Private Consultants, Private Landowners, Public Works, RCD						TBD	
LaC-CCC-23.2.1.3	Action Step	Roads/Railroads	In the Lagunitas Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsloping roads, ditch relief culverts, and installing rolling dips.	2	30	Private Consultants, Private Landowners, Public Works, RCD, State Parks						TBD	
LaC-CCC-23.2.1.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	20	Private Landowners, Public Works						TBD	Cost depend on feasibility and need of adequate spoils storage sites.
LaC-CCC-23.2.1.5	Action Step	Roads/Railroads	Decommission or treat the road sites on the priority list of 20 road sites within the San Geronimo subwatershed based on amount of sediment discharge.	2b	20	Marin County, Marin RCD, SPAWN	9.00	9.00	9.00	9.00		36	Cost based on decommissioning 3 miles of road network at a rate of $12,000/mile.
LaC-CCC-23.2.1.6	Action Step	Roads/Railroads	Implement DS level recommendations	3									
LaC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
LaC-CCC-23.2.2.1	Action Step	Roads/Railroads	Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	100	Private Landowners, Public Works						In-Kind	
LaC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to riparian species and composition										
LaC-CCC-23.2.3.1	Action Step	Roads/Railroads	Evaluate the potential of road widening projects (e.g. Sir Francis Drake Rd) on riparian corridors, and discourage encroachment into riparian zone.	3	50							In-Kind	
LaC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
LaC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.	3	20							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	3	20	Marin County, Marin RCD, NPS, Private Landowners, SPAWN, State Parks						TBD	Costs cannot be determined due to an unknown number of unauthorized users, and unknown level of enforcement that would be required.
LaC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	See WATER DIVERSIONS for other specific actions/areas	2									
LaC-CCC-24.2	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
LaC-CCC-24.2.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
LaC-CCC-24.2.1.1	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	3	10							TBD	Cost accounted for from stream flow model.
LaC-CCC-24.2.1.2	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	2	10	CDFG, MMWD, NPS, RWQCB, State Parks						TBD	Costs are expected to be minimal as some of these efforts will be part of existing programs, however some technical assistance may be necessary from a variety of agencies.
LaC-CCC-24.2.1.3	Action Step	Severe Weather Patterns	Dedicate appropriative water rights to instream flow in Olema Creek watershed (NPS is currently evaluating opportunities in this watershed).	2	7	NPS, RWQCB						In-Kind	No costs specific to recovery are associated with this effort.
LaC-CCC-24.2.1.4	Action Step	Severe Weather Patterns	Evaluate and assess impacts of local groundwater withdrawals in San Geronimo Creek watershed.	3	20	Marin RCD, MMWD, Private Landowners, RWQCB, SPAWN						TBD	
LaC-CCC-24.2.1.5	Action Step	Severe Weather Patterns	Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	2	20	CDFG, Marin County, NMFS, Private Landowners, SPAWN						TBD	Costs associated with operations are expected to be minimal, however structural modifications to facilitate appropriate operations may be costly.
LaC-CCC-24.2.1.6	Action Step	Severe Weather Patterns	Avoid reductions of flow <8 cfs below major dams in the summer	2		NMFS HCD, SWRCB							
LaC-CCC-24.2.1.7	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	3									
LaC-CCC-24.2.1.8	Action Step	Severe Weather Patterns	See DS level Recovery Actions	3									
LaC-CCC-24.2.2	Recovery Action	Severe Weather Patterns	Prevent impairment to watershed hydrology										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-24.2.2.1	Action Step	Severe Weather Patterns	Evaluate and implement rainfall capture from impervious surfaces for irrigation use to protect water quality and reduce water demand in summer.	3	10	CDFG, Marin County, Marin RCD, MMWD, NPS, SPAWN, State Parks						TBD	Costs cannot be determined due to an unknown number of participants and types of modifications required for implementation.
LaC-CCC-24.2.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
LaC-CCC-24.2.3.1	Action Step	Severe Weather Patterns	Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas	2	20	CDFG, NOAA RC, Private Landowners, RCD							Cost accounted for in riparian.
LaC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
LaC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Avoid reductions of flow <8 cfs below major dams in the summer	2	50	NMFS HCD, SWRCB							See SEVERE WEATHER PATTERNS.
LaC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Provide consistent fishery flows below Peter's Dam by improving gauging at SP Taylor Park	2	5	NMFS HCD, State Parks	1.00					1	Cost for stream flow gauge estimated at $1000/gauge. Cost does not account for maintenance or data management.
LaC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
LaC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Encourage enforcement of SWRCB Order 95-17 (specifically in the warm summer months)	2	50	NMFS HCD, SWRCB						In-Kind	
LaC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Discourage the transfer of water from Nicasio Reservoir to Kent Lake which could degrade water quality releases into Lagunitas Creek	2	50	NMFS HCD, SWRCB						In-Kind	
LaC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Discourage the proposed water diversion through Groundwater Well by North Marin Water District which could adversely affect stream flows	2	20	NMFS HCD, SWRCB						In-Kind	
LaC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)										
LaC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Develop riffles and/or spawning channels below Kent Dam to increase spawner distribution and success	2	5	CDFG, MMWD, NMFS HCD, Trout Unlimited	25.00					25	Cost based on treating 1.0 miles at a rate of $25,000/mile for LWD placement. Cost may be higher if incorporate other habitat features such as boulders, channel grading, and riparian vegetation.
LaC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
LaC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100							In-Kind	This recommendation should be considered standard practice.
LaC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
LaC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
LaC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Minimize take attributable to diversion of stream flow through alternatives such as: the operation of off-stream reservoirs, development of infrastructure necessary for conjunctive use of stream flow, and use of reclaimed water.	2	30	CDFG, Marin RCD, MMWD, Private Landowners						TBD	Costs associated with development of alternatives cannot be determined due to the unknown number and types of alternatives that might be proposed.
LaC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Implement DS level recommendations	3									

Navarro River

Location	•Mendocino County
Watershed Area	• 315.0 Square Miles
Potential Habitat	• 220.4 Stream Miles
Vegetation	• 50% Coniferous, 26% Montane Hardwood, and 15% Grassland
Erodability	•Moderate to High
Ownership Patterns	•98% Private, 2% Public
Dominant Land Uses	•Timber, Agriculture
Housing Density	•Low to Moderate
TMDL Pollutants	•Sediment, Temperature

Navarro River estuary
Photo provided by KRIS Information System, and is used with permission

Navarro River Coho Salmon: Persistent – Low Abundance

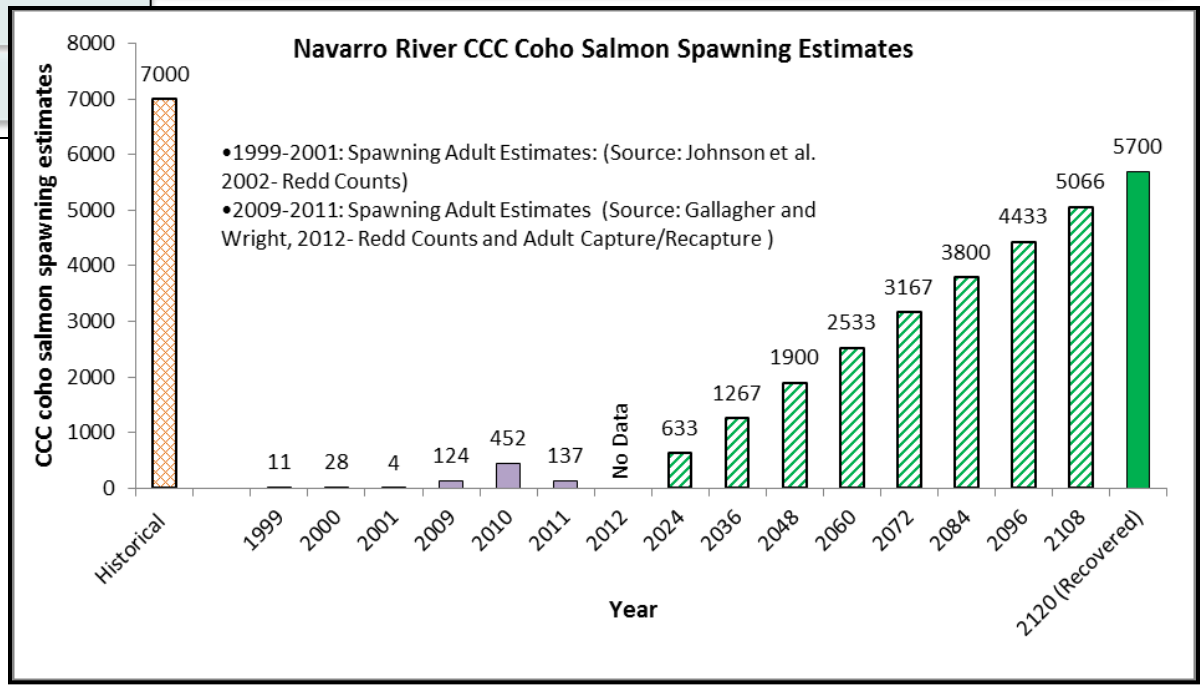
Recovery Goals

✓ Conduct monitoring to track population response to recovery action implementations

Navarro Creek Adult Spawner Targets

Downlisting to Threatened
2,850

Recovery
5,700



STEELHEAD: YES
CHINOOK SALMON: YES

Navarro River

Potential Habitat: 220.4 miles
Recovery Target: 5,700 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	FAIR	POOR	POOR	POOR	FAIR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Modify road crossings to provide access to historical habitats
- Maintain, install and enhance LWD and other complex habitat features
- Eliminate depletion of summer flows
- Develop BMP's (such as off-channel storage) for landowners conducting water diversion actions
- Address high and medium priority sediment delivery sites

Priority 2 & 3: Long-Term Restoration Actions

- Fence riparian areas from grazing
- Continue removal of *Arundo* located in the upper reaches of Rancheria Creek

Recovery Partners

TROUT UNLIMITED

NRCS Natural Resources Conservation Service

Mendocino County Resource Conservation District

MENDOCINO

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH & GAME

Photo courtesy: Campbell Timberland, Gualala River Watershed Council, Campbell Timberland, KRIS Information System and Morgan Bond, SWFSC

Navarro River

Potential Habitat: 220.4 miles
Recovery Target: 5,700 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	LOW	MEDIUM	LOW	LOW	NA	MEDIUM	MEDIUM	NA	LOW	MEDIUM	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Promote off-channel storage to reduce impacts of water diversion during the spring and summer
- Establish a moratorium on conversion of open space, rangeland, or TPZ to vineyards or other agricultural uses
- Increase size of Navarro River Redwoods State Park if acquisition opportunities arise
- New THPs should identify and decommission problematic legacy roads within WLPZ's
- For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction maintenance management and decommissioning
- Conduct annual inspections of all roads prior to winter and correct poor conditions

Priority 2 & 3: Long-Term Threat Abatement Actions

- Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)
- Develop a road sediment seduction Plan for agricultural lands
- Map unstable soils and use information to guide land use decisions, road design, THPs, and other activities that can promote erosion
- Allow trees in riparian areas to age, die, and recruit into the stream naturally
- Encourage timber landowners to implement restoration projects as part of their timber management practices
- Implement water conservation programs
- Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events

Culvert that was removed on John Smith Creek
Photo provided by KRIS Information System, and is used with permission

Conservation Highlights

- MRC has worked with TU and NMFS to improve coho salmon habitat, by replacing large culverts at John Smith Creek and conducting road upgrades.
- Mendocino County RCD and NRCS continue to work with private landowners to conduct road upgrade and sediment reduction projects throughout the watershed. Also, these agencies work with landowners to conduct stream improvement projects, such as riparian planting, and bank protection projects.

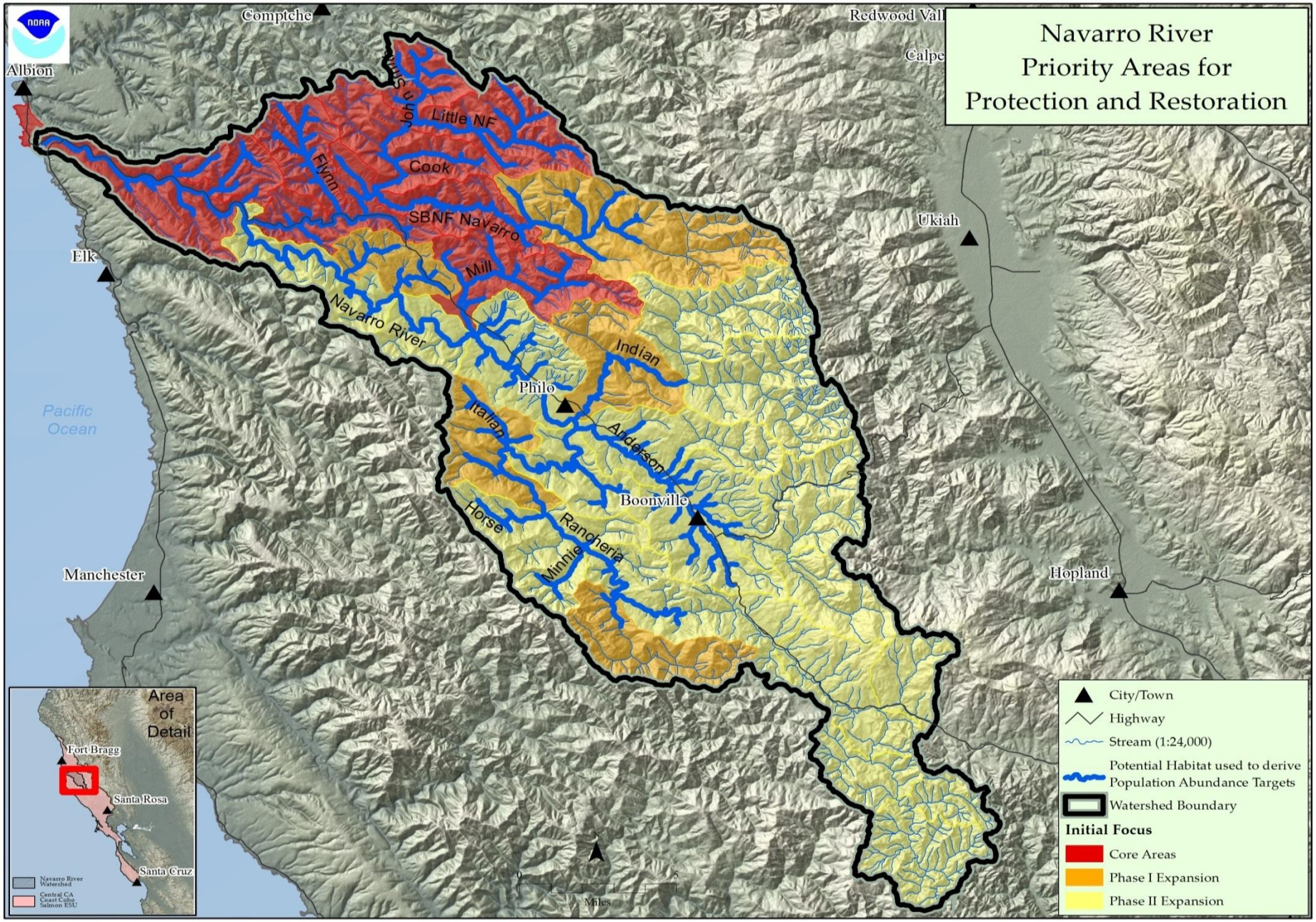


Figure 1: Map of Navarro River

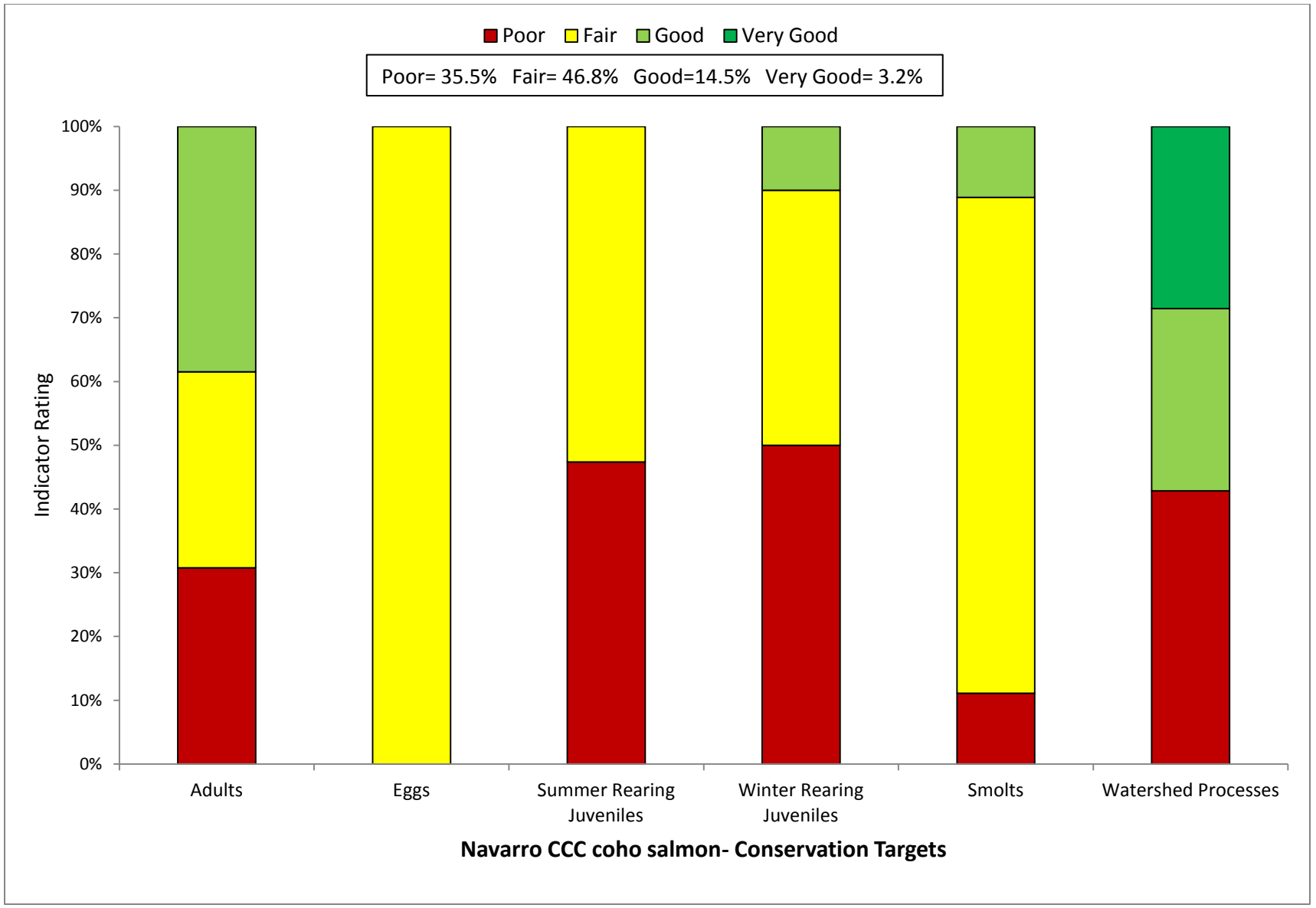


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Navarro River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4.44 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0.91 Key Pieces/100 meters)**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**53 % of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**17 % of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**88% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**≤39% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**57% streams; 56% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**8% streams; 14% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**<50% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**22% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =51-75**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =51-75**	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**1.59 Diversions/10 IP km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**50% of IP-km to 74% of IP-km accessible**	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**50% to 74% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**≤39% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)**	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**21% of streams/ IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**16% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**50% of IP-km to 74% of IP-km accessible**	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**≤39% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**50% to 74% of streams/ IP-km (>80 stream average)**	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.11 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =51-75**	Fair	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**50-74% IP-km (>6 and <16 C)**	Fair	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.165% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**1.51% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**25-15% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**8-11% of watershed >1 unit/20 acres**	Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**<25% Historical Species Composition**	Poor	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**>3 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**>1 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Navarro River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Low	Medium	Medium	Low	Medium	Medium
2	Channel Modification	Medium	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition	Medium	-	Medium	-	-	-	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	Medium	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Medium	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Low	High	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	-	-	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	High	High
14	Water Diversion and Impoundments	Medium	Low	High	Medium	Medium	Medium	Medium
Threat Status for Targets and Project		Medium	Medium	High	Medium	Medium	High	High

Cental CA Coast Coho Salmon ~ Navarro River

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

No species-specific actions were developed.

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas, and develop restoration action plans.

2.1.1.2. **Action Step:** Evaluate Highway 128 and associated crossings with focus on the segment from the North Fork Navarro Bridge to Barton Gulch. Many crossing may need to be modified to provide access to historical floodplain habitats.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Focus on tributaries of Flynn Creek, North Fork Navarro, South Branch Navarro, and Mill Creek.

3.1.1.2. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.1.3. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004). Maintain large debris accumulations along Highway 128 on the North Fork Navarro.

3.1.2. **Recovery Action:** Improve frequency of primary pools, and shelter ratings.

3.1.2.1. **Action Step:** Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.

3.1.3. **Recovery Action:** Improve pool/riffle/flatwater ratios (hydraulic diversity)

3.1.3.1. **Action Step:** Increase the frequencies to 75% of the streams within the watershed

4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Assess and map water diversions (CDFG 2004). Focus initial efforts in Core and Phase I watersheds. Expand efforts to Phase II watersheds upon completion of Core and Phase I evaluation.

4.1.1.2. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.1.1.3. **Action Step:** Require streamflow gauging devices to determine the level of impairment to natural flow. Focus initial efforts on Mill Creek, Flynn Creek, and North Fork Navarro.

4.1.1.4. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water uses. Focus efforts along Rancheria Creek, Mill Creek, and tributaries along the mainstem Navarro River above the North Fork. Tributaries such as Floodgate Creek and Perry Gulch and other small tributaries need water use evaluated.

4.1.1.5. **Action Step:** Work with SWRCB and landowners to purchase water rights that would improve and protect over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently or have potential to be impacted by water use.

4.1.1.6. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and §1707 (CDFG 2004).

4.1.1.7. **Action Step:** Support a water conservation program for rural residential water users within the Navarro River watershed.

4.1.2. **Recovery Action:** Improve passage flows

4.1.2.1. **Action Step:** Develop BMP's (such as off-channel storage) for landowners conducting water diversion actions.

4.1.2.2. **Action Step:** Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Modify or remove physical passage barriers

6.1.1.1. **Action Step:** Restore passage in high priority areas of the Navarro watershed as identified by the Mendocino RCD, MRC, the County of Mendocino, Caltrans (HWY 128), and existing fish passage databases.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover and species composition

8.1.1.1. **Action Step:** Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream). Focus efforts along Anderson Creek and its tributaries, and affected areas of the Indian and Rancheria creek watersheds.

8.1.1.2. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Work cooperatively with land trusts, and Mendocino RCD to establish conservation easements, setbacks, and riparian buffers on industrial timberland, agricultural, and rangeland within Core and Phase 1 subbasins.

8.1.1.3. **Action Step:** Continue removal of Arundo located in the upper reaches of Rancheria Creek to stop infestation of downstream areas.

8.1.1.4. **Action Step:** Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.

8.1.1.5. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Address high and medium priority sediment delivery sites as identified by the Mendocino RCD, Mendocino Redwoods Company, or other credible assessments.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.1.1. **Recovery Action:** Increase spawner density

10.1.1.1. **Action Step:** Implement action steps from Fishing/Collecting threats

10.1.2. **Recovery Action:** Increase abundance

10.1.2.1. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.

10.1.3. **Recovery Action:** Increase spatial structure and diversity

10.1.3.1. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species range or habitat

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Work with local RCD and NRCS representatives to determine stream reaches appropriate for riparian planting projects.

11.1.1.2. **Action Step:** Implement actions from Riparian action steps section.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

12.1.1. **Recovery Action:** Address the inadequacy of existing regulatory mechanisms

12.1.1.1. **Action Step:** Coordinate with the agencies to minimize conversion of range and forestland in Core and Phase 1 watersheds.

12.1.1.2. **Action Step:** Promote off-channel storage to reduce impacts of water diversion during the spring and summer (e.g. diversion during winter high flow).

12.1.1.3. **Action Step:** The State and Mendocino County should impose a moratorium on conversion of open space, rangeland, or TPZ to vineyards or other agricultural uses that impact salmonids until a grading ordinance and land conversion ordinance are in place.

12.1.1.4. **Action Step:** Investigate the potential to provide bypass flow from agricultural storage during critical low flow period of August through October.

12.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

12.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity).

12.2.1.1. **Action Step:** Develop a Road Sediment Reduction Plan for agricultural lands that prioritizes problem sites and outlines implementation and a timeline of necessary actions.

12.2.1.2. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

12.2.1.3. **Action Step:** Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.

12.2.1.4. **Action Step:** Continue implementation of the NRCS/RCD coordinated permit program for fishery restoration practices.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** NMFS and CDFG will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.

16.1.1.2. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties. Discontinue using the Russian River at Guerneville gauging station and replace with the Navarro River USGS gauging station (11468000) to reflect hydrologic conditions for coastal streams.

16.1.1.3. **Action Step:** Reduce poaching of adult coho salmon by increasing law enforcement.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent increased landscape disturbance

19.1.1.1. **Action Step:** Should large tracts of forestlands within any watershed identified as a priority in this recovery plan become available for purchase, the Federal Government, State of California, or other entities should consider purchasing the area as a conservation area.

19.1.1.2. **Action Step:** Increase size of Navarro River Redwoods State Park if opportunities arise. At the minimum purchase or develop conservation easement on lower tributaries and associated riparian areas, including important coho salmon tributaries such as Flynn Creek.

19.1.1.3. **Action Step:** Areas adjacent to currently owned State parks or forestlands supporting Core, Phase I and Phase II priority areas should be considered for purchase (if feasible within the next 5 years).

19.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.2.1. **Action Step:** Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.

19.1.2.2. **Action Step:** New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.

19.1.2.3. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

19.1.2.4. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.3. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.3.1. **Action Step:** Explore acquisition or conservation easements from willing land-owners.

19.1.3.2. **Action Step:** Allow trees in riparian areas to age, die, and recruit into the stream naturally.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Assign NMFS staff to conduct THP reviews in Navarro River watershed Core areas.

19.2.1.2. **Action Step:** Work with the California Board of Forestry to design and implement a program of BMPs for logging areas that meets the approval of NMFS and CDFG.

19.2.1.3. **Action Step:** Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.4. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Restoration projects that upgrade or decommission high risk roads in Core areas should be considered a high priority for funding (e.g., PCSRF). Where no Core areas are designated, apply this action to Phase I areas.

23.1.1.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction maintenance management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.3. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.1.1.4. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.5. **Action Step:** Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.1.1.6. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.

24.1.1.2. **Action Step:** Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.

24.1.1.3. **Action Step:** Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.

24.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

24.1.2.1. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.2.2. **Action Step:** New development in all historic CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.

24.1.2.3. **Action Step:** Coordinate with county planners to eliminate or reduce new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historic CCC coho salmon watersheds.

24.1.2.4. **Action Step:** Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Abate the threat contribution to HYDROLOGY.

25.1.1. **Recovery Action:** Address the inadequacy of existing regulatory mechanisms

25.1.1.1. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

25.1.1.2. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

25.1.1.3. **Action Step:** Work with CDFG during the 1600 permit process to re-establish natural flow regimes to improve adult migration to spawning habitats and smolt outmigration. Develop bypass flow plans for ponds and reservoirs to reduce the potential for impacts to fall flows that may inhibit adult coho passage.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

25.2.1. **Recovery Action:** Improve flow conditions (instantaneous conditions)

25.2.1.1. **Action Step:** Work with SWRCB and landowners to restore and maintain the natural hydrograph between March 1 and May 15 to minimize impacts to coho fry due to stranding by implementing alternative frost protection strategies.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Navarro River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
NaR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
NaR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas, and develop restoration action plans.	3	5	CDFG, Private Consultants, Private Landowners	253.00					253	Cost based on treating 7 miles of High IP (assume 1 project per mile in 25% high IP) at a rate of $36,046/mile.
NaR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Evaluate Highway 128 and associated crossings with focus on the segment from the North Fork Navarro Bridge to Barton Gulch. Many crossing may need to be modified to provide access to historical floodplain habitats.	1	1	CalTrans, CDFG, NOAA RC	1,587					1,587	Cost to evaluate existing passage database and plan restoration of culvert crossings on Hwy128. Cost to treat 8 crossings at a rate of $198,400/crossing would total $1,587,200. Costs should be lower if minor modifications are needed at each crossing.
NaR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NaR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
NaR-CCC-3.1.1.1	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Focus on tributaries of Flynn Creek, North Fork Navarro, South Branch Navarro, and Mill Creek.	1	10	CDFG, NOAA RC, NRCS, Private Landowners	625	625				1,250	Cost based on treating 50 miles at a rate of $25,000/mile. Based on an estimate of 50 miles in the next 10 years at 20k for Core and Phase 1 areas.
NaR-CCC-3.1.1.2	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	20							In-Kind	
NaR-CCC-3.1.1.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004). Maintain large debris accumulations along Highway 128 on the North Fork Navarro.	2	50							In-Kind	
NaR-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, and shelter ratings.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-3.1.2.1	Action Step	Habitat Complexity	Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core areas first followed by Phase I areas.	2	10	Campbell Timberland Management, CDFG, Private Landowners	56.00	56.00				112	These data would be most effective if combined into a central repository and restoration projects were prioritized according to highest restoration priority. Cost for fish/habitat monitoring is estimated at $111,192/project.
NaR-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
NaR-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase the frequencies to 75% of the streams within the watershed	2	20	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners						TBD	Cost should be accounted for in increase LWD frequency and primary pools.
NaR-CCC-4.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
NaR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
NaR-CCC-4.1.1.1	Action Step	Hydrology	Assess and map water diversions (CDFG 2004). Focus initial efforts in Core and Phase I watersheds. Expand efforts to Phase II watersheds upon completion of Core and Phase I evaluation.	2	5	Private Consultants, Private Landowners, SWRCB						TBD	Estimate based on landowner cooperation to assess diversion sites.
NaR-CCC-4.1.1.2	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFG, Mendocino County, NMFS, NOAA RC, Private Consultants, Private Landowners, SWRCB						In-Kind	
NaR-CCC-4.1.1.3	Action Step	Hydrology	Require streamflow gauging devices to determine the level of impairment to natural flow. Focus initial efforts on Mill Creek, Flynn Creek, and North Fork Navarro.	3	5	Private Landowners, SWRCB, USGS	3.00					3	Cost for stream flow gauges estimated at $1,000/gauge. Cost does not account for maintenance or data management.
NaR-CCC-4.1.1.4	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses. Focus efforts along Rancheria Creek, Mill Creek, and tributaries along the mainstem Navarro River above the North Fork. Tributaries such as Floodgate Creek and Perry Gulch and other small tributaries need water use evaluated.	1	5	CDFG, CDFG Law Enforcement, NMFS OLE, SWRCB	63.00					63	Cost for stream flow model estimated at $63,005/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-4.1.1.5	Action Step	Hydrology	Work with SWRCB and landowners to purchase water rights that would improve and protect over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently or have potential to be impacted by water use.	1	20	CDFG, FishNet 4C, NOAA RC, Private Landowners, SWRCB						TBD	Costs for acquisition of water rights and developing alternatives will need to be developed. Cost of water is reported to average 500 dollars or more per acre foot (Sunding and Zwane 2004).
NaR-CCC-4.1.1.6	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water rights to instream use via petition change of use and §1707 (CDFG 2004).	1	20	CDFG, FishNet 4C, NOAA RC, Private Landowners, RCD, SWRCB						TBD	Number of water rights holders willing to participate is unknown at this time.
NaR-CCC-4.1.1.7	Action Step	Hydrology	Support a water conservation program for rural residential water users within the Navarro River watershed.	3	50							In-Kind	
NaR-CCC-4.1.2	Recovery Action	Hydrology	Improve passage flows										
NaR-CCC-4.1.2.1	Action Step	Hydrology	Develop BMP's (such as off-channel storage) for landowners conducting water diversion actions.	1	20	NMFS HCD, NRCS, Private Landowners, SWRCB						TBD	Total cost for basin will need additional analysis. Cost per landowner is estimated to be 10-50k.
NaR-CCC-4.1.2.2	Action Step	Hydrology	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	2	10	CDFG, NMFS, Private Landowners, SWRCB						In-Kind	
NaR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NaR-CCC-6.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
NaR-CCC-6.1.1.1	Action Step	Passage	Restore passage in high priority areas of the Navarro watershed as identified by the Mendocino RCD, MRC, the County of Mendocino, Caltrans (HWY 128), and existing fish passage databases.	1	10		800	800				1,600	Cost based on treating 8 barriers in high IP at a rate of $198,400/barrier. Cost may be less depending on updated database.
NaR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NaR-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover and species composition										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-8.1.1.1	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream). Focus efforts along Anderson Creek and its tributaries, and affected areas of the Indian and Rancheria creek watersheds.	2	10	CDFG, NOAA RC, Private Landowners, RCD	47.00	47.00				94	Cost based on treating 5 miles at a rate of $18,760/mile.
NaR-CCC-8.1.1.2	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004). Work cooperatively with land trusts, and Mendocino RCD to establish conservation easements, setbacks, and riparian buffers on industrial timberland, agricultural, and rangeland within Core and Phase 1 subbasins.	3	20	CA Coastal Commission, California Coastal Conservancy, CDFG, NOAA RC, NRCS, Private Landowners, State Parks							
NaR-CCC-8.1.1.3	Action Step	Riparian	Continue removal of Arundo located in the upper reaches of Rancheria Creek to stop infestation of downstream areas.	2	10	CDFG, NOAA RC, Private Landowners, RCD	97.00	97.00				194	Cost based on treating 5 acres at a rate of $38,690/acre.
NaR-CCC-8.1.1.4	Action Step	Riparian	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel.			CalFire, Mendocino County, Mendocino Redwood Company, NRCS, Private Landowners, RCD							
NaR-CCC-8.1.1.5	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	3	20							In-Kind	
NaR-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
NaR-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	30	CDFG, NMFS, NOAA RC, RCD						TBD	Cost likely accounted for in above action steps.
NaR-CCC-8.1.2.2	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.	2	20	CDFG, NMFS, NOAA RC, Private Landowners, RCD						TBD	Cost accounted for in above action steps.
NaR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
NaR-CCC-9.1.1.1	Action Step	Sediment	Address high and medium priority sediment delivery sites as identified by the Mendocino RCD, Mendocino Redwoods Company, or other credible assessments.	1	20	CDFG, Mendocino Redwood Company, Private Landowners, RCD						TBD	More information is needed for large projects such as large slides and landings.
NaR-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
NaR-CCC-10.1.1	Recovery Action	Viability	Increase spawner density										
NaR-CCC-10.1.1.1	Action Step	Viability	Implement action steps from Fishing/Collecting threats										
NaR-CCC-10.1.2	Recovery Action	Viability	Increase abundance										
NaR-CCC-10.1.2.1	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.	1	10							TBD	
NaR-CCC-10.1.3	Recovery Action	Viability	Increase spatial structure and diversity										
NaR-CCC-10.1.3.1	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, NMFS, NOAA RC						In-Kind	Inter-agency coordination will continue as part of doing business to rescue juvenile coho salmon until habitat conditions are restored to prevent imminent risk of stranding and mortality.
NaR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species range or habitat**										
NaR-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
NaR-CCC-11.1.1.1	Action Step	Water Quality	Work with local RCD and NRCS representatives to determine stream reaches appropriate for riparian planting projects.	2	30							In-Kind	
NaR-CCC-11.1.1.2	Action Step	Water Quality	Implement actions from Riparian action steps section.										
NaR-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-12.1.1	Recovery Action	Agricultural Practices	Address the inadequacy of existing regulatory mechanisms										
NaR-CCC-12.1.1.1	Action Step	Agricultural Practices	Coordinate with the agencies to minimize conversion of range and forestland in Core and Phase 1 watersheds.	2	50							In-Kind	
NaR-CCC-12.1.1.2	Action Step	Agricultural Practices	Promote off-channel storage to reduce impacts of water diversion during the spring and summer (e.g. diversion during winter high flow).	1	10	CDFG, NMFS HCD, Private Landowners, SWRCB						TBD	Cost of implementing is unknown at this time. An analysis focusing on the amount of off-channel storage to provide improved spring and summer flows needs to be conducted prior to implementing. Participating landowners and water users could initiate prior to analysis being completed.
NaR-CCC-12.1.1.3	Action Step	Agricultural Practices	The State and Mendocino County should impose a moratorium on conversion of open space, rangeland, or TPZ to vineyards or other agricultural uses that impact salmonids until a grading ordinance and land conversion ordinance are in place.	1	60	Farm Bureau, Private Consultants, Private Landowners						In-Kind	Cost to minimize or halt future agricultural development are considered cost of doing business.
NaR-CCC-12.1.1.4	Action Step	Agricultural Practices	Investigate the potential to provide bypass flow from agricultural storage during critical low flow period of August through October.	2	20							TBD	
NaR-CCC-12.2	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NaR-CCC-12.2.1	Recovery Action	Agricultural Practices	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity).	2	40	CDFG, Farm Bureau, NMFS HCD, Private Landowners						TBD	Cost of implementing BMPs to agriculture producers is not known at this time. The cost BMPs for reducing sediment production, riparian protection, and water use will need to be determined.
NaR-CCC-12.2.1.1	Action Step	Agricultural Practices	Develop a Road Sediment Reduction Plan for agricultural lands that prioritizes problem sites and outlines implementation and a timeline of necessary actions.	2	10	Private Consultants, Private Landowners						TBD	
NaR-CCC-12.2.1.2	Action Step	Agricultural Practices	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	10	Board of Forestry, CDFG, Farm Bureau, NMFS, Private Landowners	394.00	394.00				788	Cost base on road inventory of 550 miles (assume 25% of road network) estimated at $927/mile and sediment assessment (assume 10% of road network) estimated at $1,385/mile.
NaR-CCC-12.2.1.3	Action Step	Agricultural Practices	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	2	10	Farm Bureau, NMFS, Private Consultants, Private Landowners							Cost accounted for in above action step.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-12.2.1.4	Action Step	Agricultural Practices	Continue implementation of the NRCS/RCD coordinated permit program for fishery restoration practices.	2	30							In-Kind	
NaR-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
NaR-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
NaR-CCC-16.1.1.1	Action Step	Fishing/Collecting	NMFS and CDFG will work to improve the California Freshwater Sport Fishing Regulations to minimize take of adult salmonids.	2	30	CDFG, NMFS, Public						In-Kind	
NaR-CCC-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Mendocino, Sonoma, and Marin counties. Discontinue using the Russian River at Guerneville gauging station and replace with the Navarro River USGS gauging station (11468000) to reflect hydrologic conditions for coastal streams.	2	20							In-Kind	
NaR-CCC-16.1.1.3	Action Step	Fishing/Collecting	Reduce poaching of adult coho salmon by increasing law enforcement.	2	20							TBD	Cost are difficult to determine because of availability of increased law enforcement.
NaR-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**	**3**	**60**	**California Coastal Conservancy, Private Landowners, State Parks**						**TBD**	**Cost would be millions for purchase and operation of additional land held by the State or other entity.**
NaR-CCC-19.1.1	Recovery Action	Logging	Prevent increased landscape disturbance										
NaR-CCC-19.1.1.1	Action Step	Logging	Should large tracts of forestlands within any watershed identified as a priority in this recovery plan become available for purchase, the Federal Government, State of California, or other entities should consider purchasing the area as a conservation area.	3		BLM, CDFG, Redwood Forest Foundation						TBD	Will vary with specific tract and current market value.
NaR-CCC-19.1.1.2	Action Step	Logging	Increase size of Navarro River Redwoods State Park if opportunities arise. At the minimum purchase or develop conservation easement on lower tributaries and associated riparian areas, including important coho salmon tributaries such as Flynn Creek.	1	20	Mendocino Redwood Company, Private Landowners, State Parks						TBD	Cost to acquire parcels cannot be determined due to fluctuations in market value and rate of turnover.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-19.1.1.3	Action Step	Logging	Areas adjacent to currently owned State parks or forestlands supporting Core, Phase I and Phase II priority areas should be considered for purchase (if feasible within the next 5 years).	3	30							TBD	
NaR-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
NaR-CCC-19.1.2.1	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	1	60	CalFire, CDFG, NMFS, Private Landowners, RWQCB						TBD	See roads and sediment actions.
NaR-CCC-19.1.2.2	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	1	40	CalFire, CDFG, NRCS, Private Landowners						TBD	Cost are estimated in sediment reduction actions and roads actions.
NaR-CCC-19.1.2.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	60	CalFire, CDFG, Private Consultants, Private Landowners, RWQCB						In-Kind	These action occur now in CA THP process, therefore cost is expected to be minimal.
NaR-CCC-19.1.2.4	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	60	Private Landowners						In-Kind	Additional cost of retaining trees is not know at this time. Landowners need to estimate timber volumes that would be lost.
NaR-CCC-19.1.3	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
NaR-CCC-19.1.3.1	Action Step	Logging	Explore acquisition or conservation easements from willing land-owners.	3	20	Private Consultants, Private Landowners						TBD	Cost difficult to determine because of fair market value and rate of turnover.
NaR-CCC-19.1.3.2	Action Step	Logging	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	60	Board of Forestry, CalFire, Mendocino County, Mendocino Redwood Company, Private Landowners							
NaR-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
NaR-CCC-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews in Navarro River watershed Core areas.	2	50							In-Kind	
NaR-CCC-19.2.1.2	Action Step	Logging	Work with the California Board of Forestry to design and implement a program of BMPs for logging areas that meets the approval of NMFS and CDFG.	1	3	CalFire, NMFS, NMFS OLE, Private Landowners, RWQCB						In-Kind	
NaR-CCC-19.2.1.3	Action Step	Logging	Discourage Counties from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	20	CDFG, Mendocino County, NMFS PRD, RWQCB, State Parks						In-Kind	
NaR-CCC-19.2.1.4	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	60	CalFire, Mendocino County, NMFS, Private Landowners						In-Kind	
NaR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NaR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
NaR-CCC-23.1.1.1	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in Core areas should be considered a high priority for funding (e.g., PCSRF). Where no Core areas are designated, apply this action to Phase I areas.	1	10	CDFG, Mendocino County, Mendocino Redwood Company, NOAA RC, Private Landowners	630	630				1,260	Cost based on decommissioning 105 miles of riparian road network at a rate of $12,000/mile. If roads were upgraded only, cost would equal $2,205,000
NaR-CCC-23.1.1.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply best management practices for road construction maintenance management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	10	CDFG, Mendocino County Department of Public Works, Mendocino Redwood Company, NOAA RC, NRCS, Private Landowners, Public, RCD	2,100	2,100				4,200	Cost based on treating 200 miles of road at a rate of $21,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	5	CDFG, NOAA RC, Private Landowners, RCD						TBD	Cost accounted for in road and sediment assessment.
NaR-CCC-23.1.1.4	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	20							In-Kind	
NaR-CCC-23.1.1.5	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	30							In-Kind	
NaR-CCC-23.1.1.6	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	30								Cost accounted for in restoration projects that upgrade or decommission riparian roads.
NaR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**	**1**		**CalFire, California Geological Survey, CalTrans, CDFG, Mendocino Redwood Company, NRCS, Private Landowners, Public, RCD, RWQCB**							
NaR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
NaR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	2	60	Mendocino County, NOAA RC, Private Landowners, Public, SWRCB						TBD	An analysis of critical flow levels is needed to determine amount of water to determine extent of reduced in water consumption
NaR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	2	60	CDFG, NMFS, NMFS OLE, Private Landowners, SWRCB						TBD	Cost of providing bypass flow can not be estimated without further analysis.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	2	20	NOAA RC, Private Landowners, USACE						In-Kind	
NaR-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)	3	20	CDFG, Mendocino County, NMFS, RWQCB						TBD	Additional analysis needed to determine cost of modifying regulations at various levels.
NaR-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	60	Board of Forestry, CalFire, CDFG, Mendocino County, Private Landowners						TBD	Cost of protecting high risk areas is unknown at this time.
NaR-CCC-24.1.2.2	Action Step	Severe Weather Patterns	New development in all historic CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.	2	60							In-Kind	
NaR-CCC-24.1.2.3	Action Step	Severe Weather Patterns	Coordinate with county planners to eliminate or reduce new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historic CCC coho salmon watersheds.	2	50							In-Kind	
NaR-CCC-24.1.2.4	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.	2	50							In-Kind	
NaR-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Abate the threat contribution to HYDROLOGY.**										
NaR-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Address the inadequacy of existing regulatory mechanisms										
NaR-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	20							In-Kind	
NaR-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	2	20							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NaR-CCC-25.1.1.3	Action Step	Water Diversion/Impoundment	Work with CDFG during the 1600 permit process to re-establish natural flow regimes to improve adult migration to spawning habitats and smolt outmigration. Develop bypass flow plans for ponds and reservoirs to reduce the potential for impacts to fall flows that may inhibit adult coho passage.	2	30							In-Kind	
NaR-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**										
NaR-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Improve flow conditions (instantaneous conditions)										
NaR-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Work with SWRCB and landowners to restore and maintain the natural hydrograph between March 1 and May 15 to minimize impacts to coho fry due to stranding by implementing alternative frost protection strategies.	2	10							In-Kind	

Noyo River

Location	•Mendocino County
Watershed Area	• 113.0 Square Miles
Potential Habitat	• 127.0 Stream Miles
Vegetation	• 71% Coniferous, 29% Riparian or Montane Forest
Erodability	•Moderate to High
Ownership Patterns	•81% Private; 19% Public
Dominant Land Uses	•Timber
Housing Density	•Moderate
TMDL Pollutants	•Sediment, Temperature

Noyo River harbor
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Noyo River Coho Salmon: Present – moderate abundance

Recovery Goals

✓Continue CDFG counts at life cycle station (longest running in the ESU)on South Fork Noyo River

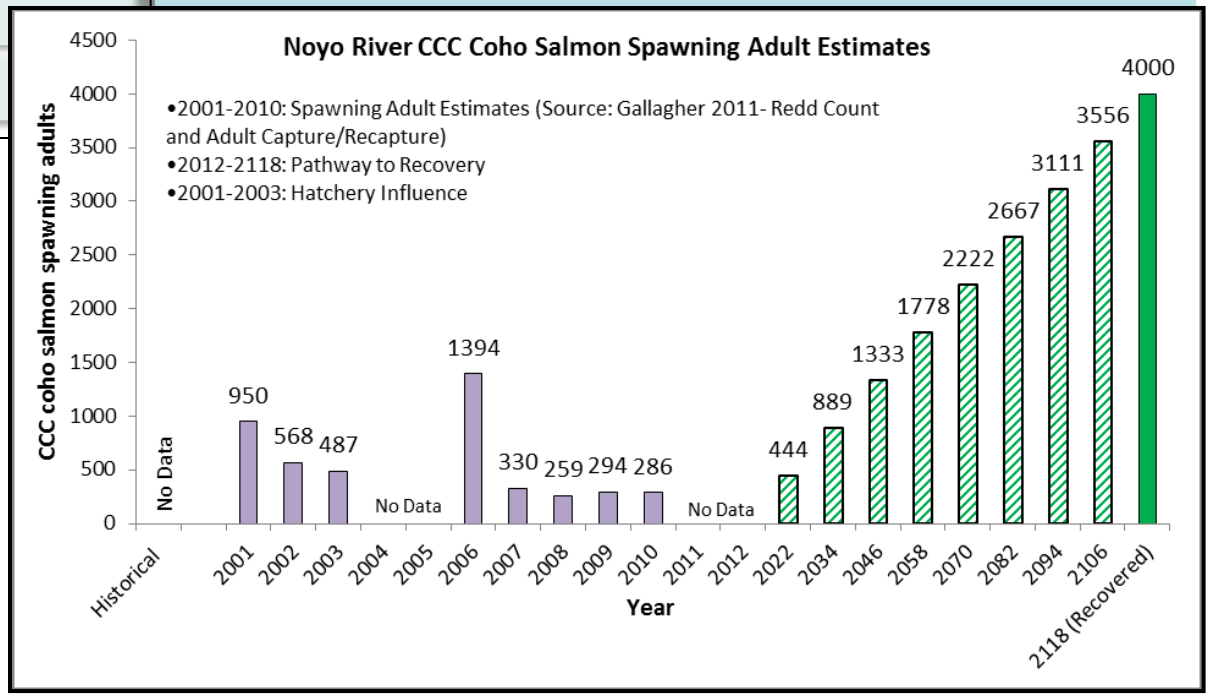
✓ Continue juvenile monitoring efforts

Noyo River
Adult Spawner Targets

Downlisting to Threatened
2,000

Recovery
4,000

STEELHEAD: YES
CHINOOK SALMON: YES



Noyo River

Potential Habitat: 127.0 miles
Recovery Target: 4,000 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	GOOD	GOOD	FAIR	FAIR	POOR	FAIR	FAIR	FAIR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Install large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth
- Promote passive diversion devices designed to allow diversion of water only when minimum streamflow is met
- Treat high priority slides and landings

Priority 2 & 3: Long-Term Restoration Actions

- Work with the California Western Railroad to stop removal of LWD from stream channels
- Promote off-channel storage in the upper watershed
- Improve canopy cover
- Identify locations, develop and maintain sediment catchment basins
- Implement a monitoring program

Campbell Timberland Management LLC

Noyo Watershed Alliance, Fort Bragg, California

Recovery Partners

Jackson Demonstration State Forest

Resources Agency California Department Fish & Game

Mendocino

California Department of Forestry & Fire Protection CAL FIRE Since 1885

Photo Courtesy from left to right: Campbell Timberland, Gualala River Watershed Council, Campbell Timberland, KRIS Information System and Morgan Bond, SWFSC.

Noyo River

Potential Habitat: 127.0 miles
Recovery Target: 4,000 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	LOW	MEDIUM	LOW	LOW	NA	LOW	HIGH	NA	LOW	LOW	MEDIUM	MEDIUM	LOW

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Design and implement a program of BMPs for road maintenance on private roads similar to the program for public roads
- Prevent increased landscape disturbance
- Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas

Priority 2 & 3: Long-Term Threat Abatement Actions

- Assign NMFS staff to conduct THP reviews of the highest priority areas within the watershed
- Limit winter use of unsurfaced roads and recreational trails

Passage impediment associated with a railroad crossing.
Photo courtesy of NMFS.

Conservation Highlights

- Noyo Watershed Alliance is working on sediment remediation associated with road
- CalFire, Jackson Demonstration State Forest, and Campbell Timberland Management have augmented habitat complexity by installing LWD
- Mendocino Redwood Company has undertaken sediment remediation projects
- CDFG is conducting coho salmon spawner surveys.

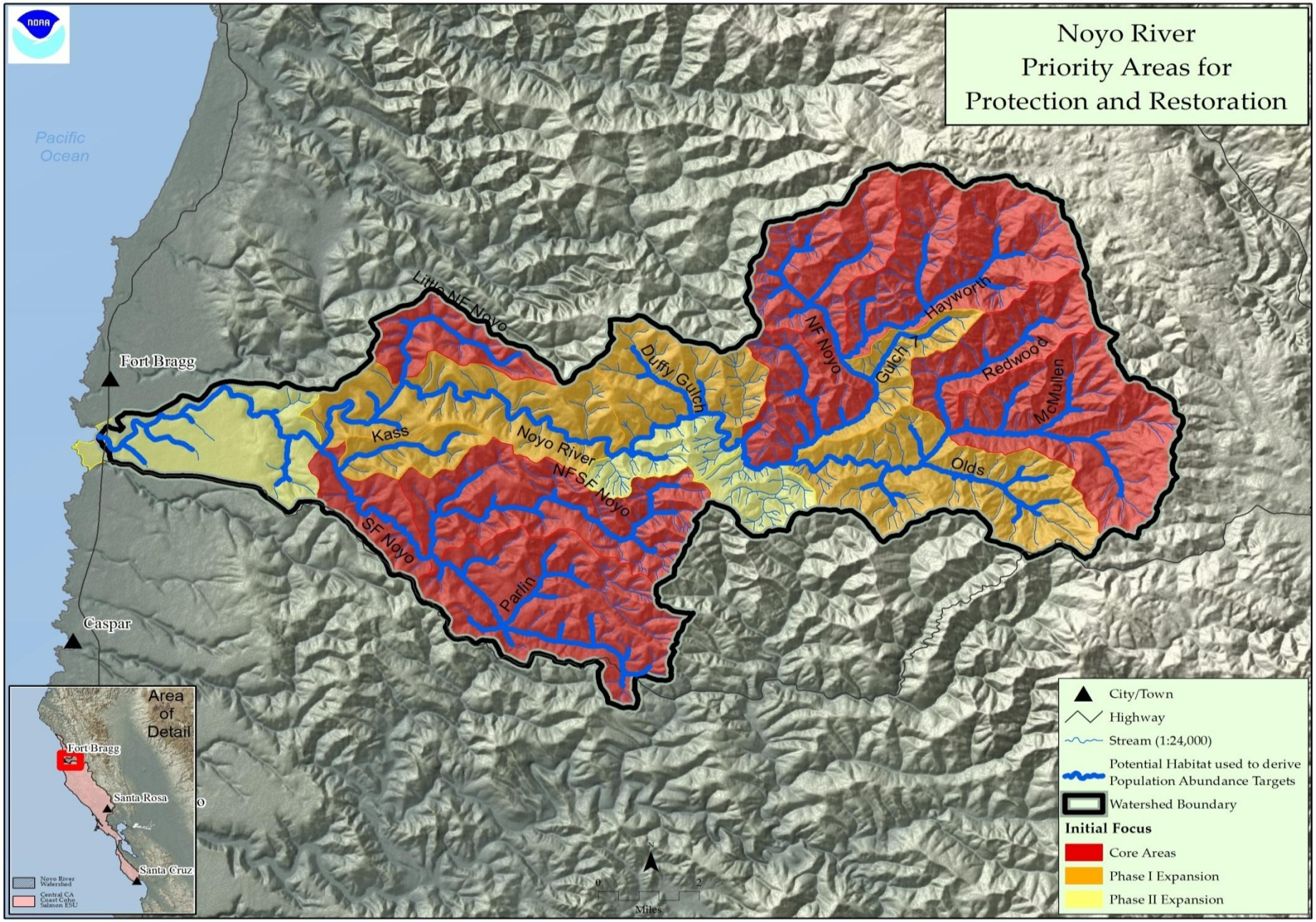


Figure 1: Map of Noyo River

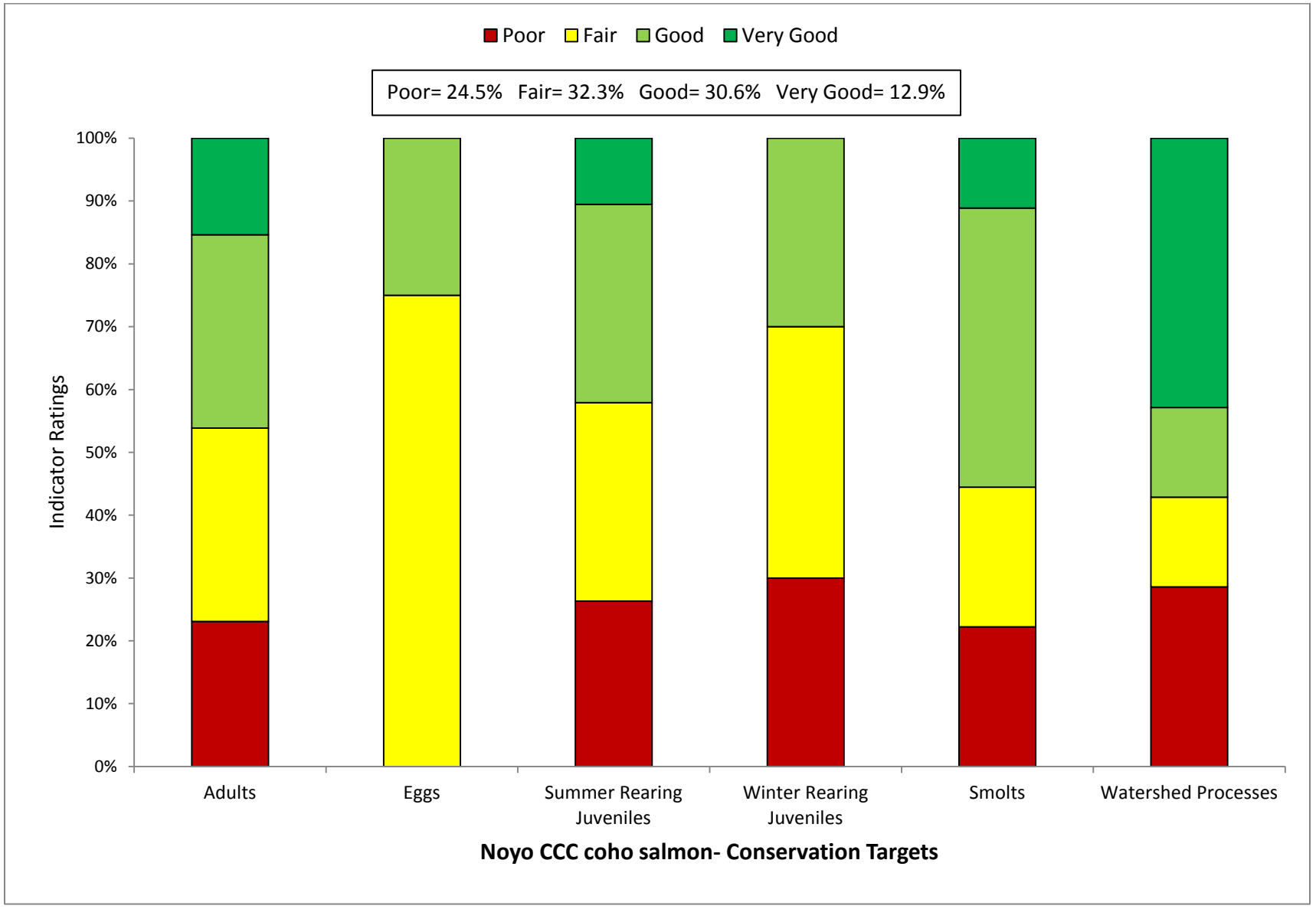


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Noyo River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**2.6 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**98.85% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**>1 spawner per IP-km to < low risk spawner density**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**38% streams; 65% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**14% streams; 31% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**59% streams 72% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**6% stream; 1% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =35-50**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.41 Diversions/10 IP km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**>90% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**>90% of streams/ IP-km (>70% average stream canopy; >85% where coho IP overlaps)**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40 - 54% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**<50% IP km (<20 C MWMT; <16 C MWMT where coho IP overlaps)**	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0.2 - 0.6 fish/meter^2**	Fair	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**>90% of Historical Range**	Very Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**71% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**6% stream; 1% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**75% of IP-km to 90% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**55 - 69% Class 5 & 6 across IP-km**	Good	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.059 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =35-50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.251 % of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.018% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**26-35% of Watershed in Timber Harvest**	Fair	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**<8% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**>3 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**>1 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Noyo River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Low	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Low	Low	Low	Low	Low
3	Disease, Predation and Competition	Medium	-	Medium	Low	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Low	Low
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Low	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	High	Medium	Medium	High	High
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Low	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	Medium	Medium	Low	High	Medium
13	Severe Weather Patterns	Medium	Medium	Medium	High	Low	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Low	Low	Low	Low	Low
Threat Status for Targets and Project		Medium	Medium	High	Medium	Medium	High	High

Central CA Coast Coho Salmon ~ Noyo River

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

No species-specific actions were developed.

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Delineate unconfined reaches possessing or having potential for winter rearing habitat restoration.

2.1.1.2. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.3. **Action Step:** Focus off-channel restoration actions in the lower mainstem Noyo River and Core areas and areas with high IP-km values (> 0.7).

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase LWD , primary pools and shelter ratings.

3.1.1.1. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.1.2. **Action Step:** Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information, where germane, from MRC Noyo Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFG stream habitat data to help determine reaches for LWD placement. Core areas of the South Fork Noyo, Little North Fork Noyo and Redwood Creek are priorities for restoration of LWD.

3.1.1.3. **Action Step:** Work with the railroad (California Western Railroad) to stop removal of LWD from the Noyo River.

3.1.1.4. **Action Step:** Develop and implement LWD projects in the Noyo River watershed using guidance from Albin (2006), Noyo River Watershed Enhancement Plan, or other credible watershed assessments.

3.1.1.5. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.

4.1.1.2. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

4.1.1.3. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.1.1.4. **Action Step:** Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers. Work with the City of Fort Bragg and private landowners in the upper watershed to reduce diversion during the low flow summer period.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Modify or remove physical passage barriers

6.1.1.1. **Action Step:** Assess and restore passage at barriers associated with the California Western Railroad.

6.1.1.2. **Action Step:** Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Treat high priority slides and landings identified in the MRC Noyo River Watershed Analysis or the Jackson Demonstration State Forest Road Management Plan.

9.1.1.2. **Action Step:** NMFS and other landowners will work with RCD or NRCS to encourage sediment reduction assessments (first for subwatersheds in Core areas, then for Phase I areas).

9.1.1.3. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Promote development of a life cycle station (Gallagher and Gallagher 2005). A likely location would be at the former egg taking station located on the South Fork Noyo River in the Jackson Demonstration State Forest.

10.1.1.2. **Action Step:** Continue and improve upon monitoring activities to determine the population status of salmonid adults and smolts in the mainstem and its tributaries.

10.1.2. **Recovery Action:** Increase abundance

10.1.2.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Implement actions to maintain and restore water temperatures to meet habitat requirements for CCC coho salmon in specific streams (CDFG 2004).

11.1.1.1. **Action Step:** Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.

11.1.1.2. **Action Step:** Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.

11.1.1.3. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

11.1.1.4. **Action Step:** Work with landowners to purchase easements on water rights to encourage the maintenance of surface flows.

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent increased landscape disturbance

19.1.1.1. **Action Step:** Complete comprehensive assessment/implementation of erosion control measures in the entire North Fork River basin (CDFG 2004).

19.1.1.2. **Action Step:** Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, and disconnected from the stream network as appropriate.

19.1.1.3. **Action Step:** New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.

19.1.1.4. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas within the Noyo River watershed.

19.2.1.2. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency of operations within Core, and Phase I CCC coho salmon areas.

19.2.1.3. **Action Step:** NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.

23.1.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.1.1.3. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.1.1.4. **Action Step:** Encourage County of Mendocino to address and adequately maintain the Sherwood Ridge Road. Encourage County of Mendocino to completely close and monitor gates and barriers during the winter period.

23.1.1.5. **Action Step:** Design and implement a program of BMPs for road maintenance on private roads similar to the program for public roads (Sommarstrom et al., 2002).

23.1.1.6. **Action Step:** Restoration projects that upgrade or decommission high risk roads in Core areas should be considered an extremely high priority for funding (e.g., PCSRF).

23.1.1.7. **Action Step:** Fully implement the Noyo River TMDL.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanism

23.2.1. **Recovery Action:** Prevent increased landscape disturbance

23.2.1.1. **Action Step:** Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.2.1.2. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.2.1.3. **Action Step:** Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.2.1.4. **Action Step:** Ensure all existing and new road and railway crossings minimize potential sediment delivery to the stream environment and allow upstream and downstream passage of adult and juvenile coho salmon.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology.

24.1.1.1. **Action Step:** Develop and implement critical flow levels for the mainstem Noyo River impacted by water diversions for the City of Fort Bragg.

24.1.1.2. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.

24.1.1.3. **Action Step:** Identify and work with water users to minimize depletion of summer base flows during drought years.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Noyo River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
NoR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
NoR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate unconfined reaches possessing or having potential for winter rearing habitat restoration.	2	3	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners	10.00					10	Rough estimate for consultant to use existing data and conduct some ground truthing.
NoR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners						In-Kind	
NoR-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Focus off-channel restoration actions in the lower mainstem Noyo River and Core areas and areas with high IP-km values (> 0.7).	2	10	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners	90.50	90.50				181	Cost based on treating 5 miles, with 1 project/mile in high IP, at a rate of $36,046/mile.
NoR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NoR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase LWD , primary pools and shelter ratings.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-3.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	60	Cal Western Railroad, CalFire, California Coastal Conservancy, California Department of Mines and Geology, Campbell Timberland Management, CDFG, City of Fort Bragg, Mendocino Redwood Company, NMFS, Private Landowners, RWQCB, USACE						0	There will be no cost when leaving remaining instream structures in place.
NoR-CCC-3.1.1.2	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Use information, where germane, from MRC Noyo Watershed Analysis to determine stream locations with high instream LWD demand, and utilize CDFG stream habitat data to help determine reaches for LWD placement. Core areas of the South Fork Noyo, Little North Fork Noyo and Redwood Creek are priorities for restoration of LWD.	1	10	Cal Western Railroad, CalFire, California Coastal Conservancy, Campbell Timberland Management, CDFG, City of Fort Bragg, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, NOAA RC, Pacific States Marine Fisheries Commission, Private Landowners, RWQCB, Trout Unlimited	62.50	62.50				125	Projects such as this are directly aimed at improving long-term survival for all freshwater lifestages of CCC coho salmon. Cost is based on treating 5 miles, assuming 50% of high IP, at a rate of $25,000/mile. If ELJ are used, total cost would be $505,600.
NoR-CCC-3.1.1.3	Action Step	Habitat Complexity	Work with the railroad (California Western Railroad) to stop removal of LWD from the Noyo River.	1	10	Cal Western Railroad, CDFG, NMFS PRD, NOAA RC						In-Kind	Cost of educating the railroad regarding the importance of large woody debris and their DFG 1600 program is expected to be part of conducting business.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-3.1.1.4	Action Step	Habitat Complexity	Develop and implement LWD projects in the Noyo River watershed using guidance from Albin (2006), Noyo River Watershed Enhancement Plan, or other credible watershed assessments.	2	10								Cost accounted for in install or enhance existing LWD, boulders or other instream features.
NoR-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	60	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners						In-Kind	
NoR-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NoR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
NoR-CCC-4.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.	2	60	CalFire, Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino Redwood Company, NOAA RC, Private Landowners						TBD	Cost difficult to determine based on landowner participation.
NoR-CCC-4.1.1.2	Action Step	Hydrology	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	1	60	Campbell Timberland Management, CDFG, Jackson Demonstration State Forest, Private Landowners, SWRCB						In-Kind	Need to work with private and large industrial timberland owners to develop water storage for summer needs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-4.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	2	20	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Consultants, Private Landowners						TBD	
NoR-CCC-4.1.1.4	Action Step	Hydrology	Encourage water conservation and the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers. Work with the City of Fort Bragg and private landowners in the upper watershed to reduce diversion during the low flow summer period.	3	20	City of Fort Bragg, County of Mendocino, NMFS PRD, SWRCB						TBD	
NoR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NoR-CCC-6.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
NoR-CCC-6.1.1.1	Action Step	Passage	Assess and restore passage at barriers associated with the California Western Railroad.	2	10	Cal Western Railroad, CDFG, Mendocino Redwood Company	362.00	362.00				724	Cost based on treating 1 barrier at a rate of $723,858/unit.
NoR-CCC-6.1.1.2	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	10	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners						In-Kind	
NoR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NoR-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-8.1.1.1	Action Step	Riparian	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	20		3,250	3,250	3,250	3,250		13,000	Cost based on treating 8 miles of high IP, at 80 acres/mile, at a rate of $20,057/acre.
NoR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
NoR-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
NoR-CCC-9.1.1.1	Action Step	Sediment	Treat high priority slides and landings identified in the MRC Noyo River Watershed Analysis or the Jackson Demonstration State Forest Road Management Plan.	1	5	CalFire, Campbell Timberland Management, Mendocino Redwood Company, Private Landowners						TBD	Cost difficult to estimate because assessments for the magnitude of the problem were not available. Additionally, many sediment sources in Core watersheds have been addressed, often through the timber harvest process and these costs should be considered an ongoing operation expense.
NoR-CCC-9.1.1.2	Action Step	Sediment	NMFS and other landowners will work with RCD or NRCS to encourage sediment reduction assessments (first for subwatersheds in Core areas, then for Phase I areas).	2	10	CalFire, Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners, RCD						In-Kind	Since majority of watershed is owned by private timber companies, much of the road network has likely been assessed.
NoR-CCC-9.1.1.3	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	2	60	CalFire, Campbell Timberland Management, Mendocino Redwood Company, Private Landowners	250.00	250.00	250.00	250.00	250.00	3,000	This infrastructure is likely present in many of the Noyo subwatersheds. Additional sites may be installed as part of the timber harvest plan process and the cost for construction will likely be absorbed on a harvest plan by harvest plan basis. Ongoing maintenance will likely occur as part of yearly evaluation prior to the winter period. Maintenance costs are estimated at $50,000/yr.
NoR-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NoR-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-10.1.1.1	Action Step	Viability	Promote development of a life cycle station (Gallagher and Gallagher 2005). A likely location would be at the former egg taking station located on the South Fork Noyo River in the Jackson Demonstration State Forest.	2	10	Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino Redwood Company, Private Landowners	117.50	117.50				235	Cost for a life cycle station estimated at $234,600/station. Cost does not account for maintenance or data management.
NoR-CCC-10.1.1.2	Action Step	Viability	Continue and improve upon monitoring activities to determine the population status of salmonid adults and smolts in the mainstem and its tributaries.	2	10	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NMFS PRD, Private Landowners	335.00	335.00				670	Cost for annual adult spawner ground surveys estimated at $16,650/year and smolt outmigration estimated at $50,300/year for N. Central Coast diversity stratum.
NoR-CCC-10.1.2	Recovery Action	Viability	Increase abundance										
NoR-CCC-10.1.2.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	Campbell Timberland Management, Jackson Demonstration State Forest, Mendocino Redwood Company, Private Landowners						In-Kind	Inter-agency coordination will continue as part of doing business to rescue juvenile coho salmon until habitat conditions are restored to prevent imminent risk of stranding and mortality.
NoR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NoR-CCC-11.1.1	Recovery Action	Water Quality	Implement actions to maintain and restore water temperatures to meet habitat requirements for CCC coho salmon in specific streams (CDFG 2004).										
NoR-CCC-11.1.1.1	Action Step	Water Quality	Implement riparian canopy projects in the Noyo River watershed using Albin (2006) as guidance. Tributaries to have riparian canopy restoration are: Hayshed Gulch, middle Noyo River, Duffy Gulch, Hayworth Creek, Olds Creek and its tributaries.	2	40	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners							Cost accounted for in riparian recovery actions.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-11.1.1.2	Action Step	Water Quality	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.	3	30	CalFire, Campbell Timberland Management, CDFG, Jackson Demonstration State Forest, Mendocino Redwood Company, NMFS, Private Landowners							Cost of this action step is likely covered through future THPs in the watershed.
NoR-CCC-11.1.1.3	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	2	20	Campbell Timberland Management, CDFG, Mendocino Land Trust, Mendocino Redwood Company, NMFS PRD, NOAA RC, NRCS, Private Landowners							
NoR-CCC-11.1.1.4	Action Step	Water Quality	Work with landowners to purchase easements on water rights to encourage the maintenance of surface flows.	3	20	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Private Landowners, SWRCB						TBD	
NoR-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
NoR-CCC-19.1.1	Recovery Action	Logging	Prevent increased landscape disturbance										
NoR-CCC-19.1.1.1	Action Step	Logging	Complete comprehensive assessment/implementation of erosion control measures in the entire North Fork River basin (CDFG 2004).	2	5	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NOAA RC, Trout Unlimited	30.00					30	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-19.1.1.2	Action Step	Logging	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, and disconnected from the stream network as appropriate.	2	40	Campbell Timberland Management, CDFG, Mendocino Redwood Company, NMFS PRD, NOAA RC, Private Consultants, Private Landowners						In-Kind	
NoR-CCC-19.1.1.3	Action Step	Logging	New THPs should identify problematic legacy roads within WLPZ's, decommission them, and revegetate the area with appropriate native species.	1	10	CalFire, CDFG, Mendocino Redwood Company, Private Consultants, Private Landowners, Trout Unlimited						In-Kind	
NoR-CCC-19.1.1.4	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	Board of Forestry, CalFire, CDFG, Mendocino Redwood Company, NMFS PRD, Private Consultants						In-Kind	
NoR-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
NoR-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
NoR-CCC-19.2.1.1	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas within the Noyo River watershed.	1	60	CalFire, CDFG, Mendocino County, NMFS PRD, RWQCB						In-Kind	Discouraging incompatible land uses can likely be done through existing regulatory channels utilizing staff time.
NoR-CCC-19.2.1.2	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency of operations within Core, and Phase I CCC coho salmon areas.	2	40	Board of Forestry, CalFire, Mendocino Redwood Company, NMFS PRD, Private Consultants						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-19.2.1.3	Action Step	Logging	NMFS staff should provide recommendations on potential restoration projects that could be incorporated into timber harvest plans.	2	10	CalFire, Campbell Timberland Management, NMFS PRD, Private Consultants, Private Landowners						In-Kind	
NoR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
NoR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
NoR-CCC-23.1.1.1	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	5	Campbell Timberland Management, Mendocino Redwood Company, NMFS PRD, Private Consultants, Private Landowners, Trout Unlimited	50.00					50	
NoR-CCC-23.1.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	20	CalFire, Campbell Timberland Management, CDFG, Mendocino Redwood Company, Private Landowners						In-Kind	
NoR-CCC-23.1.1.3	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	3	10	Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners	102.50	102.50				205	Cost for road inventory estimated at $927/mile. Assume 25% of road network inventoried per year.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-23.1.1.4	Action Step	Roads/Railroads	Encourage County of Mendocino to address and adequately maintain the Sherwood Ridge Road. Encourage County of Mendocino to completely close and monitor gates and barriers during the winter period.	2	10	Campbell Timberland Management, Mendocino County Department of Public Works, Mendocino Redwood Company, Private Landowners						In-Kind	This likely already exists for large timberland owners in the basin.
NoR-CCC-23.1.1.5	Action Step	Roads/Railroads	Design and implement a program of BMPs for road maintenance on private roads similar to the program for public roads (Sommarstrom et al., 2002).	1	20	Mendocino County Department of Public Works, NOAA RC, Private Landowners						In-Kind	Work with Mendocino County DOT to develop cost estimate for BMP cost in Noyo River watershed.
NoR-CCC-23.1.1.6	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in Core areas should be considered an extremely high priority for funding (e.g., PCSRF).	1	10		1,555	1,555				3,110	Cost based on decommission 259 miles of riparian road network at a rate of $12,000/mile. Cost to upgrade would equal $5,439,000.
NoR-CCC-23.1.1.7	Action Step	Roads/Railroads	Fully implement the Noyo River TMDL.	3	30	Campbell Timberland Management, CDFG, Mendocino Redwood Company, Private Landowners, RWQCB						In-Kind	
NoR-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										
NoR-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent increased landscape disturbance										
NoR-CCC-23.2.1.1	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	100	CalFire, Campbell Timberland Management, CDFG, Mendocino County, Mendocino Redwood Company, NMFS PRD, Private Landowners						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-23.2.1.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, Campbell Timberland Management, Mendocino County, Mendocino Redwood Company, NMFS PRD, Private Landowners						In-Kind	This recommendation should be considered standard practice.
NoR-CCC-23.2.1.3	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	60	Cal Western Railroad, CalFire, California Department of Mines and Geology, Campbell Timberland Management, Mendocino Redwood Company, NRCS, Private Landowners, RWQCB						TBD	Costs may vary depending on number of road crossings.
NoR-CCC-23.2.1.4	Action Step	Roads/Railroads	Ensure all existing and new road and railway crossings minimize potential sediment delivery to the stream environment and allow upstream and downstream passage of adult and juvenile coho salmon.	2	20	Cal Western Railroad, CDFG, NMFS HCD, NOAA RC						In-Kind	
NoR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
NoR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology.										
NoR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for the mainstem Noyo River impacted by water diversions for the City of Fort Bragg.	3	10	CDFG, NMFS, Private Landowners, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project.
NoR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	3	60	CDFG, NMFS, Private Landowners, SWRCB						TBD	This action is predicated on above actions. Cost is expected to be minimal due to relatively few diversions in the watershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
NoR-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows during drought years.	3	10	Campbell Timberland Management, City of Fort Bragg, Mendocino Redwood Company, Private Consultants, Private Landowners						TBD	Cost depends upon landowner participation.

Pescadero Creek

Location	•San Mateo County
Watershed Area	•81.0 Square Miles
Potential Habitat	•54.9 Stream Miles
Vegetation	•66% Coniferous, 22% Shrubland, 8% Grassland
Erodability	•Moderate to High
Ownership Patterns	•77% Private; 23% Public
Dominant Land Uses	•Rural Residential, Timber, Agricultural
Housing Density	•Low to Moderate
TMDL Pollutants	•Sediment

Pescadero Creek
Photo by Joel Casagrande

Pescadero Creek Coho Salmon: Nearly Extirpated

Recovery Goals

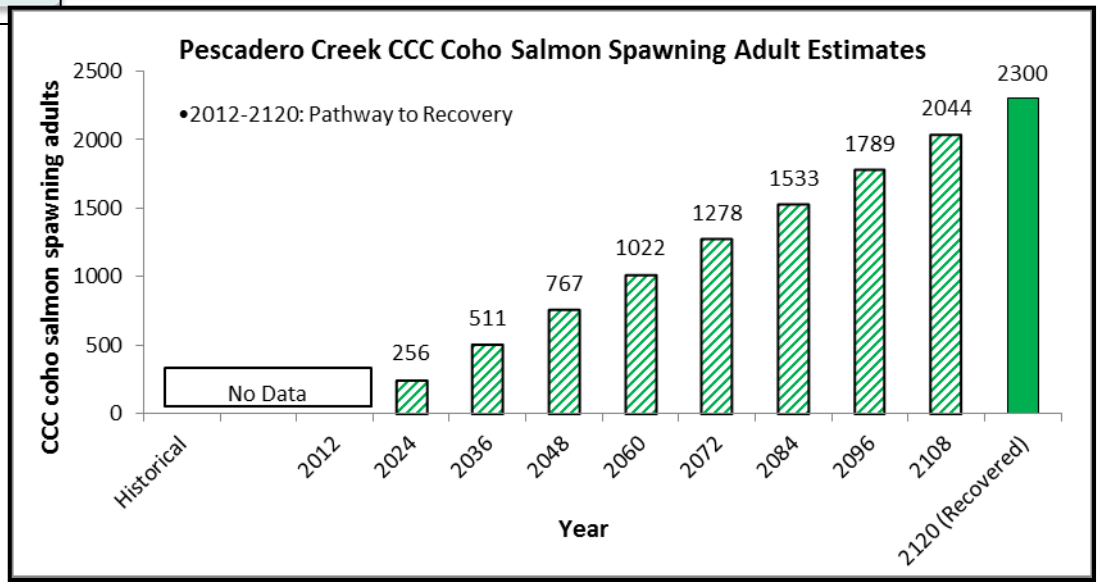
✓ Implement a monitoring program to evaluate the performance of recovery efforts

Pescadero Creek Adult Spawner Targets

Downlisting to Threatened
1,150

Recovery
2,300

STEELHEAD: YES
CHINOOK SALMON: NO



Pescadero Creek

Potential Habitat: 54.9 miles
Recovery Target: 2,300 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	FAIR	GOOD	GOOD	FAIR	FAIR	FAIR	POOR	POOR	VERY GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Promote restoration projects designed to create or restore alcove, backwater channel, ephemeral tributary, or seasonal habitats
- Design new development to allow streams to meander in historical patterns
- Maintain, install and enhance LWD and other complex habitat features
- Provide incentives to water rights holders willing to convert some or all of their water right to instream use
- Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas
- Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds

Priority 2 & 3: Long-Term Restoration Actions

- Implement restoration actions to benefit listed salmonids in the estuary
- Prevent illegal or casual breaching of the sandbar to the Pescadero Creek lagoon
- Promote off-channel storage and irrigation efficiency measures to reduce impacts of water diversion
- Initiate education programs and outreach
- Establish and/or maintain continuous native riparian buffers
- Establish release imprinting stations where smolts could be held a minimum of two weeks prior to release

Recovery Partners

San Mateo RCD

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, City of Santa Rosa and Morgan Bond, SWFSC

Pescadero Creek

Potential Habitat: 54.9 miles
Recovery Target: 2,300 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	NA	LOW	MEDIUM	NA	MEDIUM	MEDIUM	HIGH	HIGH	HIGH

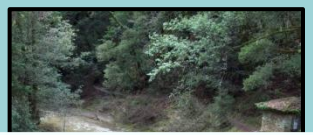
Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage forest-to-vineyard land or rural residential conversions
- Protect channel migration zones and their riparian areas by designing new roads and development to allow streams to meander in historical patterns
- Ensure all water diversions in the watershed are in compliance with all applicable laws and policies
- Existing areas with floodplains or off channel habitats should be protected from future development

Priority 2 & 3: Long-Term Threat Abatement Actions

- Protect headwater channels with larger buffers to minimize sediment delivery downstream
- Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are limiting
- All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected from the stream



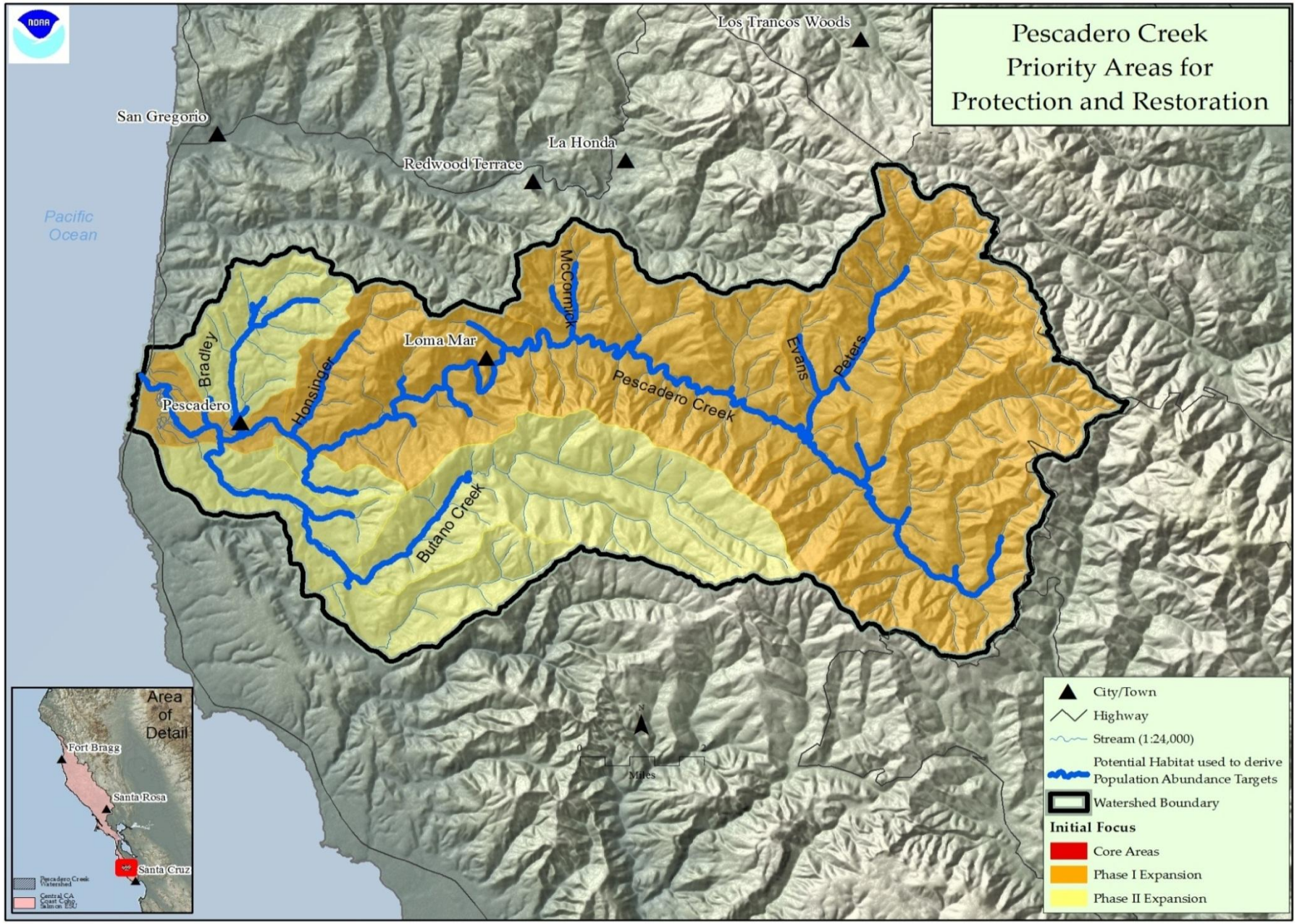


Figure 1: Pescadero Creek Map

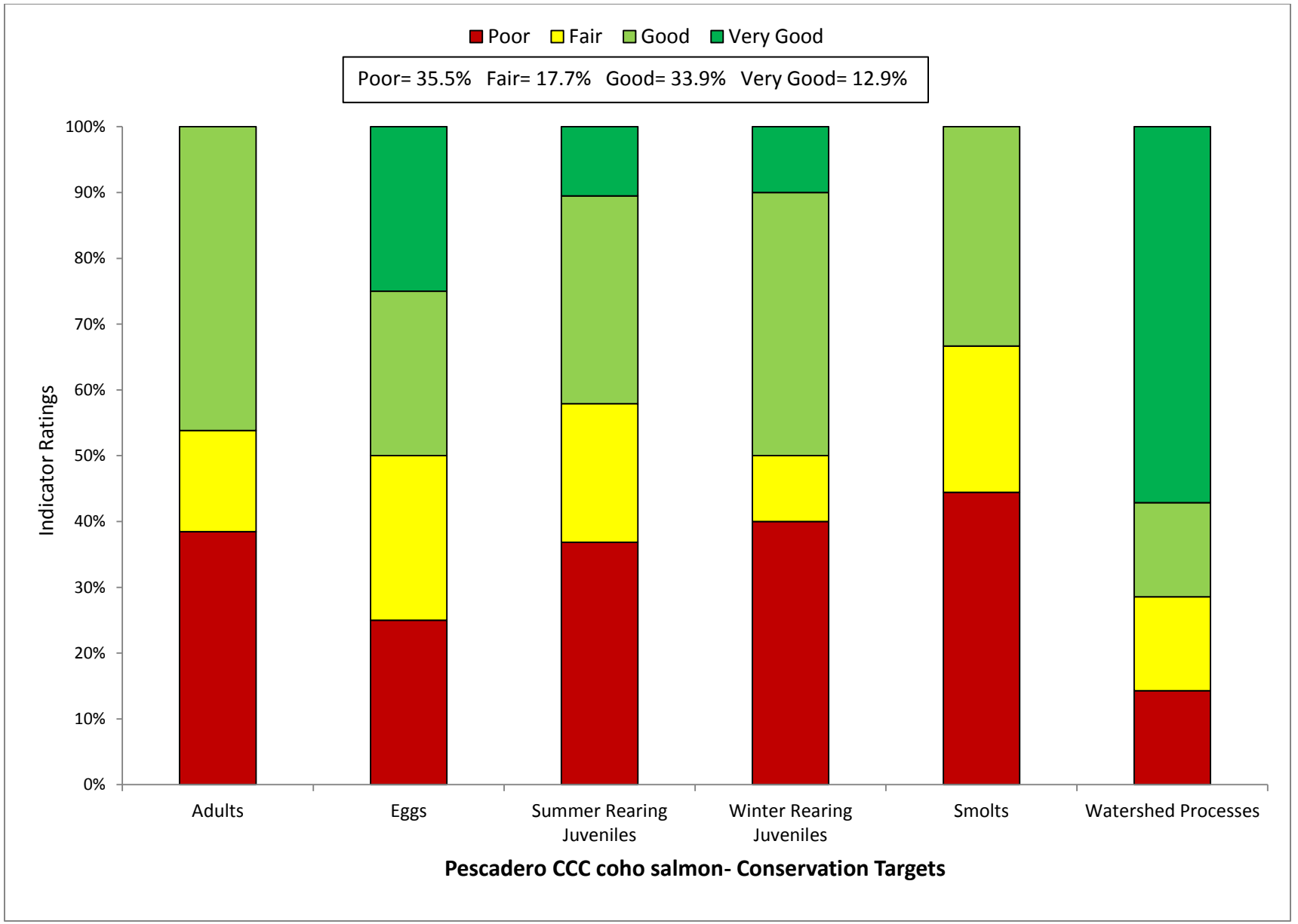


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Pescadero Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams 98% IP (>30% Pools; >20% Riffles)**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**20% streams 2% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =67**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**89% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**100% streams 100% IP (>50% stream average scores of 1 & 2)**	Very Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired and non-functional**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**0% of streams/ IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams 98% IP (>30% Pools; >20% Riffles)**	Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**20% streams; 2% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =75**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =35-50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**9.05 Diversions/10 IP-km**	Poor	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**78.3% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**50% to 74% of streams/ IP-km (>85% average stream canopy)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% streams 100% IP (>50% stream average scores of 1 & 2)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP-km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-Km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**>90% of Historical Range**	Very Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams 98% IP (>30% Pools; >20% Riffles)**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**20% streams; 2 IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**78.3 of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**100% streams 100% IP (>50% stream average scores of 1 & 2)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**impaired but functional**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**20% streams; 2 IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**9.05 Diversions/10 IP-km**	Poor	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Scores =75**	Fair	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density =0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.246% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**1.47% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**11% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**3% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Intact Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**3 Miles/Square Mile**	Fair	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**3.3 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Pescadero Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Medium	Medium	Medium	Medium	Medium	Medium
2	Channel Modification	Medium	Low	Medium	Medium	Medium	Medium	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	High	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	High	Medium	High	Medium	High	High
5	Fishing and Collecting	High	-	Medium	-	High	-	High
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	High	Medium	Medium	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Medium	Medium	Medium	Medium	Medium	Medium
11	Residential and Commercial Development	Low	Medium	Medium	Medium	Medium	Medium	Medium
12	Roads and Railroads	Medium	High	High	High	High	Medium	High
13	Severe Weather Patterns	Medium	High	High	High	High	Medium	High
14	Water Diversion and Impoundments	Medium	Low	High	Low	High	Medium	High
Threat Status for Targets and Project		High	High	High	High	Very High	High	High

Central CA Coast Coho Salmon ~ Pescadero Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Assess the benefits of altering to existing dikes and levees which currently reduce shoreline complexity and natural function

1.1.2. **Recovery Action:** Rehabilitate inner estuarine hydrodynamics

1.1.2.1. **Action Step:** Encourage USFWS to reinitiate consultation for biological opinion with State Parks regarding the estuary restoration project.

1.1.2.2. **Action Step:** Evaluate all floodgates located within the tidal portion of Pescadero Creek and determine the feasibility of re-claiming historic tidal slough habitat.

1.1.3. **Recovery Action:** Rehabilitate natural river mouth dynamics

1.1.3.1. **Action Step:** Restore the timing of sandbar closure so that it closes in June / July (as it did prior to reconstruction of the Highway 1 bridge) so as to provide adequate time for de-stratification and conversion to freshwater.

1.1.4. **Recovery Action:** Improve the quality and extent of freshwater lagoon habitat

1.1.4.1. **Action Step:** Implement restoration actions that benefit listed salmonids and other special status species in the estuary. Requirements and goals will vary by species.

1.1.5. **Recovery Action:** Reduce extent of estuarine shoreline development

1.1.5.1. **Action Step:** Evaluate existing conservation easements in the Estuary to ensure they are in conformance with original terms and conditions of the easement.

1.1.5.2. **Action Step:** Construction of new buildings and associated infrastructure should only occur above the historical estuary tidal prism.

1.1.6. **Recovery Action:** Reduce frequency of artificial breaching events

1.1.6.1. **Action Step:** Implement patrols by citizens groups, State Parks, and law enforcement to ensure the sandbar is not illegally breached.

1.1.6.2. **Action Step:** Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Pescadero Creek lagoon.

1.1.6.3. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.2. **Action Step:** Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Encourage retention of large woody material for all historical coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.1.2. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

3.1.1.3. **Action Step:** Educate landowners, land managers, and County staff regarding the importance of Large Woody Material to coho salmon survival and recovery, and watershed processes.

3.1.1.4. **Action Step:** Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.

3.1.1.5. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.1.6. **Action Step:** Incorporate large woody debris (preferably large diameter redwood trees) into stream bank protection projects, where appropriate.

3.1.1.7. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

3.2.1. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.2.1.1. **Action Step:** Fund a watershed coordinator position.

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions

4.1.1.1. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.1.1.2. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.1.1.3. **Action Step:** Develop more efficient and coordinated use of water resources to provide increased supply, restore groundwater levels, and increase dry weather baseflows through conjunctive management, use of reclaimed wastewater, and increased storage or utilization of excess winter stream flows.

4.1.1.4. **Action Step:** Promote irrigation efficiency projects for agricultural practices.

4.1.2. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.2.1. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.

4.1.2.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with streamside road density (< 100 meters)

5.1.1.1. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.1.2. **Action Step:** Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors.

9.1.1.2. **Action Step:** Encourage San Mateo to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

9.1.2.2. **Action Step:** Establish and/or maintain continuous native riparian buffers.

9.1.2.3. **Action Step:** Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.

9.1.2.4. **Action Step:** Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

9.1.2.5. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.2.1.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. Phase 1 areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2.1.2. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.2.2. **Recovery Action:** Increase spawner density

10.2.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.3. **Objective:** Address other natural or manmade factors affecting the species' continued existence

10.3.1. **Recovery Action:** Increase spawner density

10.3.1.1. **Action Step:** Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.1.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

11.1.1.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

11.1.1.3. **Action Step:** Encourage San Mateo County to establish wider riparian buffers in residential and urban areas.

11.1.1.4. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

14.1.1.1. **Action Step:** Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.5. **Action Step:** Encourage CalFire to provide plan to all non-County fire fighters when providing firefighting assistance in the Pescadero Creek watershed (and all other watersheds in the County).

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.

15.1.2.2. **Action Step:** In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

15.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.3.1. **Action Step:** Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.

16.1.1.2. **Action Step:** Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.

16.1.1.3. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Pescadero Creek.

16.1.1.4. **Action Step:** Install/construct permanent signs at all major public access points along Pescadero Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).

16.1.1.5. **Action Step:** Increase oversight on anglers fishing in Pescadero to evaluate compliance with fishing regulations.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

18.1.1.1. **Action Step:** Reduce the adverse effects of grazing and ranching to water quality in the Bradley Creek subwatershed.

18.1.1.2. **Action Step:** Establish and implement a conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.

18.1.1.3. **Action Step:** To minimize gully initiation, grazing should be kept at relatively low intensities on the steeper slopes in this area.

18.1.2. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.1.2.1. **Action Step:** Locate water sources away from riparian areas.

18.1.2.2. **Action Step:** Aid landowners willing to fence off riparian areas in choosing alternatives water source sites (preferably ones that are hydrologically disconnected from stream flows).

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion

19.1.3. **Recovery Action:** Prevent impairment to habitat complexity

19.1.3.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

19.1.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.4.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.4.2. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.4.3. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.5. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

19.1.5.1. **Action Step:** Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.

19.1.6. **Recovery Action:** Prevent increased landscape disturbance

19.1.6.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.1.7. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, etc.)

19.1.7.1. **Action Step:** All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.

19.1.7.2. **Action Step:** Avoid road construction in riparian zones

19.1.7.3. **Action Step:** All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.

19.2.1.2. **Action Step:** Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of coho salmon

19.2.1.3. **Action Step:** Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using

revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).

19.2.1.4. **Action Step:** Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.

19.2.1.5. **Action Step:** Discourage San Mateo County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.6. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

19.2.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

19.2.2.1. **Action Step:** Increase buffer widths on Class II streams.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.1.1.2. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.1.3. **Action Step:** Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.

23.1.1.4. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.2.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.2.3. **Action Step:** Reduce erosion from mainline timber harvest roads.

23.1.2.4. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.2.5. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.

23.1.2.6. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.2.7. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.2.8. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.

23.1.2.9. **Action Step:** Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.

23.1.2.10. **Action Step:** Encourage County to continue to implement the San Mateo County Road Maintenance Manual

23.1.3. **Recovery Action:** Prevent impairment to passage and migration

23.1.3.1. **Action Step:** Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

23.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.4.1. **Action Step:** Encourage adoption and implementation of a plan similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation 2008) regarding roadside maintenance activities. This plan was developed to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Encourage San Mateo County to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.2.2. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.2.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.3.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.3.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.2.3.3. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.2.3.4. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

24.1.1.1. **Action Step:** Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).

24.1.1.2. **Action Step:** Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).

24.1.1.3. **Action Step:** Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.

24.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.2.1. **Action Step:** Ensure all diversions in the watershed are in compliance with all applicable laws and policies.

24.1.3. **Recovery Action:** Prevent impairment to water quality

24.1.3.1. **Action Step:** Ensure tolerable water temperatures are maintained during drought periods.

24.1.3.2. **Action Step:** Implement performance standards in Stormwater Management Plans.

24.1.4. **Recovery Action:** Prevent impairment to passage and migration

24.1.4.1. **Action Step:** Work with CDFG, County of San Mateo, and knowledgeable biologists to develop emergency rules and adopt implementation agreements regarding contingency efforts during drought conditions.

24.1.4.2. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.

24.1.4.3. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).

24.1.4.4. **Action Step:** Evaluate performance of all existing fish ladders to pass migrating fish during drought conditions.

24.1.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.5.1. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

24.1.5.2. **Action Step:** Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.

24.1.5.3. **Action Step:** Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

24.1.6. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.6.1. **Action Step:** Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in San Mateo County.

24.1.6.2. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.6.3. **Action Step:** Establish targeted polices, requirements and assistance for sandy soils areas.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater) do not further impair estuary water quality conditions for rearing juvenile salmonids.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.

25.1.2.3. **Action Step:** Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).

25.1.2.4. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in Pescadero Creek.

25.1.3.2. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.4.1. **Action Step:** Ensure water diversions do not impair water temperatures in Pescadero Creek.

25.1.4.2. **Action Step:** Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.2. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.3. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

25.2.1.4. **Action Step:** Promote conjunctive use of water with water projects whenever possible to maintain or restore salmonid habitat.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Pescadero Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
PeC-CCC-1.1.1.1	Action Step	Estuary	Assess the benefits of altering to existing dikes and levees which currently reduce shoreline complexity and natural function	3	10	CDFG, Farm Bureau, NMFS, San Mateo County, State Parks, USFWS	1,100	1,100				2,200	Issues regarding the estuary have been contentious for many years. Resolving these issues and implementing effective restoration actions is considered essential due to the relative importance of estuaries on the Central Coast for salmonid rearing. Removing, reconfiguring, or breaching levees would likely help initiate restoration of natural estuarine functions. The 320 acre Pescadero marsh/estuary/lagoon has been reduced in size following European arrival; nonetheless, it is relatively intact in areal extent when compared to many other major estuaries in the Santa Cruz Mountains diversity stratum (e.g., San Lorenzo River, Aptos and Soquel creeks). While the Pescadero estuary was extensively converted for agricultural purposes, it also has relatively little permanent infrastructure (hard-scape) within the historical tidal prism (which increases the feasibility of large scale restoration efforts). However, the estuary/lagoon is significantly impaired due to a variety of anthropogenic alterations which affect the overall hydrology and water chemistry. NMFS (2008) estimated floodplain and tributary reconnection could range in cost from $8,721 to $81,395 per acre. Costs in Pescadero Marsh would likely be at the higher edge of that estimate range. If side channel restoration is proposed NMFS (2008) estimated cost could range between $34,884 and $290,698 per acre. Diking, channelization, reclamation, and excessive sedimentation have dramatically altered the size and character of Pescadero Marsh over the past 150 years. Between 1900 and 1960 the size of the delta/open water area of the marsh decreased by over 50%, primarily due to reclamation of marshland for agriculture. CEMAR (2010) discussed a number of potential restoration actions that could include (1) lowering the right bank levee of Pescadero Creek at the upper end of the Marsh, (2) Raising or repairing the low levee along the channel adjacent to North Marsh that leads to North Pond, and (3) Remove some or all of the remaining levees between Butano Creek and Butano Marsh. Cost based on treating 8 acres assume 5% of current estuarine extent) at a rate of $272,120/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-1.1.2	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics										Project per the biological opinion's project description was not implemented as described. As such, reinitiation of consultation pursuant to section 7 of ESA may be necessary. In 1993, California Department of Parks and Recreation implemented restoration actions "Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990)" to both increase as well as isolate hydrologic connectivity between areas within the estuary/lagoon/marsh complex. The stated goals were to protect habitat for sensitive species, provide flood control, and reduce sediment within the estuary/lagoon/marsh. In the southern portion of the Marsh, restoration actions included widening the lower portion of Butano creek and removing portions of levees across various areas in the Marsh. In the northern portion of the Marsh, restoration actions included widening and excavating a channel connecting Pescadero Creek with North Pond, excavating a channel, and building a levee with eight gated-culverts crossed the channel in close proximity to its confluence with Pescadero Creek. The gated culverts were to be manually closed when the sandbar formed to facilitate freshwater conversion. The purpose of these culverts was to enhance and protect rearing habitat for steelhead (rapid freshwater conversion provides improved water quality conditions) as well as to provide habitat for other sensitive species (California red legged frog, San Francisco garter snake, tidewater goby, and Western pond turtle). Additionally, a "low elevation levee" was built separating North Pond and North Marsh for the purpose of isolating North Marsh from tidal influence to protect and enhance sensitive species (California red legged frog, San Francisco garter snake, and tidewater goby) habitat. Unfortunately, Pescadero Marsh Natural Preserve Hydrological Enhancement Plan (Williams 1990) was not implemented according to the intended hydrological and biological goals: the low elevation levee was constructed too low and the culverts quickly rusted and became inoperable (Smith and Reis 1997). In 1995, the sandbar began forming substantially later in the year and this continues to present day (Smith and Reis 1997; Smith 2009). Currently, there is not enough time to fully convert the water column to a freshwater lagoon and the water quality is impaired. Tidewater now over-tops the "low elevation

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-1.1.2.1	Action Step	Estuary	Encourage USFWS to reinitiate consultation for biological opinion with State Parks regarding the estuary restoration project.	3	3	State Parks, USACE, USFWS						In-Kind	levee" which has changed the designed freshwater habitat for sensitive species (other than steelhead) to unsuitable saltwater conditions. Smith (1990) documented that steelhead juveniles grew very rapidly in Pescadero lagoon prior to implementation of the two aforementioned projects in the 1990s. The benefits of the lagoon are compromised when conditions, as described above, occur. The impaired condition of the lagoon is one of the most significant limiting factors to the steelhead population in the Pescadero Creek watershed and could limit coho salmon when populations are re-established in the watershed.
PeC-CCC-1.1.2.2	Action Step	Estuary	Evaluate all floodgates located within the tidal portion of Pescadero Creek and determine the feasibility of re-claiming historic tidal slough habitat.	2	3	State Parks, USFWS							Cost accounted for increase the extent of estuarine habitat.
PeC-CCC-1.1.3	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										Changes to the steelhead population and water quality were documented following replacement of Highway One Bridge in 1991 and implementation of the Pescadero Marsh Natural Preserve Hydrological Enhancement Plan in 1993. Since construction of these project the system no longer converts to a seasonal freshwater lagoon because the sandbar forms two to three months later than it did prior to the 1993 (in the early fall rather than in the late spring / early summer). Early closure is believed necessary to prevent fish kills and maximize lagoon productivity. Three years of experimentation should be adequate to ascertain whether this action produces favorable results in regard to frequent fish kills that many believe adversely affect the steelhead population rearing in the closed lagoon. If this experiment results in desired results it should be incorporated into ongoing Pescadero operations by State Parks during most water years. This action has a potential to produce significant benefits to rearing coho salmon by precluding fish kills and maximizing water quality benefits. Permitting requirements should be closely coordinated between all responsible agencies by a well-

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-1.1.3.1	Action Step	Estuary	Restore the timing of sandbar closure so that it closes in June / July (as it did prior to reconstruction of the Highway 1 bridge) so as to provide adequate time for de-stratification and conversion to freshwater.	3	3	CA Coastal Commission, CalTrans, CDFG, NMFS, Public, RWQCB, State Parks, USACE, USFWS	48.00					48	qualified and experienced permitting lead with a track record of success on challenging projects. CCC steelhead are directly impacted by these conditions; CCC coho salmon are likely absent from the watershed and not currently impacted. However, these conditions could impact coho salmon to some degree if a run is successfully re-established in Pescadero Creek. Cost based on treating 8 acres (assume 5% of total estuarine habitat) at a rate of $6,000/acre. Cost can be vary widely depending on various experimental approaches to sandbar closure.
PeC-CCC-1.1.4	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat										
PeC-CCC-1.1.4.1	Action Step	Estuary	Implement restoration actions that benefit listed salmonids and other special status species in the estuary. Requirements and goals will vary by species.	2	10	CalTrans, CDFG, Farm Bureau, NMFS, Private Landowners, RWQCB, San Mateo County, State Parks, USACE, USFWS							Efforts should be guided by appropriate protection and enhancement guidelines. Restoration should include immediate actions as well as long term actions to address systemic problems in the estuary. Short term actions could include measures from CEMAR's Dec. 9, 2010, and Smith and Reis (1997) list of potential restoration actions. All actions should include a monitoring component so the impacts of the actions are well understood by all parties interested in the Pescadero Marsh. CEMAR (2010) discussed a number of potential restoration actions that could include (1) lowering the right bank levee of Pescadero Creek at the upper end of the Marsh, (2) Raising or repairing the low levee along the channel adjacent to North Marsh that leads to North Pond, and (3) Remove some or all of the remaining levees between Butano Creek and Butano Marsh. Other options are likely also viable and should be explored. Cost accounted for in other recovery actions.
PeC-CCC-1.1.5	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										
PeC-CCC-1.1.5.1	Action Step	Estuary	Evaluate existing conservation easements in the Estuary to ensure they are in conformance with original terms and conditions of the easement.	3	5	Private Landowners						In-Kind	This cost should be minimal and should be considered a standard business practice by the entity that has granted conservation easements for private properties in the estuary.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-1.1.5.2	Action Step	Estuary	Construction of new buildings and associated infrastructure should only occur above the historical estuary tidal prism.	2	100	CalTrans, FEMA, San Mateo County, State Parks, USACE						In-Kind	New infrastructure should be constructed above the historical tidal prism. Although a large portion of the tidal prism has been reclaimed for agriculture it is conceivable some of these farmed areas could be restored and provide important water quality and ecological benefits to the estuary. Development of permanent infrastructure in these areas usually precludes future ecologically beneficial restoration and typically results in additional chronic degradation due to flood prevention measures, and other similar actions, into the future.
PeC-CCC-1.1.6	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
PeC-CCC-1.1.6.1	Action Step	Estuary	Implement patrols by citizens groups, State Parks, and law enforcement to ensure the sandbar is not illegally breached.	2	100	CDFG Law Enforcement, NMFS OLE, Pescadero Municipal Advisory Council, Public, State Parks						In-Kind	Rough cost estimate for the 100 year period. Close coordination by all parties would likely comprise the majority of the costs. Other methods should also be evaluated such as installation of cameras that provide real time oversight. Cost of recovery action are expected to be minimal due to volunteer patrols.
PeC-CCC-1.1.6.2	Action Step	Estuary	Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the Pescadero Creek lagoon.	2	100	CDFG Law Enforcement, NMFS OLE, State Parks						TBD	Financial rewards may act as a deterrent to those involved in the unauthorized breaching of the lagoon. The lagoon has a long history of illegal breaches and to date no one has been successfully prosecuted for this activity. Breaching is believed to result in significant adverse impacts to steelhead rearing (and coho salmon if present) in the lagoon. Breaching has historically coincided with the start of the December steelhead fishing season in Pescadero Creek.
PeC-CCC-1.1.6.3	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	CDFG, State Parks	1.50	1.50				3	Cost of signage varies widely depending on materials and information. Assume standard rate of $1,000/sign.
PeC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PeC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
PeC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	20	CDFG, NMFS, NRCS, San Mateo County, San Mateo RCD, State Parks						TBD	The number of projects will vary depending on landowner participation and acceptance.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CDFG, FEMA, RWQCB, San Mateo County, USACE						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
PeC-CCC-3.1.1.1	Action Step	Habitat Complexity	Encourage retention of large woody material for all historical coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	Big Creek Lumber Co., CalFire, CalTrans, CDFG, FEMA, NMFS, NRCS, Pescadero Municipal Advisory Council, POST, Private Landowners, Red Tree, RWQCB, San Mateo County, San Mateo RCD, USACE						In-Kind	This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations funding restoration projects. Manipulation of LWD should not occur until evaluated by the County of San Mateo Planning staff and hydrologist and/or qualified biologist familiar with Central Coast streams. LWD target could likely be achieved in a relatively short time period of existing if naturally recruited large wood was left intact by landowners. Cost savings would be significant. Currently a significant amount of large woody material in removed without proper authorization in the Pescadero Creek. Poor LWD ratings were documented for most of the 23 sample reaches evaluated by ESA et al. (2004) within the watershed. ESA et al. (2004) noted a high proportion of recently recruited LWD and low proportion of decayed wood in the channel compared to a similar inventory on the Garcia River in Mendocino County, California. The small proportion of decayed pieces in the Pescadero-Butano water is indicative of instream wood removal. ESA et al. (2004) also noted that over half the conifer recruitment observed in their 23 sample reaches occurred in just two reaches located in Portola Redwoods State Park, suggesting the relatively mature forest stands in the park generate a high proportion of LWD recruited to the channels, and an inherently higher degree of protection of these attributes likely occurs due to government ownership. The paucity of LWD in areas outside the park likely is the major contributor to the lower shelter values estimated in the watershed (an average rating of 20 out of a possible total of shelter rating of 300).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-3.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	1	20	CalFire, IWRP, Mid Peninsula Open Space District, Private Landowners, Red Tree, San Mateo County, San Mateo RCD	96.25	96.25	96.25	96.25		385	Estimates in the State Coho Plan indicate that LWD placement costs about $20,000 per stream mile; costs rise as the width of the water bodies increase and as the size of the material to be placed in channels grows. Currently, the Pescadero watershed lacks a LWD inventory but available information indicates LWD is lacking. Assuming universal landowner approval and permission, the cost to install LWD in the 44.1 IP-km (27mi) = $384,750. Cost based on treating 13.5 miles (assume 1 project per mile in 50% High IP) at a rate of $28,500 We believe this cost would be significantly more in the Pescadero watershed due to concerns regarding LWD stability and flooding that would require more engineering. If ELJ used, cost would be $1,556,236. Additionally, the LWD targets proposed in this plan likely exceed those estimated in the State Plan resulting in increased costs. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation.
PeC-CCC-3.1.1.3	Action Step	Habitat Complexity	Educate landowners, land managers, and County staff regarding the importance of Large Woody Material to coho salmon survival and recovery, and watershed processes.	1	2	CalTrans, CDFG, FEMA, FishNet 4C, NMFS, San Mateo County, San Mateo RCD, State Parks						In-Kind	Program should initially be directed at landowners along important stream reaches where large wood removal has been identified as an ongoing concern by the resource agencies and the County of San Mateo. Cost estimate may expand if large wood removal continues to occur at current levels following completion of the program. The recommendation is based on ongoing efforts throughout the ten year period. Education effort would include workshops, mailings, fliers, signage, and focused presentations. Costs could be somewhat minimized through the use of existing materials already created nearby from the RCD of Santa Cruz County and County of Santa Cruz.
PeC-CCC-3.1.1.4	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	1	5	CalTrans, CDFG, IWRP, NMFS, Private Landowners, RWQCB, San Mateo RCD, State Parks, USACE	127.00					127	A comprehensive LWD inventory has not been conducted in Pescadero, however ESA (2004) did conduct reach level sampling in a discrete number of units and documented a paucity of LWD. A review of CDFG habitat typing information confirms the overall lack of wood formed structure. LWD installation should not wait until the completion of an inventory effort but should occur simultaneously. An appropriate approach would be beginning restoration actions in stream reaches with high IP values for both CCC coho and steelhead. Cost based on fish/habitat restoration at a rate of $126,758/project

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-3.1.1.5	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	2	100	CalTrans, CDFG, FEMA, NMFS, Private Landowners, San Mateo County, San Mateo RCD, USACE						In-Kind	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure.
PeC-CCC-3.1.1.6	Action Step	Habitat Complexity	Incorporate large woody debris (preferably large diameter redwood trees) into stream bank protection projects, where appropriate.	3	100	CalTrans, CDFG, FEMA, NMFS, Private Landowners, San Mateo County, San Mateo RCD, USACE						In-Kind	Costs should be minimal because the bank protection action would likely occur anyway. This recommendation would be implemented only when an existing problem has been identified and is in needed of protection.
PeC-CCC-3.1.1.7	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	Big Creek Lumber Co., CalFire, POST, Private Landowners, Red Tree, State Parks	130.00	130.00	130.00	130.00		520	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely or insignificant to downstream reaches. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost based on treating 4 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,622/acre.
PeC-CCC-3.2	**Objective**	**Habitat Complexity**	**Address other natural or manmade factors affecting the species' continued existence**										
PeC-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-3.2.1.1	Action Step	Habitat Complexity	Fund a watershed coordinator position.	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, California Geological Survey, CalTrans, CDFG, IWRP, Mid Peninsula Open Space District, NOAA RC, NRCS, Pescadero Municipal Advisory Council, POST, Private Landowners, RPFs, RWQCB, San Mateo County, San Mateo RCD, State Parks, SWRCB, USFWS	325.00	325.00				650	A watershed coordinator is necessary in Pescadero Creek watershed due to 1) the large number of small landowners adjacent to important watercourses and, 2) multiple governmental jurisdictions that often work in a limited and uncoordinated fashion in regard to restoration activities. A coordinator should be able to work with various stakeholders to facilitate rapid implementation of high priority restoration and habitat enhancement projects. A watershed coordinator should have a thorough understanding of social and environmental constraints and opportunities in the Pescadero Creek watershed. A qualified coordinator will be well versed in various State, County, and Federal permitting requirements and local issues and concerns with the various constituencies.
PeC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PeC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions										
PeC-CCC-4.1.1.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	1	20	CDFG, IWRP, POST, Private Landowners, SWRCB						TBD	The price at which water is sold on environmental water markets is determined by negotiations between landowners and purchasing entities. The aggregate fiscal cost of water acquisition will depend on the quantity of water acquired and whether water rights will be permanently transferred or purchased for single periods of time. Initial efforts should be directed at water diversions in the Butano watershed.
PeC-CCC-4.1.1.2	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	100	CDFG, Farm Bureau, IWRP, NOAA RC, NRCS, POST, Private Landowners, San Mateo County, San Mateo RCD, State Parks, SWRCB, Trout Unlimited						TBD	Water augmentation costs were estimated in regards to the Shasta-Scott Pilot Program (CDFG 2004). These results indicated potentially significant costs. Off channel storage cost will vary depending on landowner participation, regulatory agency participation, and permitting requirements.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-4.1.1.3	Action Step	Hydrology	Develop more efficient and coordinated use of water resources to provide increased supply, restore groundwater levels, and increase dry weather baseflows through conjunctive management, use of reclaimed wastewater, and increased storage or utilization of excess winter stream flows.	2	100	CDFG, IWRP, NRCS, POST, San Mateo RCD, SWRCB						TBD	Costs will vary depending on landowner participation.
PeC-CCC-4.1.1.4	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	2	20	Farm Bureau, Laguna Foundation, NRCS, POST, San Mateo RCD							Initial focus should be directed towards agricultural practices in the Butano sub-watershed.
PeC-CCC-4.1.2	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
PeC-CCC-4.1.2.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	10	CDFG, Farm Bureau, San Mateo County						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.
PeC-CCC-4.1.2.2	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon	2	10		36.00	36.00				72	Cost for stream flow monitoring estimated at $72,000/project.
PeC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with streamside road density (< 100 meters)										
PeC-CCC-5.1.1.1	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	1	100	CalFire, California Geological Survey, CDFG, RWQCB, San Mateo County, USACE						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-5.1.1.2	Action Step	Landscape Patterns	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	1	100	Private Landowners, San Mateo County, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
PeC-CCC-9.1.1.1	Action Step	Sediment	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors.	3	20	CalTrans, Farm Bureau, Pescadero Municipal Advisory Council, Private Landowners, RWQCB, San Mateo County, San Mateo RCD						TBD	Re-vegetation would also facilitate amelioration of instream temperatures and would provide a source for future LWD recruitment. This recommendation will likely be received with some resistance by some landowners. Costs will vary depending on landowner participation and existing landuse.
PeC-CCC-9.1.1.2	Action Step	Sediment	Encourage San Mateo to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	3	100	Pescadero Municipal Advisory Council, Private Landowners, San Mateo County						TBD	High priority areas include locations adjacent to the Pescadero Marsh, areas within the historical tidal prism of the marsh that are candidates for restoration, and location in sandstone and/or steep mixed lithology geology. Other important areas include tributaries that maintain good quality or easily restored, and currently occupied habitats.
PeC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
PeC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalTrans, NRCS, RWQCB, San Mateo County, State Parks						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.
PeC-CCC-9.1.2.2	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	2	100	CalFire, CalTrans, NRCS, POST, RWQCB, San Mateo County, State Parks						In-Kind	In a study on the San Lorenzo River in Santa Cruz County, Balance Hydrologics found stream reaches with a total of 1.5 to 2 bankfull widths (on both banks) of healthy native riparian vegetation offer the best instream habitat and have the most stable banks (Balance Hydrologics Inc. 1998). These riparian width recommendations are also appropriate for Pescadero and would facilitate return of watershed processes to properly functioning conditions.
PeC-CCC-9.1.2.3	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	100	Farm Bureau, NRCS, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-9.1.2.4	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFG, FEMA, NMFS PRD, NRCS, RWQCB, San Mateo County, San Mateo RCD, USACE, USFWS						In-Kind	Inspections should be considered a standard business practice by all regulatory agencies and this action should not be considered as an additional cost.
PeC-CCC-9.1.2.5	Action Step	Sediment	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	3	100	CalFire, CalTrans, NRCS, Private Landowners, San Mateo County, San Mateo RCD, USACE						In-Kind	Cost are likely minimal if incorporated into general management plan for commercial and residential areas.
PeC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
PeC-CCC-10.1.1.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, State Parks						In-Kind	
PeC-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.	1	10	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, State Parks						TBD	Re-introduction should only occur in subwatersheds where instream habitat conditions are suitable for all coho salmon lifestages. Conditions evaluated should include summer flow conditions, cover, winter refugia, pools depths, instream temperature, and gravel quality. Cost cannot be determined until priority locations are identified and numbers of coho salmon needed to reseed those areas are established.
PeC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCC-10.2.1	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
PeC-CCC-10.2.1.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Phase 1 areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	15	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, State Parks	42.33	42.33	42.33			127	Cost for fish/habitat restoration are $126,758.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-10.2.1.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	100	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, State Parks						In-Kind	While standard methods are available, outreach will be required to encourage all landowners to utilize them. Costs for outreach and education are difficult to determine due to an unknown number of participants, staff turnover, etc. Costs for a statewide outreach and education program were estimated at $60K (CDFG 2004). Costs for a watershed specific program would likely be a fraction of that.
PeC-CCC-10.2.2	Recovery Action	Viability	Increase spawner density										
PeC-CCC-10.2.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, State Parks	28.00	28.00	28.00	28.00		112	Standardized surveys should not occur until a small sustained run of CCC coho salmon is re-established in the watershed. Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum and therefore, Pescadero ranks lower in overall priority in the immediate future. However, it will ultimately be important to begin assessing the overall adult run size in Pescadero due to its designation as an Independent watershed for both coho and steelhead. Redd monitoring using (GTRS sampling design) may be less expensive than establishing life cycle station to count migrating adults and smolts. All assessments should use standardized methods. Methods should be consistent across the ESU or at a minimum the Santa Cruz Mtns Diversity Stratum. Cost for spawner surveys are estimated at $56,470/year.
PeC-CCC-10.3	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**										
PeC-CCC-10.3.1	Recovery Action	Viability	Increase spawner density										
PeC-CCC-10.3.1.1	Action Step	Viability	Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	2	10	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, State Parks							Imprinting stations will increase the likelihood of adults returning and re-establish a run in targeted sub basins. A total of three to five imprinting station may be needed in various tributaries of Pescadero Creek. Stations should continue until a run is verifiably re-established. Suitable locations should be carefully evaluated for their potential to support a viable run.
PeC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-11.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.
PeC-CCC-11.1.1.1	Action Step	Water Quality	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100	CalFire, CalTrans, Private Landowners, RWQCB, San Mateo County, USACE, USEPA						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.
PeC-CCC-11.1.1.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10	CalFire, San Mateo County						In-Kind	
PeC-CCC-11.1.1.3	Action Step	Water Quality	Encourage San Mateo County to establish wider riparian buffers in residential and urban areas.	2	10	CDFG, NMFS, Private Landowners, San Mateo County							This will likely be a sensitive issue for many landowners with property located next to riparian areas. This recommendation should be applied to all new development projects.
PeC-CCC-11.1.1.4	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100	Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD						In-Kind	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort.
PeC-CCC-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
PeC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
PeC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.	3	20	Private Landowners, San Mateo RCD	1,525	1,525	1,525	1,525		6,100	Cost based on treating 2 miles (assume 80 acres/mile in 5% High IP) at a rate of $37,574/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PeC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire						In-Kind	This recommendation should be considered a standard practice.
PeC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
PeC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Some areas in the Pescadero watershed have high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, higher stream temperatures, which are already above optimal condition along the mainstem, would likely result.
PeC-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						In-Kind	Standard business practice.
PeC-CCC-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County fire fighters when providing firefighting assistance in the Pescadero Creek watershed (and all other watersheds in the County).	2	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	Cost of providing the plan is minimal.
PeC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
PeC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	2	10	CalFire, San Mateo County, San Mateo RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-15.1.2.2	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations (e.g., drafting water from areas other than Pescadero lagoon). Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
PeC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										
PeC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire							Require all water truck/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
PeC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**										
PeC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
PeC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire						0	
PeC-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
PeC-CCC-16.1.1.1	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFG, NMFS							
PeC-CCC-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CalTrans, CDFG, Public, State Parks							If river mouth has been artificially breeched without appropriate authorization, prohibitions on offshore should continue until appropriate flows occur.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Pescadero Creek.	2	3	CDFG, NMFS						In-Kind	Low flow closures are needed for the Pescadero Creek based on flow conditions in from a nearby watershed in the Santa Cruz Mountains. Additionally, due to later recent runs of CCC coho salmon in the stream south of the Golden Gate, the date of opening season should be pushed back to later in the fishing season (currently fishing season starts on December 15) to at least January 15. Consideration should be given to pushing the entire fishing season back so that the total number of angling days in not reduced significantly.
PeC-CCC-16.1.1.4	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along Pescadero Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	1	10	CDFG, Pescadero Municipal Advisory Council, Private Landowners, San Mateo County, San Mateo RCD	7.50	7.50				15	Cost for signs varies widely depending on materials and content of signs. Cost based on $500/sign. Assume a minimum of 30.
PeC-CCC-16.1.1.5	Action Step	Fishing/Collecting	Increase oversight on anglers fishing in Pescadero to evaluate compliance with fishing regulations.	2	10	CDFG, CDFG Law Enforcement, NMFS OLE							
PeC-CCC-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-18.1.1	Recovery Action	Livestock	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PeC-CCC-18.1.1.1	Action Step	Livestock	Reduce the adverse effects of grazing and ranching to water quality in the Bradley Creek subwatershed.	3	30	Farm Bureau, Private Landowners, San Mateo RCD						TBD	Cost cannot be determined due to variability of landowner participation and extent of impacts.
PeC-CCC-18.1.1.2	Action Step	Livestock	Establish and implement a conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs. RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.	3	15	CDFG, NRCS, Private Landowners						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-18.1.1.3	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on the steeper slopes in this area.	3	100	Farm Bureau, NRCS, Private Landowners, RWQCB, San Mateo RCD						In-Kind	The lower Pescadero is vulnerable to gully initiation. Establishing conservative targets would reduce the total number of AUM but would also reduce restoration costs to address gullies.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-18.1.2	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
PeC-CCC-18.1.2.1	Action Step	Livestock	Locate water sources away from riparian areas.	3	100	Farm Bureau, NRCS, Private Landowners, San Mateo RCD						TBD	CDFG estimated water control structures at $15,000 each. The cost of moving a water source for grazing cattle is likely much lower. However, costs cannot be estimated because landowner participation is unknown and site specific conditions are currently unknown.
PeC-CCC-18.1.2.2	Action Step	Livestock	Aid landowners willing to fence off riparian areas in choosing alternatives water source sites (preferably ones that are hydrologically disconnected from stream flows).	2	100	Farm Bureau, Private Landowners, San Mateo RCD						TBD	CDFG 2004 estimates fencing costs in 2002 dollars at $4 per LF. Costs may be higher in the Pescadero watershed. Total costs are unknown and may vary depending on landowner participation and total amount of habitat fenced.
PeC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PeC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										
PeC-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, CDFG, Private Landowners, San Mateo County						TBD	Cost for this recommendation will be determined by feasibility of road surface treatment and extent of miles of road to be treated.
PeC-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to habitat complexity										
PeC-CCC-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
PeC-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	Cost is expected to be minimal
PeC-CCC-19.1.4.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	This action should be considered a high priority within the Butano watershed. This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).
PeC-CCC-19.1.5	Recovery Action	Logging	Prevent impairment to water quality (impaired instream temperature)										
PeC-CCC-19.1.5.1	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, CDFG, Private Landowners, San Mateo County						in-Kind	
PeC-CCC-19.1.6	Recovery Action	Logging	Prevent increased landscape disturbance										
PeC-CCC-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	
PeC-CCC-19.1.7	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, etc.)										
PeC-CCC-19.1.7.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, CDFG, Private Landowners, San Mateo County						In-Kind	
PeC-CCC-19.1.7.2	Action Step	Logging	Avoid road construction in riparian zones	2								In-Kind	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction within the Butano watershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-19.1.7.3	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	3	100	CalFire, CDFG, Private Landowners, San Mateo County						TBD	Cost for this recommendation depend on extent and feasibility of decommissioning legacy roads and landings.
PeC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
PeC-CCC-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.	3	20	CalFire, CDFG, Private Landowners, RWQCB						In-Kind	
PeC-CCC-19.2.1.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of coho salmon	3	20	Big Creek Lumber Co., Private Landowners, Red Tree						In-Kind	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Other considerations could potentially covering timber harvest activities for multiple watersheds within San Mateo County.
PeC-CCC-19.2.1.3	Action Step	Logging	Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	10	NMFS						In-Kind	The need for this action may change if the California Forest Practice Rules change and reach a no-take standard or the state receives incidental take authorization through the HCP process.
PeC-CCC-19.2.1.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in stream reaches where large woody material is deficient.	2	100	Big Creek Lumber Co., CalFire, CDFG, Private Landowners, Red Tree, Redwood Empire						In-Kind	Installing large woody material into stream deficient in large wood should be considered a top restoration priority, particularly in Core and Priority 1 subwatersheds. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
PeC-CCC-19.2.1.5	Action Step	Logging	Discourage San Mateo County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CDFG, NMFS, San Mateo County						In-Kind	Maintaining forestlands as functional forests is a key strategy for returning the watershed to properly functioning conditions.
PeC-CCC-19.2.1.6	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CDFG, NMFS, San Mateo County						In-Kind	Cost should be minimal and long-term savings due to reduced watershed impacts should be significant.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-19.2.2	Recovery Action	Logging	Prevent impairment to water quality (impaired instream temperature)										
PeC-CCC-19.2.2.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, Private Landowners, RPFs, RWQCB							Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC ESU) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for coho salmon rearing.
PeC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
PeC-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	0.05	0.05	0.05	0.05		0	This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides. Cost based on road inventory assessment at a rate of $1066/mile for 160 miles (assume 75% of road network)..
PeC-CCC-23.1.1.2	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, CalTrans, Private Landowners, San Mateo County	127.50	127.50	127.50	127.50	127.50	2,550	Replacement of culverts/bridges and upgrading to NMFS standards will result in increased cost for materials and construction but will likely result in structures that can withstand large storm events better than many existing structures. This recommendation should be considered standard practice. Cost based on upgrading 10 road crossing (assume minor 2 lane road and 25% of total crossings upgraded) at a rate of $254,278/unit.
PeC-CCC-23.1.1.3	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	2	10	CalFire, CalTrans, Private Landowners, San Mateo County						TBD	Many road associations are inadequately funded. A road improvement fund for the Pescadero could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity. This action encourages implementation of many existing policies. Cost accounted in part in other recovery actions. Setting up database is likely minimal cost once road inventory is completed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-23.1.1.4	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	17.50	17.50	17.50	17.50		70	Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards. Targeted areas should include sub watersheds with high erosion potential (e.g., lower portion of the Pescadero watershed). Roads that receive frequent use by the public will be very difficult to decommission; roads in more remote areas, particularly those historically used for timber harvest or in public ownership will likely be much easier to target for decommissioning. Roads located in steep sandstone geology or nearstream sandstone geology should receive the highest priority for decommissioning. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 5 miles of road network at a rate of $13,680/mile.
PeC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PeC-CCC-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County						In-Kind	ESA et al. (2004) noted that while construction and maintenance practices are steadily improving, there are many miles of unused and/or abandoned secondary roads on both public and private lands that have not been properly upgraded or decommissioned commensurate with the decrease in management intensity in the basin. Many of these roads may be poorly designed with regard to drainage (ESA et al. 2004). Even though chronic fine sediment production decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to many forms of erosion, including culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (ESA et al. 2004). On many forest and ranch roads located on both public and private lands, periodic maintenance occurs in the absence of an attempt to address chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossing can continue sediment delivery.
PeC-CCC-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County	91.00	91.00				182	Some road assessment have already been conducted in the watershed. Initial assessment efforts should target Core and Priority 1 sub watersheds. Existing assessments should be used when possible. Cost for road inventory accounted for in above action steps. Cost for erosion assessment estimated at $14.03/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-23.1.2.3	Action Step	Roads/Railroads	Reduce erosion from mainline timber harvest roads.	2	20	CalFire, CDFG, RWQCB, San Mateo County						In-Kind	Road densities are high throughout the watershed, estimated at 2.7 miles of road per square mile of watershed area, and at 3.2 miles per square mile of riparian area. Many of these roads are poorly situated and constructed, and improperly maintained. Roads were ranked as accounting for the largest percentage of total sediment delivery in the watershed from 1983-2002 by ESA et al. (2004). The total road-related sediment delivery rate during this time period was estimated at 50,379 yards^3 per year, which is more than twice the combined sediment delivery of all other land use in the watershed. Cost accounted for in other recovery actions and will incorporate measures to reduce road densities.
PeC-CCC-23.1.2.4	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	20	CalFire, CalTrans, NRCS, Private Landowners, San Mateo County						TBD	Partial barriers are present in the Pescadero watershed. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz County have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. If bridges are not feasible, replacement culverts on fish bearing streams must have a natural bottom. Cost accounted for road inventory assessment.
PeC-CCC-23.1.2.5	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	5	CalFire, CalTrans, RWQCB, San Mateo County, State Parks						TBD	Inadequate storage of sediment has been an ongoing issue in Pescadero watershed. The paucity of locations for temporary storage of landslide material is a significant constraint. Sites should be identified within the duration specified and this action should be continued in perpetuity. Future efforts may require incentives to increase landowner participation. Cost estimates cannot be determine until the feasibility and quantity of adequate spoils storage site is completed.
PeC-CCC-23.1.2.6	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County						TBD	Roadside berms can result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails).
PeC-CCC-23.1.2.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County, State Parks						0	Cost for type and quantity of energy dissipaters will be determined from road inventory assessment. However, this should be considered a standard business practice and minimal costs are anticipated.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-23.1.2.8	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, IWRP, NRCS, Private Landowners, State Parks						In-Kind	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff.
PeC-CCC-23.1.2.9	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalTrans, FEMA, San Mateo County, State Parks						TBD	Costs are difficult to accurately determine but it may result in a long term cost savings. San Mateo County should seek amendments to FEMA policies to facilitate improvements that prevent erosion and failure, particularly for watersheds targeted in this and the CCC coho salmon recovery plan.
PeC-CCC-23.1.2.10	Action Step	Roads/Railroads	Encourage County to continue to implement the San Mateo County Road Maintenance Manual	2	100	San Mateo County							
PeC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
PeC-CCC-23.1.3.1	Action Step	Roads/Railroads	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	3	20	CalTrans, IWRP, Private Landowners, San Mateo County, San Mateo RCD	8,750	8,750	8,750	8,750		35,000	Few partial barriers are present in the Pescadero Watershed. According to CDFG 2004 cost estimates can range from 150K to 800K depending on location and type of barrier. Some modified barriers in Santa Cruz Mountains Diversity Stratum have cost more than these estimates. Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater beneficial affects to various lifestages. Cost based on treating 7 impassable barriers at a rate of $500,560/barrier.
PeC-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										
PeC-CCC-23.1.4.1	Action Step	Roads/Railroads	Encourage adoption and implementation of a plan similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation 2008) regarding roadside maintenance activities. This plan was developed to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalFire, CalTrans, FEMA, IWRP, NRCS, San Mateo County, San Mateo RCD, USACE						In-Kind	
PeC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
PeC-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-23.2.1.1	Action Step	Roads/Railroads	Encourage San Mateo County to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	San Mateo County							The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within Pescadero Creek and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degrade streambed conditions in the watershed.
PeC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCC-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CDFG, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, San Mateo County, USACE, USFWS							Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
PeC-CCC-23.2.2.2	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	5	CalFire, CalTrans, Mid Peninsula Open Space District, POST, San Mateo County, State Parks							A well designed road management plan should result in overall cost savings due to lower maintenance costs. Particular emphasis should be directed at avoiding new road construction within the historical tidal prism of the Pescadero Marsh in order to avoid precluding future restoration actions and areas of high IP value.
PeC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PeC-CCC-23.2.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	CalFire, CalTrans, CDFG, Mid Peninsula Open Space District, NMFS, NRCS, POST, Private Landowners, RPFs, RWQCB, San Mateo County, USACE						In-Kind	Standard business practice; however, implementation may be difficult in the watershed due to the large number of small landowners and varying degree of financial resources. County of San Mateo evaluated roads and trails and likely have a good idea of priority locations that should be addressed on an annual basis. Rural roads should receive the majority of the attention vs. mainline roads in the watershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-23.2.3.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	CalFire, RPFs, RWQCB, San Mateo County, USACE							This should be considered the minimum standard for dirt roads in the watershed.
PeC-CCC-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	CalFire, NRCS, Public, RPFs, San Mateo County, USACE						0	Cost should be considered part of land owner road management plans.
PeC-CCC-23.2.3.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, RWQCB							
PeC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PeC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary (impaired quality and extent)										
PeC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	FEMA, State Parks, USACE							Cost accounted for in ESTUARY.
PeC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	FEMA, State Parks, USACE							Cost accounted for in ESTUARY.
PeC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, State Parks, USACE							Cost accounted for in ESUARY.
PeC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies.	1	5	Private Landowners, SWRCB						In-Kind	The SWRCB should conduct periodic sweeps of diversions in Pescadero Creek to ensure they are in compliance with annual reporting requirements and that annual water usage is accurately reported.
PeC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality										
PeC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	2	5	Private Landowners, RWQCB, SWRCB	5.00					5	Water temperatures during drought will be directly affected by ongoing surface water diversions in Pescadero Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost based on stream temperature monitoring (assume minimum of 10 sites) at a cost of $500/unit. Cost estimate does not account for maintenance or data management.
PeC-CCC-24.1.3.2	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	Private Landowners, RWQCB, SWRCB						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
PeC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Work with CDFG, County of San Mateo, and knowledgeable biologists to develop emergency rules and adopt implementation agreements regarding contingency efforts during drought conditions.	3	10	CDFG, NMFS, Private Consultants, Private Landowners, SWRCB						In-Kind	
PeC-CCC-24.1.4.2	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	3	2	CDFG Law Enforcement, NMFS OLE							Costs are anticipated to be absorbed into ongoing activities.
PeC-CCC-24.1.4.3	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CalFire, CalTrans, CDFG, NMFS, RWQCB, SWRCB						In-Kind	
PeC-CCC-24.1.4.4	Action Step	Severe Weather Patterns	Evaluate performance of all existing fish ladders to pass migrating fish during drought conditions.	2	5	CalTrans, CDFG, NOAA RC, San Mateo County	41.00					41	Evaluation should include an evaluation of existing maintenance requirements and development of landowner agreements where appropriate. Escapement monitoring cost are $40,541/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-24.1.5	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
PeC-CCC-24.1.5.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						TBD	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. However, avoiding development in areas prone to flooding will reduce the frequency of "emergency" conditions and adverse consequences to watershed processes associated with flood-fight efforts.
PeC-CCC-24.1.5.2	Action Step	Severe Weather Patterns	Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE							Not building flood control projects will not incur expenses. Particular attention should be directed at ensuring substantial future infrastructure is not placed within the historical tidal prism of the estuary.
PeC-CCC-24.1.5.3	Action Step	Severe Weather Patterns	Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	100	FEMA, San Mateo County						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-24.1.6	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
PeC-CCC-24.1.6.1	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in San Mateo County.	2	5	CDFG, NMFS HCD, San Mateo County						In-Kind	Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailor to general San Mateo County constraints. Costs may be higher if new guidelines are developed that do not rely on protocols from past studies.
PeC-CCC-24.1.6.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalTrans, County of San Mateo, FEMA, Public, USACE						TBD	Particular attention should be directed in the lower portion of the watershed including Butano Creek. A sediment assessment for high-risk shallow seeded landside areas is needed to determine extent of erosion potential and protective measures.
PeC-CCC-24.1.6.3	Action Step	Severe Weather Patterns	Establish targeted polices, requirements and assistance for sandy soils areas.	2	10	CalTrans, County of San Mateo, FEMA, Public, USACE							Extreme flood events such as those that occurred in 1955 could result in major input of sediment from upslope locations. Much of the lower watershed is comprised of highly erodible geology which would likely impact spawning and rearing habitats when sediment enters the stream channel. Improvements in land use practices will likely lower sediment yield rates following future flooding events.
PeC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PeC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair estuary water quality conditions for rearing juvenile salmonids.	1	100	CDFG, County of San Mateo, State Parks, SWRCB						In-Kind	Aquatic conditions in Pescadero Creek are adversely affected by water diversions -- the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board. Water diversions adversely impact the summer lifestage by reducing flows and available habitat for rearing and feeding in the riverine areas as well as the estuary. Water diversions also extend the duration necessary for conversion to a freshwater lagoon during the summer. Work would entail SWRCB reviewing all existing water diversions and contacting diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to come into compliance. Initial focus should be directed at diversions in the Butano watershed.
PeC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
PeC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	10	CDFG, County of San Mateo, POST, State Parks, SWRCB	36.00	36.00				72	Cost for evaluating stream flow model are estimated at $71,825.
PeC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	2	10	CDFG, County of San Mateo, NMFS, POST, Private Landowners, San Mateo RCD, SWRCB						TBD	Site specific studies should be conducted to ensure adequate instream flow targets are established for all life stages. Studies should include determining critical flow levels for stream reaches impacted by diversions, both future and current diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions would also be needed. The greatest numbers of water diversions are located in the lower watershed and in Butano Creek. Diversion in Butano Creek and its tributaries, coupled with degraded instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. Cost accounted for ensure water supply demands can be met (see above).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).	2	10	CDFG, County of San Mateo, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, SWRCB						TBD	Water diversions reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions. Initial focus to minimize the adverse effects of diversions should be focused in the Butano watershed. Completion of stream flow model will determine adequate conservation measures to insure adequate surface flows for coho.
PeC-CCC-25.1.2.4	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	30	CDFG, County of San Mateo, Farm Bureau, NMFS, Private Landowners, San Mateo RCD, SWRCB						In-Kind	In impacted areas, this recommendation should be a high priority. Cost will vary widely depending on willingness of water diverters to modify water diversions. Costs may be significant depending on site conditions and number of devices installed.
PeC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
PeC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in Pescadero Creek.	2	100	CDFG, County of San Mateo, NMFS, POST, Private Landowners, SWRCB						In-Kind	
PeC-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFG, NMFS, POST, Private Landowners, SWRCB						In-Kind	This recommendation should be considered standard practice.
PeC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
PeC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure water diversions do not impair water temperatures in Pescadero Creek.	2	100	CDFG, County of San Mateo, NMFS, POST, Private Landowners, SWRCB							As part of future 1600 agreement, CDFG should require installation of temperature thermographs upstream and downstream of the diversion. These results should be reviewed on a yearly basis by the SWRCB and CDFG. Cost accounted for in SEVERE WEATHER PATTERNS.
PeC-CCC-25.1.4.2	Action Step	Water Diversion/Impoundment	Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFG, NMFS, SWRCB						TBD	
PeC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**										
PeC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PeC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	2	5	CDFG, POST, SWRCB	8.00					8	Cost is based on a one year pilot study. The study would evaluate rates of compliance and overall impact of currently permitted diversion to coho salmon and steelhead survival and recovery. This should be adopted as a standard practice by CDFG. However, full implementation may be limited due to a lack of staffing. In this circumstance, other alternatives should be evaluated.
PeC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	100	SWRCB							The greatest numbers of water diversions are located in the lower watershed and in Butano Creek. Diversion in Butano Creek and its tributaries, coupled with degraded instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period.
PeC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	100	CDFG, County of San Mateo, NMFS, State Parks, SWRCB, USFWS						0	
PeC-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Promote conjunctive use of water with water projects whenever possible to maintain or restore salmonid habitat.	2	100	California Coastal Conservancy, CDFG, County of San Mateo, Farm Bureau, NRCS, POST, Private Landowners, San Mateo RCD, SWRCB, Trout Unlimited							Costs will vary significantly depending on landowner cooperation, infrastructure constraints, and types of infrastructure necessary to meet landowner needs. Due to the predicted levels of flow impairment in the watershed it is likely that significant infrastructure and coordination will be required to meet minimum flow requirements for steelhead viability and therefore, costs will be significant.

Pine Gulch Creek

Location	•Sonoma County
Watershed Area	•17.0 Square Miles
Potential Habitat	•11.4 Stream Miles
Vegetation	•50% Coniferous, 22% Riparian, 13% Grassland
Erodability	•Moderate
Ownership Patterns	•22% Private, 78% Public
Dominant Land Uses	•Recreation
Housing Density	•Low to Moderate
TMDL Pollutants	•Sediment, Temperature, Nutrients, Pathogens, Metals

Pine Gulch Creek
Photo National Park Service, Point Reyes

Pine Gulch Creek Coho Salmon: Nearly Extirpated

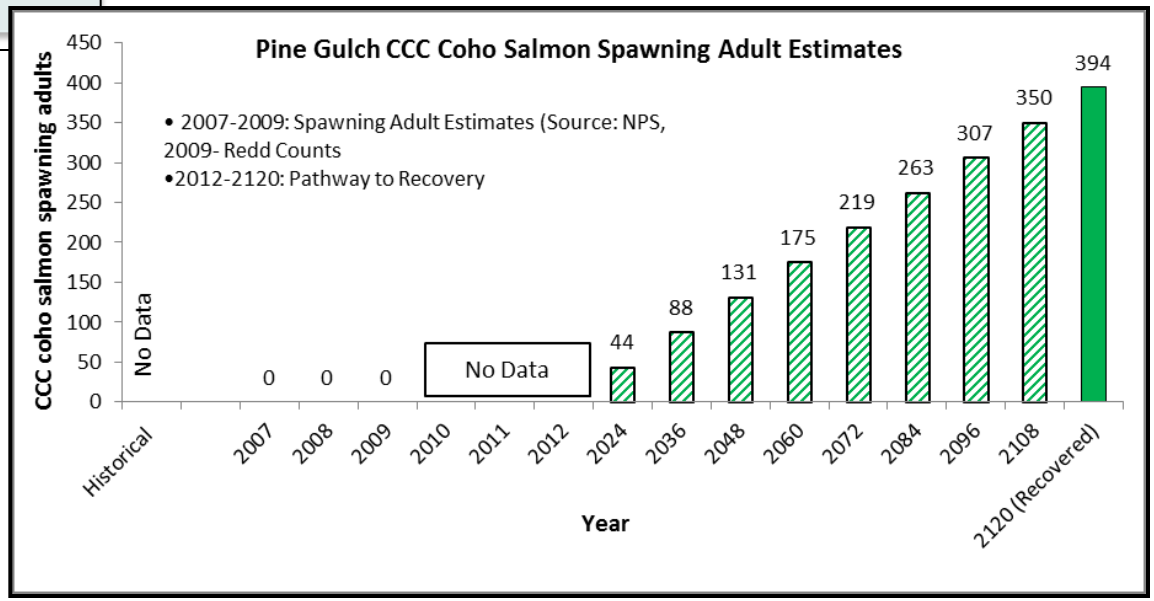
Recovery Goals

✓ Expand fish and habitat monitoring programs

Pine Gulch Creek Adult Spawner Targets

Downlisting to Threatened
197

Recovery
394



STEELHEAD: YES
CHINOOK SALMON: NO

Pine Gulch Creek

Potential Habitat: 11.4 miles
Recovery Target: 394 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	FAIR	VERY GOOD	POOR	FAIR	GOOD	FAIR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically
- Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the Coastal Diversity Stratum

Priority 2 & 3: Long-Term Restoration Actions

- Increase capacity of estuarine habitat and continue restoration efforts in Bolinas Lagoon
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats and complex habitat features
- Counties and municipalities should adopt a policy of "managed retreat"
- Investigate the feasibility of beaver re-location and re-introductions
- Address season of diversion, off-stream reservoirs, and bypass flows to be more protective of coho salmon

Recovery Partners

California State Parks – Since 1864
Marin Municipal Water District
County of Marin
Tomales Bay Watershed Council
National Park Service
SPAWN

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Gualala River Watershed Council, City of Santa Rosa and Morgan Bond, SWFSC

Pine Gulch Creek

Potential Habitat: 11.4 miles
Recovery Target: 394 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	HIGH	MEDIUM	MEDIUM	LOW	NA	MEDIUM	LOW	NA	MEDIUM	HIGH	HIGH	HIGH	HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Address sediment sources from road networks and other actions delivering sediment to stream channels
- Implement exclusion fencing and off-stream water storage

Landslide near Pine Gulch Creek
Photo by National Park service, Point Reyes

Priority 2 & 3: Long-Term Threat Abatement Actions

- Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows
- Implement relevant high priority treatments from the PWA assessment. Promote road decommissioning when feasible
- Work with land owners or public agencies to acquire water for instream flows to minimize adverse effects of droughts to salmonids
- Promote the use of reclaimed water for agricultural or other uses
- Adequately screen water diversions to prevent juvenile salmonid mortalities

Conservation Highlights

- Private landowners are augmenting flow through off-channel storage in Pine Gulch Creek to improve hydrology for coho salmon

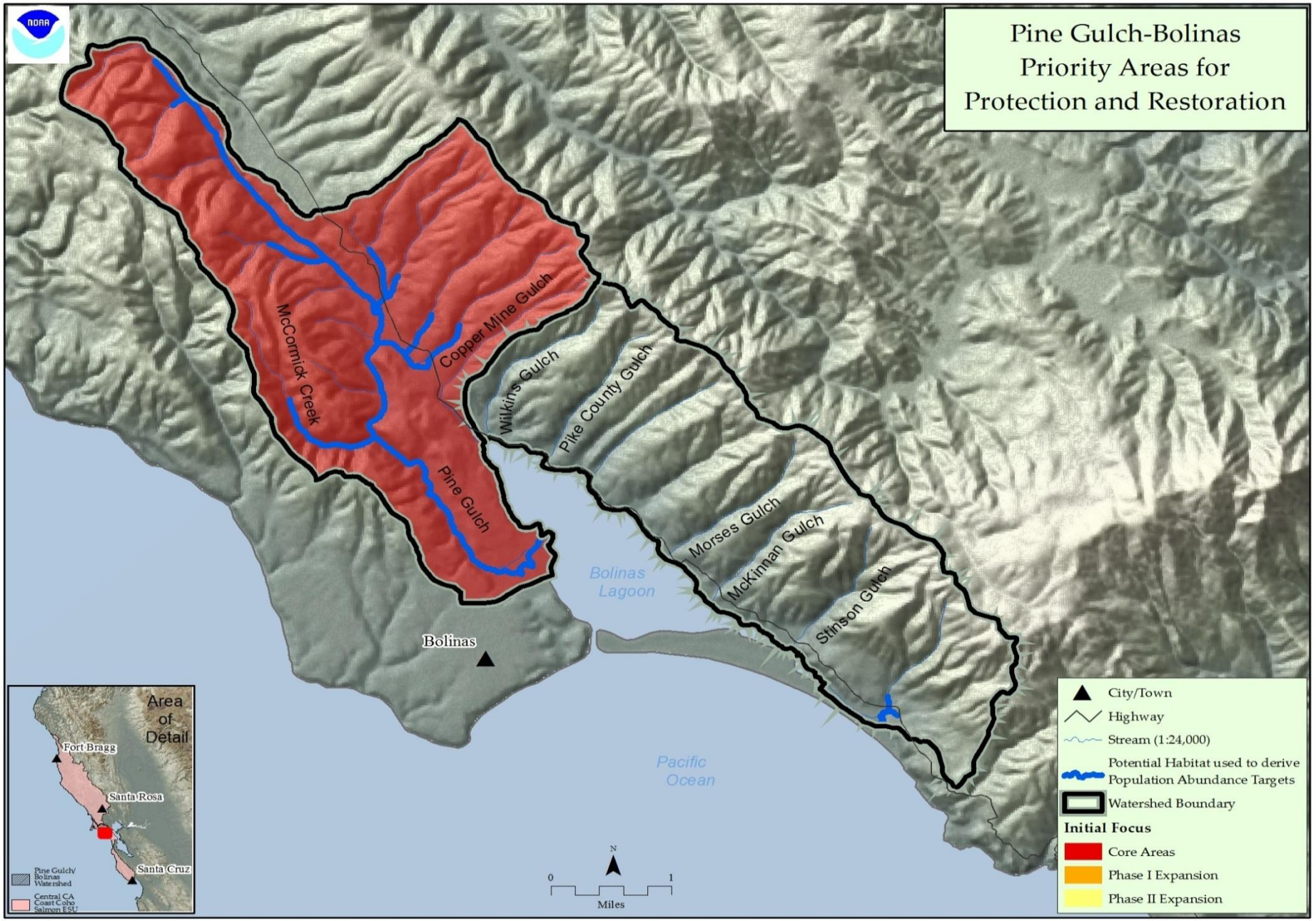


Figure 1: Map of Pine Gulch Creek

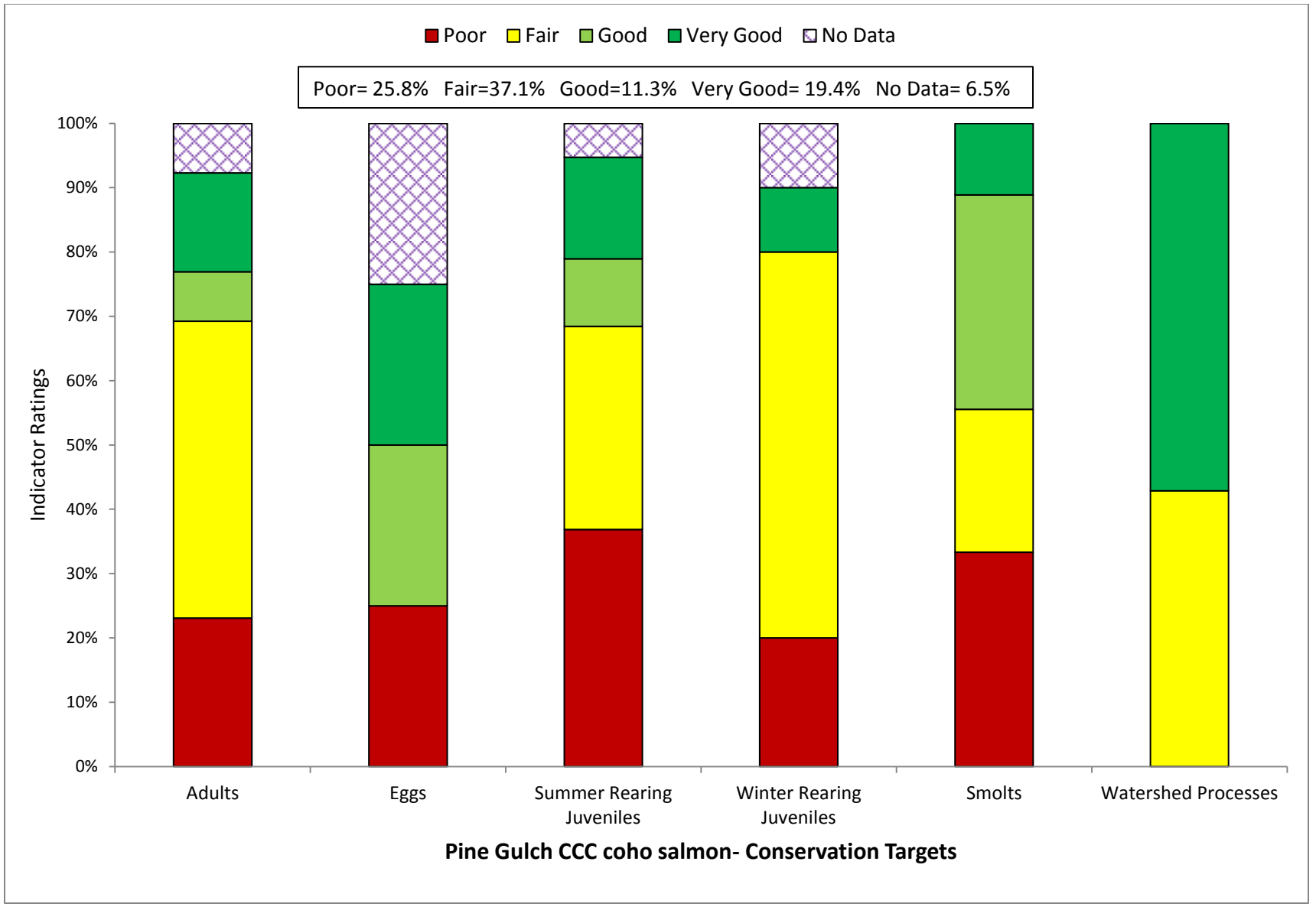


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Pine Gulch Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**NA**	0	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**96% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**3% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-Km to 74% of IP-km**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km (Reference Spence)**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**ND**	0	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**0% streams 0% IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**NA**	0	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**<50% of streams/ IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =58**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.58 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**96% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**<50% of streams/ IP-km (>85% average stream canopy)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**3% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP-km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**>90% of streams/ IP-km maintains severity score of 3 or lower**	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**NA**	0	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**96% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**3% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.58 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**1.65% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**20% of Watershed in Agriculture**	Fair	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**<10% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**6% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**25-50% Historical Species Composition**	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**1.4 Miles/Square Mile**	Very Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**0.9 Miles/Square Mile**	Fair	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile
Winter Rearing	Water Quality	Turbidity	**0.9 Miles/Square Mile**	Fair	Newcombe and Jensen 2003	>74% of IP km maintains severity score of 3 or lower

Table 2: CAP Threats Results ~ Pine Gulch Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Medium	Medium	Low	Low	High	Medium
2	Channel Modification	High	Medium	Medium	High	Medium	High	High
3	Disease, Predation and Competition	Medium	-	Medium	Low	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Medium	Medium
5	Fishing and Collecting	Medium	-	-	-	-	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Medium	Medium	Medium	Medium	Medium	Medium	Medium
8	Logging and Wood Harvesting	Low	Low	Low	Low	Low	Medium	Low
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Medium	Medium
11	Residential and Commercial Development	Medium	Medium	Medium	High	Medium	High	High
12	Roads and Railroads	Medium	High	Medium	Medium	Low	High	High
13	Severe Weather Patterns	Medium	Medium	High	High	Medium	High	High
14	Water Diversion and Impoundments	High	Low	Very High	Low	Medium	Medium	High
Threat Status for Targets and Project		High	High	High	High	Medium	Very High	High

Cental CA Coast Coho Salmon ~ Pine Gulch Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**
   - 1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range
     - 1.1.1. **Recovery Action:** Increase the extent of estuarine habitat
       - 1.1.1.1. **Action Step:** Increase capacity of estuarine habitat in Bolinas Lagoon according to the recommendations in the Gulf of the Farallones National Marine Sanctuary preferred alternative.
       - 1.1.1.2. **Action Step:** Continue restoration efforts on Bolinas lagoon to benefit coho salmon during all life phases and seasons.

2. **Restoration- Floodplain Connectivity**
   - 2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 2.1.1. **Recovery Action:** Increase and enhance velocity refuge
       - 2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.
       - 2.1.1.2. **Action Step:** Restore channel function in the lower watershed to create off channel habitat.
       - 2.1.1.3. **Action Step:** Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.
   - 2.2. **Objective:** Address the inadequacy of existing regulatory mechanisms
     - 2.2.1. **Recovery Action:** Increase and enhance velocity refuge
       - 2.2.1.1. **Action Step:** Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

3. **Restoration- Habitat Complexity**
   - 3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range
     - 3.1.1. **Recovery Action:** Improve shelter rating
       - 3.1.1.1. **Action Step:** Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core and Phase I areas first.
     - 3.1.2. **Recovery Action:** Increase frequency of primary pools
       - 3.1.2.1. **Action Step:** Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (CDFG 2004).

3.1.3. **Recovery Action:** Improve habitat complexity

3.1.3.1. **Action Step:** Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations

4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

4.1.1.2. **Action Step:** Implement the Pine Gulch Creek Watershed Enhancement Project. The proposed project includes appropriation of water to storage during the winter season, controlled riparian diversion between April and July 1, and no diversion between July 1 and December 15 of each year.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for coho salmon (CDFG 2004).

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.

8.1.2.3. **Action Step:** Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)

9.1.1.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

9.1.1.3. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels. (See ROADS). Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).

9.1.1.4. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).

9.1.1.5. **Action Step:** Implement DS level actions and BMP's

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population.

10.1.1.2. **Action Step:** Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the DS, while minimizing departure from the genetic profile that historically existed in the population.

10.1.2. **Recovery Action:** Increase spawner density by monitoring the population status for response to recovery actions.

10.1.2.1. **Action Step:** Conduct instream habitat assessment where there are data gaps to develop restoration recommendations

10.1.2.2. **Action Step:** Conduct upslope watershed assessments to define limiting factors. Encourage all major landowners to participate

10.1.3. **Recovery Action:** Increase spatial structure and diversity

10.1.3.1. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.3.2. **Action Step:** Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.

10.1.3.3. **Action Step:** Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed

11. Restoration- Water Quality

11.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

11.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.2.1. **Recovery Action:** Improve stream temperature conditions

11.2.1.1. **Action Step:** Assess the water temperature regime during the summer season for three to five years to determine the role of water temperature as a limiting factor in coho salmon production (CDFG 2004).

11.2.1.2. **Action Step:** Plant native vegetation to promote streamside shade.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

13.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.1.1. **Recovery Action:** Prevent impairment of floodplain connectivity

13.1.1.1. **Action Step:** All proposed development projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.

13.1.1.2. **Action Step:** Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

13.1.1.3. **Action Step:** Encourage counties to develop a Sensitive Habitat Ordinance

13.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.2.1. **Recovery Action:** Prevent impairment of floodplain connectivity

13.2.1.1. **Action Step:** Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow "emergencies".

13.2.1.2. **Action Step:** Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. **Threat- Fire/Fuel Management**

No species-specific actions were developed.

16. **Threat- Fishing/Collecting**

No species-specific actions were developed.

17. **Threat- Hatcheries**

No species-specific actions were developed.

18. **Threat- Livestock**

No species-specific actions were developed.

19. **Threat- Logging**

No species-specific actions were developed.

20. **Threat- Mining**

No species-specific actions were developed.

21. **Threat- Recreation**

No species-specific actions were developed.

22. **Threat- Residential/Commercial Development**

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

22.1.1.1. **Action Step:** Implement actions in ROADS and RAILROADS

22.1.1.2. **Action Step:** Implement DS level Actions

22.1.2. **Recovery Action:** Prevent impairment to floodplain connectivity

22.1.2.1. **Action Step:** Implement actions in FLOODPLAIN

22.1.2.2. **Action Step:** Implement DS level actions

22.1.3. **Recovery Action:** Prevent impairment to riparian species and composition

22.1.3.1. **Action Step:** Implement actions in RIPARIAN

22.1.4. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.4.1. **Action Step:** Implement actions in WATER DIVERSIONS

22.1.4.2. **Action Step:** Implement DS level actions

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

22.2.1. **Recovery Action:** Prevent increased landscape disturbance

22.2.1.1. **Action Step:** Implement DS level actions and BMP's

23. **Threat- Roads/Railroads**

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, dams, etc.)

23.1.1.1. **Action Step:** Revaluate the high priority treatment recommendations for unpaved roads from the PWA assessment, and implement recommended treatments if they are still relevant. If not, reassess and make new recommendations for treatment. Push for decommissioning when feasible.

23.1.1.2. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.2. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.1.2.1. **Action Step:** NMFS and other stakeholders will work with RCD or NRCS to encourage hiring of consultants to conduct road assessments (first for subwatersheds in Core areas, then for Phase I areas).

23.1.2.2. **Action Step:** Address sediment sources from road networks and other actions that deliver sediment to stream channels.

23.1.2.3. **Action Step:** Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.2.1.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

24. **Threat- Severe Weather Patterns**

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.

24.1.1.2. **Action Step:** All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.

25. **Threat- Water Diversion/Impoundment**

25.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.1.1. **Recovery Action:** Prevent impacts from future water development

25.1.1.1. **Action Step:** Develop off channel water storage for farming operation within the watershed to increase summer pool habitat in the lower portion of the watershed.

25.1.1.2. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.1.2. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.2.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Pine Gulch Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PGC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
PGC-CCC-1.1.1.1	Action Step	Estuary	Increase capacity of estuarine habitat in Bolinas Lagoon according to the recommendations in the Gulf of the Farallones National Marine Sanctuary preferred alternative.	2	40	CDFG, Golden Gate National Recreation Area, Gulf of the Farallones National Marine Sanctuary, Marin County, Marin County Open Space District, USACE						TBD	
PGC-CCC-1.1.1.2	Action Step	Estuary	Continue restoration efforts on Bolinas lagoon to benefit coho salmon during all life phases and seasons.	2	10	CDFG, Golden Gate National Recreation Area, Gulf of the Farallones National Marine Sanctuary, Marin County, Marin County Open Space District, NMFS	1,550	1,550				3,100	Cost based on treating 10% of 1,140 acres of estuary habitat at a rate of $272,120/acre.
PGC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
PGC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, NMFS, NPS	22.50	22.50				45	Cost based on treating 1.25 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
PGC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Restore channel function in the lower watershed to create off channel habitat.	2	10	CDFG, NMFS, NPS	25.50	25.50				51	Cost based on treating 25% of 2 miles of lower Pine Gulch at a rate of $101,120/mile.
PGC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.	2	20	NPS						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-2.2	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**										
PGC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
PGC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	20	FishNet 4C, Marin County						TBD	
PGC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve shelter rating										
PGC-CCC-3.1.1.1	Action Step	Habitat Complexity	Identify historic CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover. Prioritize Core and Phase I areas first.	2	40	CDFG, NMFS, NPS							Cost are encumbered in increase shelter rating.
PGC-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
PGC-CCC-3.1.2.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase and improve pool frequency and depth (CDFG 2004).	2	10	CDFG, NMFS, NPS	25.00	25.00				50	Cost based on treating 10% of 5 miles of stream at a rate of $101,120/ELJ.
PGC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve habitat complexity										
PGC-CCC-3.1.3.1	Action Step	Habitat Complexity	Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations	2	10		5.00	5.00				10	Cost for beaver re-introduction based on estimate at $10,000/beaver family translocation.
PGC-CCC-4.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
PGC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-4.1.1.1	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	20	CDFG, Marin County, SWRCB						In-Kind	
PGC-CCC-4.1.1.2	Action Step	Hydrology	Implement the Pine Gulch Creek Watershed Enhancement Project. The proposed project includes appropriation of water to storage during the winter season, controlled riparian diversion between April and July 1, and no diversion between July 1 and December 15 of each year.	2	40	CDFG, Marin County, Private Landowners, State Water Resources Control Board						TBD	
PGC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
PGC-CCC-8.1.1.1	Action Step	Riparian	Restore and protect riparian vegetation to improve migration and summer/overwintering habitat for coho salmon (CDFG 2004).	2	20	CDFG, NMFS, NPS	400.00	400.00	400.00	400.00		1,600	Cost based on treating 0.5 miles (assume 80 acres/mile in 5% High IP with 1 mile minimum) at a rate of $20,057/acre.
PGC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
PGC-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	30	, CDFG, NMFS						TBD	Cost likely accounted for in above action steps.
PGC-CCC-8.1.2.2	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.	2	20	, CDFG, NMFS						TBD	Cost likely accounted for in above action steps.
PGC-CCC-8.1.2.3	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	2	10	Marin RCD, MMWD						In-Kind	
PGC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
PGC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-9.1.1.1	Action Step	Sediment	Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)	2	10		56.00	56.00				112	Cost based on fish/habitat monitoring estimated at $111,192/project.
PGC-CCC-9.1.1.2	Action Step	Sediment	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	10		31.50	31.50				63	Cost based on road inventory estimated at $927/mile and sediment assessment estimated at $12/acre (assume 25% of total watershed acres)..
PGC-CCC-9.1.1.3	Action Step	Sediment	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels. (See ROADS). Restoration projects that upgrade or decommission high risk roads should be considered an extremely high priority for funding (e.g., PCSRF).	2								TBD	Cost accounted for in above action step.
PGC-CCC-9.1.1.4	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	2	10		12.00	12.00				24	Cost based on decommissioning 2 miles of riparian road network at a rate of $12,000/mile
PGC-CCC-9.1.1.5	Action Step	Sediment	Implement DS level actions and BMP's	3									
PGC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
PGC-CCC-10.1.1.1	Action Step	Viability	Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population.	1		CDFG, NMFS PRD, NPS, State Parks, Trout Unlimited, UC Extension						TBD	
PGC-CCC-10.1.1.2	Action Step	Viability	Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the DS, while minimizing departure from the genetic profile that historically existed in the population.	1		CDFG, NMFS, NPS, State Parks, Trout Unlimited, UC Extension						TBD	
PGC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density by monitoring the population status for response to recovery actions.		40	NPS						TBD	Continue to support ongoing monitoring efforts by NPS

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-10.1.2.1	Action Step	Viability	Conduct instream habitat assessment where there are data gaps to develop restoration recommendations	3	5		2.70					3	Cost based on habitat typing survey estimated at $333/IP km.
PGC-CCC-10.1.2.2	Action Step	Viability	Conduct upslope watershed assessments to define limiting factors. Encourage all major landowners to participate	3	10							TBD	Cost likely accounted for in sediment assessment.
PGC-CCC-10.1.3	Recovery Action	Viability	Increase spatial structure and diversity										
PGC-CCC-10.1.3.1	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10							In-Kind	
PGC-CCC-10.1.3.2	Action Step	Viability	Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.	1	10	, CDFG, USACE						TBD	
PGC-CCC-10.1.3.3	Action Step	Viability	Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed	2	5	, CDFG, Marin RCD, NMFS						In-Kind	
PGC-CCC-11.1	**Objective**	**Water Quality**	**Address the inadequacy of existing regulatory mechanisms.**										
PGC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
PGC-CCC-11.1.1.1	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	20	NPS						TBD	
PGC-CCC-11.2	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-11.2.1	Recovery Action	Water Quality	Improve stream temperature conditions										
PGC-CCC-11.2.1.1	Action Step	Water Quality	Assess the water temperature regime during the summer season for three to five years to determine the role of water temperature as a limiting factor in coho salmon production (CDFG 2004).	3	5	NPS						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-11.2.1.2	Action Step	Water Quality	Plant native vegetation to promote streamside shade.	2	20		402.50	402.50	402.50	402.50		1,610	Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with 1 mile minimum) at a rate of $20,057/acre.
PGC-CCC-13.1	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms**										
PGC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment of floodplain connectivity										
PGC-CCC-13.1.1.1	Action Step	Channel Modification	All proposed development projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.	2	10	Marin County, NPS, Private Landowners						TBD	
PGC-CCC-13.1.1.2	Action Step	Channel Modification	Counties and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	20	Marin County						In-Kind	
PGC-CCC-13.1.1.3	Action Step	Channel Modification	Encourage counties to develop a Sensitive Habitat Ordinance	2	10	Marin County						In-Kind	
PGC-CCC-13.2	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment of floodplain connectivity										
PGC-CCC-13.2.1.1	Action Step	Channel Modification	Agencies should develop large woody debris retention programs and move away from the practice of removing instream large woody debris under high flow "emergencies".	2	10	NPS						In-kind	
PGC-CCC-13.2.1.2	Action Step	Channel Modification	Conduct restoration activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows.	2	10	Marin County, Marin RCD, NPS	62.50	62.50				125	Cost based on $25,000/mile for 5 miles of stream with 1 project/mile.
PGC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PGC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Implement actions in ROADS and RAILROADS	2									
PGC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Implement DS level Actions	3									
PGC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity										
PGC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Implement actions in FLOODPLAIN	2									
PGC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Implement DS level actions	3									
PGC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										
PGC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Implement actions in RIPARIAN	2									
PGC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
PGC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Implement actions in WATER DIVERSIONS	2									
PGC-CCC-22.1.4.2	Action Step	Residential/Commercial Development	Implement DS level actions	3									
PGC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms.**										
PGC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
PGC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Implement DS level actions and BMP's	3									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PGC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent alterations to sediment transport (road condition/density, dams, etc.)										
PGC-CCC-23.1.1.1	Action Step	Roads/Railroads	Revaluate the high priority treatment recommendations for unpaved roads from the PWA assessment, and implement recommended treatments if they are still relevant. If not, reassess and make new recommendations for treatment. Push for decommissioning when feasible.	2	10		235.00	235.00				470	Cost based on treating 14 miles of road network at $21,000/mile. Cost to decommission road network to viability targets is $168,000.
PGC-CCC-23.1.1.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	50							In-Kind	
PGC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
PGC-CCC-23.1.2.1	Action Step	Roads/Railroads	NMFS and other stakeholders will work with RCD or NRCS to encourage hiring of consultants to conduct road assessments (first for subwatersheds in Core areas, then for Phase I areas).	2	50							TBD	Cost accounted for in road and sediment assessment.
PGC-CCC-23.1.2.2	Action Step	Roads/Railroads	Address sediment sources from road networks and other actions that deliver sediment to stream channels.	2	20							TBD	Cost likely accounted for in sediment assessment.
PGC-CCC-23.1.2.3	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	3	10		22.00	22.00				44	Cost based on decommissioning 4 miles of road network at $12,000/mile.
PGC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
PGC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-23.2.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	50							In-Kind	
PGC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
PGC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
PGC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	2	10	Marin RCD						TBD	
PGC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	All local and state planning and development should consider, and provide contingencies for, droughts in a manner compatible with CCC coho salmon recovery needs.	2	20	Marin County, NPS						TBD	
PGC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
PGC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impacts from future water development										
PGC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Develop off channel water storage for farming operation within the watershed to increase summer pool habitat in the lower portion of the watershed.	2	30	California Coastal Conservancy, CDFG, Marin County, Private Landowners, State Water Resources Control Board						TBD	Cost depend on landowner participation.
PGC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	20	Marin County, Marin RCD, NRCS, State Water Resources Control Board						In-Kind	
PGC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PGC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100							In-Kind	This recommendation should be considered standard practice.

Pudding Creek

Location	•Mendocino County
Watershed Area	• 18.0 Square Miles
Potential Habitat	•118.5 Stream Miles
Vegetation	•74% Coniferous •4% Riparian or Montane Forest
Erodability	•Moderately Low
Ownership Patterns	•100% Private
Dominant Land Uses	•Timber
Housing Density	•Low
TMDL Pollutants	•Temperature

Pudding Creek estuary
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Pudding Creek Coho Salmon: Persistent – moderately abundant

Recovery Goals

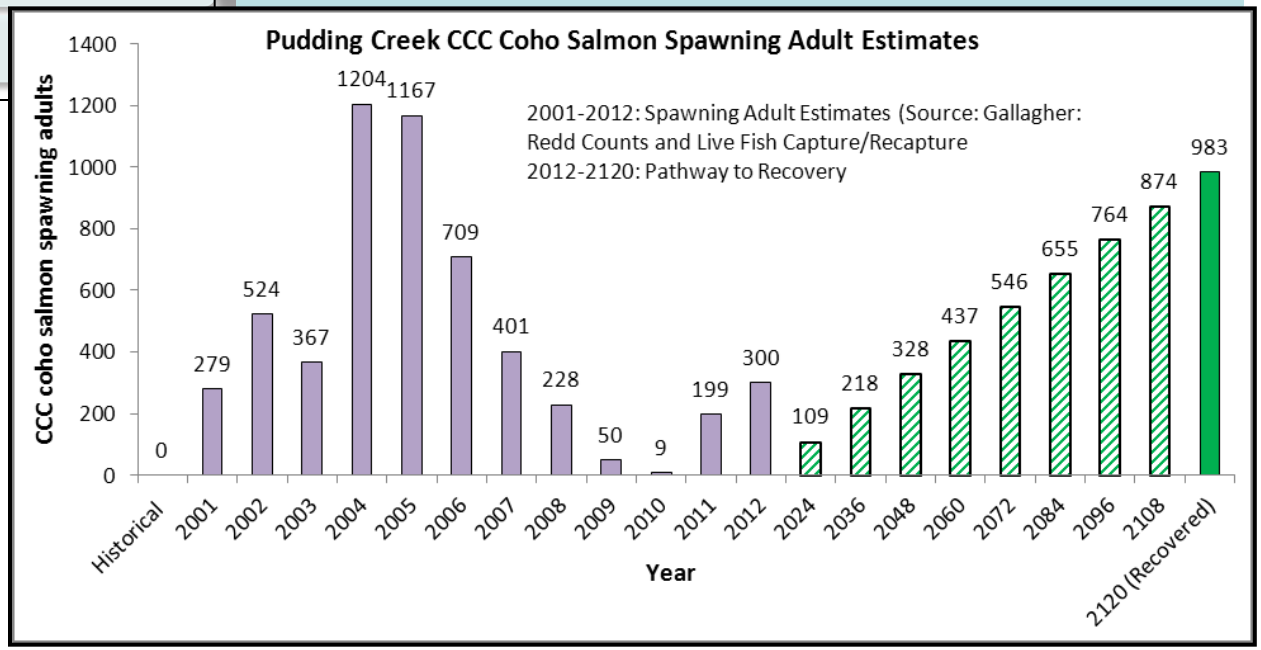
- ✓ Continue funding the life cycle monitoring station
- ✓ Evaluate effects of habitat restoration efforts
- ✓ Evaluate effects of the impoundment on over wintering survival and passage

Pudding Creek Adult Spawner Targets

Downlisting to Threatened
492

Recovery
983

STEELHEAD: YES
CHINOOK SALMON: NO



Pudding Creek

Potential Habitat: 26.4 miles
Recovery Target: 983 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	GOOD	GOOD	POOR	POOR	GOOD	FAIR	FAIR	FAIR	POOR

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Evaluate lower Pudding Creek impoundment and its contribution/effect to coho salmon survival
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Evaluate channel restoration opportunities in the Little Valley subwatershed
- Retain, recruit and actively input large wood into stream
- Continue ongoing life cycle monitoring station at the Pudding Creek dam
- Continue juvenile monitoring originally initiated by CDFG in 1980's near the Slaughterhouse Gulch confluence

Priority 2 & 3: Long-Term Restoration Actions

- Improve dissolved oxygen concentrations in the Pudding Creek impoundment
- Decommission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access
- Protect riparian plant community within inset floodplains and riparian corridors
- Conduct conifer release to promote growth of larger diameter trees where appropriate
- Develop a Road Sediment Reduction Plan to evaluate and treat roads and skid trails

Campbell TIMBERLAND MANAGEMENT LLC

Recovery Partners

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH & GAME

Photo courtesy from left to right: Campbell Timberland, Gualala River Watershed Council, Campbell Timberland, City of Santa Rosa and Kristen Kittleson, County of Santa Cruz.

Pudding Creek

Potential Habitat: 26.4 miles
Recovery Target: 983 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	MEDIUM	MEDIUM	MEDIUM	LOW	NA	LOW	HIGH	LOW	LOW	LOW	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Implement actions to restore channel meander and instream complexity
- Discourage future forestland conversions.

Priority 2 & 3: Long-Term Threat Abatement Actions

- Protect headwater channels with larger buffers and encourage tree retention on the axis of headwall swales
- Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities
- Use available best management practices for road construction, maintenance, management and decommissioning
- Fully maintain all roads with inside ditches unless these roads have been properly decommissioned
- Limit winter use of unsurfaced roads and recreational trails
- Ensure Pudding Creek fish ladder will pass migrating fish during drought conditions

Salmon at the lifecycle station.
Photo courtesy: Campbell Timberland

Conservation Highlights

- Campbell Timberland Management is working restore habitat complexity through placement of large woody debris structures and sediment remediation projects. They will also conduct effectiveness monitoring.
- Campbell Timberland Management and the California Department of Fish and Game have collaborated on adult and smolt coho salmon surveys.

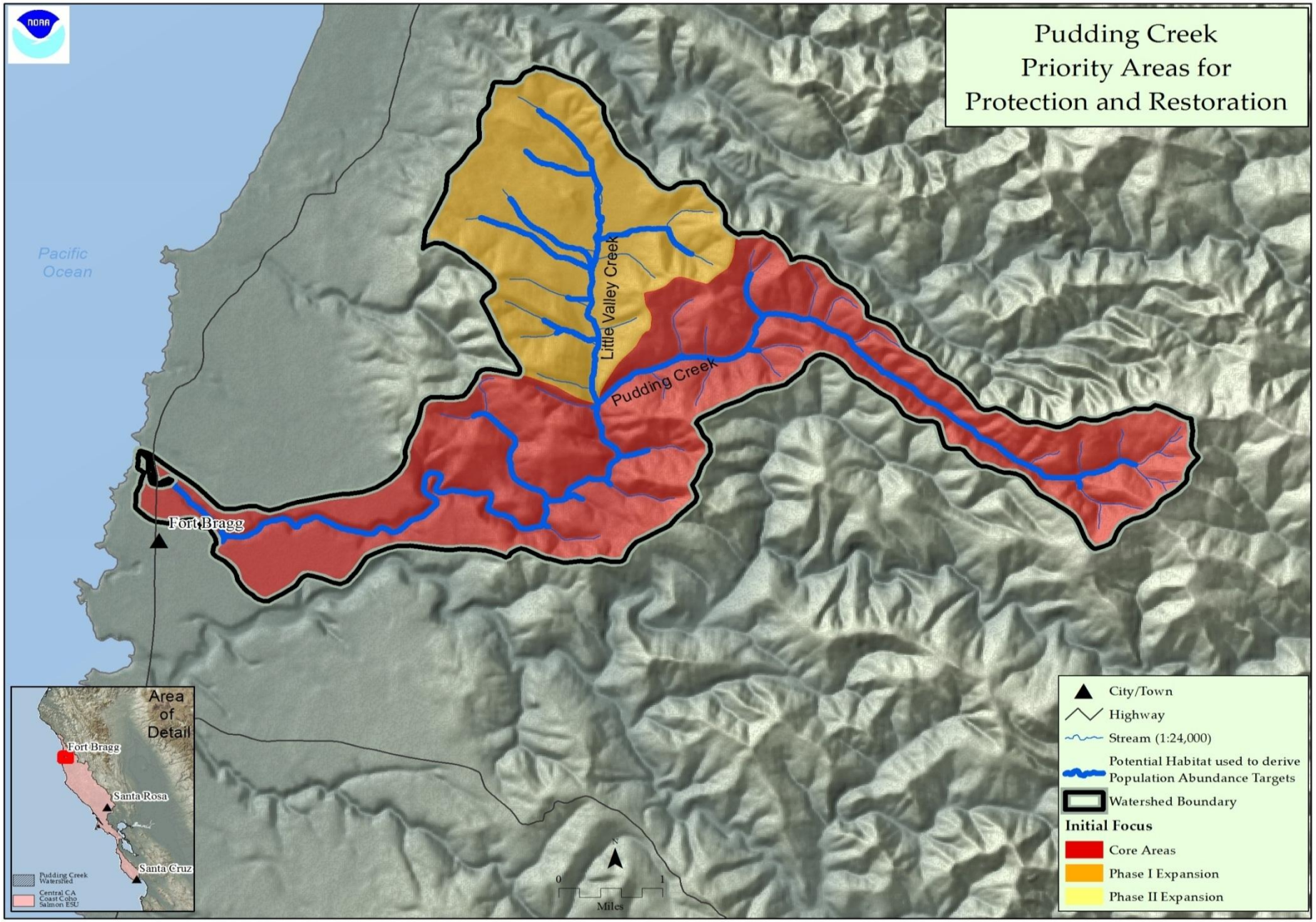


Figure 1: Map of Pudding Creek

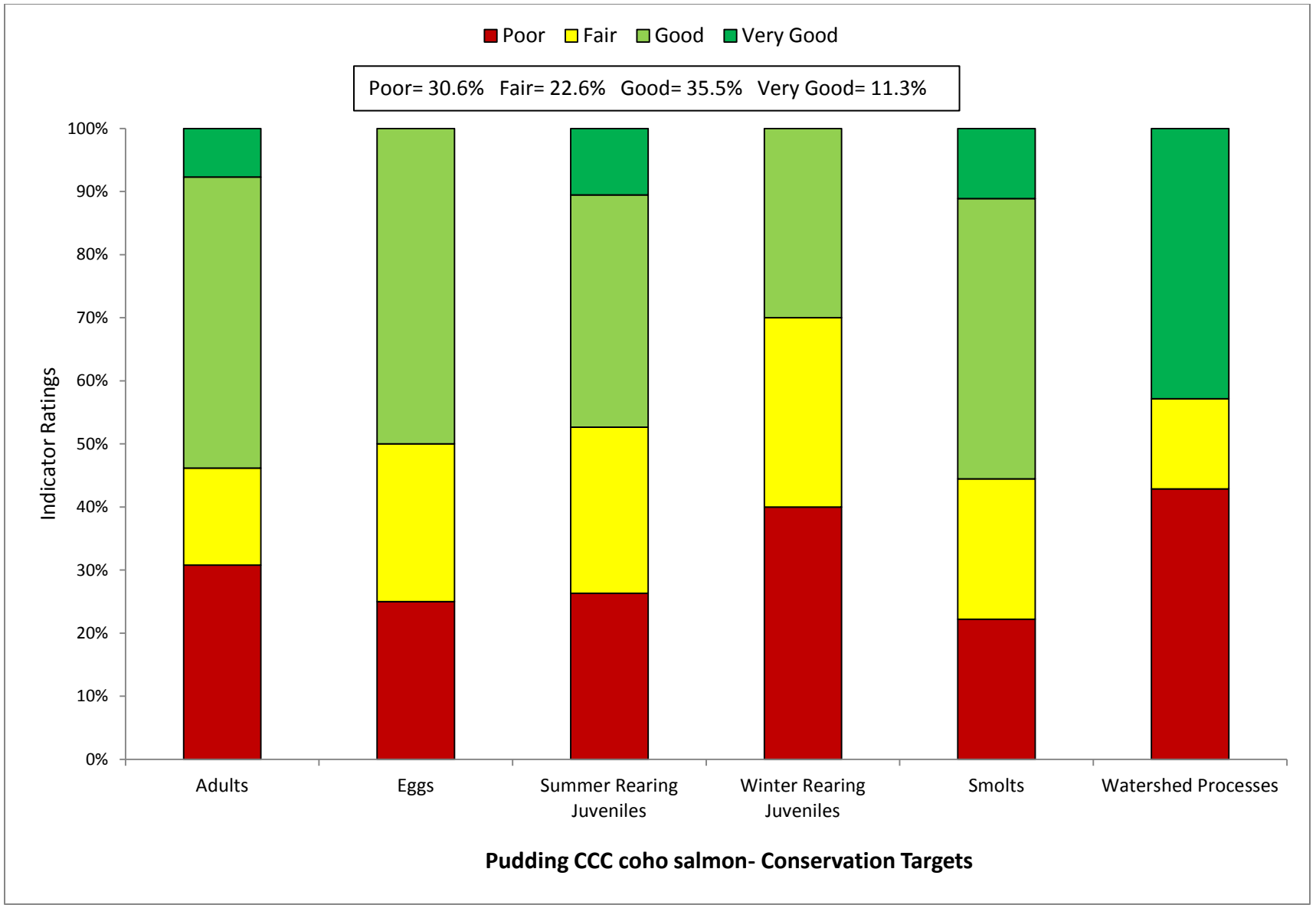


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Pudding Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**0.38 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 to 1.3 Key Pieces/ 100m**	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% by streams 86% by IP-km (>30% Pools; >20% Riffles)**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**43% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**37% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**> 80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**1-20 spawner per IP-km**	Fair	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**50% streams 86% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.38 Key Pieces/ 100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/ 100m**	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**<50% of streams IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams 86% IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**43% streams/IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =58**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score <35**	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.69 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**> 90% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**70-80% of streams/IP with average canopy >85%**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**37% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% streams 86% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0.2-0.5 fish/meter^2**	Fair	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.38 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/ 100m**	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams 86% IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**43% of streams/ IP-Km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**> 90% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**37% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% streams 86% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-Km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**43% of streams/ IP-Km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.69 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**> 90% IP-km (>6 and <16 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-Km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces moderate risk spawner density**	Fair	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**1.4% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**35% of Watershed in Timber Harvest**	Fair	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**33% of watershed >1 unit/20 acres**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**> 75% Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**9.4 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**9.7 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Pudding Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Medium	Medium	High	Low	High	High
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	Medium	High	High	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	High	Medium	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Medium	Medium	Medium	Medium
Threat Status for Targets and Project		Medium	Medium	High	High	Medium	High	High

Central CA Coast Coho Salmon ~ Pudding Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Evaluate Pudding Creek impoundment and its contribution/effect to coho salmon survival (CDFG 2004).

1.1.1.2. **Action Step:** Evaluate habitat potential and benefits of providing passage under Highway 1 to the impoundment at Ocean Lake Mobile Home Park.

1.1.2. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.2.1. **Action Step:** Repair dam as appropriate to maintain over wintering habitat in the estuary (CDFG 2004).

1.1.3. **Recovery Action:** Develop and implement programs to address water quality concerns.

1.1.3.1. **Action Step:** Improve dissolved oxygen concentrations in the Pudding Creek impoundment from installation of aeration devices (such as SolarBees)

1.1.3.2. **Action Step:** Minimize water drafting from the Pudding Creek impoundment.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.2. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.

2.1.1.3. **Action Step:** Evaluate channel restoration opportunities in the Little Valley subwatershed and evaluate potential benefits to juvenile rearing habitats.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Implement a large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).

3.1.1.2. **Action Step:** Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).

3.1.1.3. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.2. **Recovery Action:** Improve shelter rating and percent primary pools

3.1.2.1. **Action Step:** Promote growth of larger diameter trees where appropriate.

3.1.2.2. **Action Step:** Protect existing riparian areas to maintain LWD supply and canopy.

3.1.2.3. **Action Step:** Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

4. Restoration- Hydrology

No species-specific actions were developed.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with road density

5.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

5.1.2. **Recovery Action:** Prevent landscape disturbance

5.1.2.1. **Action Step:** Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems

5.1.2.2. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.2.3. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

8.1.1.2. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

9.1.1.2. **Action Step:** Decommission Slaughterhouse Gulch riparian road.

9.1.1.3. **Action Step:** Evaluate all roads and skid trails throughout the winter period on their lands.

9.1.1.4. **Action Step:** Permitting agencies should evaluate all authorized erosion control measures during the winter period.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.1.1. **Recovery Action:** Increase spawner density

10.1.1.1. **Action Step:** Continue ongoing life cycle monitoring station at Pudding Creek dam (CDFG 2004). Establish consistent reporting methods to ensure ESU-wide consistency.

10.1.1.2. **Action Step:** Re-evaluate spawner density targets pending completion of Little Valley habitat suitability report.

10.1.1.3. **Action Step:** Continue juvenile monitoring originally initiated by CDFG in 1980's near the Slaughterhouse Gulch confluence.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.1.1. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Include County of Mendocino in regards to inclusion of Sherwood Ridge Road.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to habitat complexity

19.1.2.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

19.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.3.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.3.2. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.3.3. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

19.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.4.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.5. **Recovery Action:** Prevent increased landscape disturbance

19.1.5.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).

19.2.1.2. **Action Step:** Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.

19.2.1.3. **Action Step:** Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.2. **Action Step:** Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.

23.1.1.3. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.1.4. **Action Step:** Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.

23.1.2. **Recovery Action:** Prevent impairment to passage and migration

23.1.2.1. **Action Step:** Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.2.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.1.1. **Action Step:** Ensure all diversions in the watershed are in compliance with all applicable laws and policies.

24.1.1.2. **Action Step:** Evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).

24.1.2. **Recovery Action:** Prevent impairment to passage and migration

24.1.2.1. **Action Step:** Ensure Pudding Creek fish ladder to performing sufficiently to pass migrating fish during drought conditions.

24.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.3.1. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.1.3.2. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Pudding Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
PC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
PC-CCC-1.1.1.1	Action Step	Estuary	Evaluate Pudding Creek impoundment and its contribution/effect to coho salmon survival (CDFG 2004).	1	5	Campbell Timberland Management, CDFG, NMFS, Private Consultants	180.00					180	The impoundment at Pudding Creek may function as winter habitat for coho salmon and possibly as summer rearing habitat at the upper end of the impoundment. Water quality near the dam is often poor during the summer/fall low flow period. Evaluation should include a component to assess native and exotic predators and determine if levels of predation are detrimental to viability targets. Evaluation should include potential benefits/detriments to tidewater goby and steelhead as well as sculpin movement. Evaluation should include potential impacts to emigrating juvenile attempting to move upstream in the estuarine reach, description of the significance of various impacts, and whether the estuary promotes conditions suitable to delayed migration (and possible missing year class benefits). Cost based on juvenile migration monitoring at a rate of $178,344.
PC-CCC-1.1.1.2	Action Step	Estuary	Evaluate habitat potential and benefits of providing passage under Highway 1 to the impoundment at Ocean Lake Mobile Home Park.	3	20	CalTrans, CDFG, Mendocino County							
PC-CCC-1.1.2	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
PC-CCC-1.1.2.1	Action Step	Estuary	Repair dam as appropriate to maintain over wintering habitat in the estuary (CDFG 2004).	3	10	CA Coastal Commission, Georgia-Pacific, USACE						TBD	Ideally, the dam should only be repaired following completion of evaluation study and only if benefits are found to outweigh the detriments to the Pudding Creek coho salmon population. If evaluation study concludes the dam does not facilitate improved rearing conditions compared to an unimpaired estuary for coho salmon, the dam should be removed, and the estuary restored to historical conditions.
PC-CCC-1.1.3	Recovery Action	Estuary	Develop and implement programs to address water quality concerns.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-1.1.3.1	Action Step	Estuary	Improve dissolved oxygen concentrations in the Pudding Creek impoundment from installation of aeration devices (such as SolarBees)	2	5	Campbell Timberland Management, CDFG, Georgia-Pacific	80.00					80	Dissolved oxygen levels may limit salmonid use of the Pudding Creek impoundment during the summer- increasing dissolved oxygen concentration may increase the total amount of rearing area for juvenile salmonids in the watershed. This evaluation should be considered in conjunction with a comprehensive evaluation of the impoundment. Poor oxygen concentrations are presumably due to the large quantities of decomposing (non-native) aquatic vegetation in the impoundment.
PC-CCC-1.1.3.2	Action Step	Estuary	Minimize water drafting from the Pudding Creek impoundment.	3	100	CDFG, City of Fort Bragg, Georgia-Pacific, SWRCB						In-Kind	The water right holder should evaluate the potential impacts of their water diversion to rearing juvenile coho salmon. This will only likely need to occur if future diversions are markedly increased over current diversions.
PC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.**										
PC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
PC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	10	Campbell Timberland Management, CDFG, NOAA RC, Private Landowners	55.00	55.00				110	Cost based on treating 3 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
PC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	2	20	CalFire, Campbell Timberland Management	6.00	6.00	6.00	6.00		24	Cost based on decommissioning 2 miles of riparian road network at a rate of $12,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Evaluate channel restoration opportunities in the Little Valley subwatershed and evaluate potential benefits to juvenile rearing habitats.	1	7	Campbell Timberland Management, CDFG, NOAA RC, RWQCB, Trout Unlimited	21.43	8.57				30	The evaluation should consider all available historical documentation and include input from geomorphologists and restoration experts. The evaluation should include a series of recommendation to restore channel complexity in Little Valley if restoration is determined to have a net benefit to juvenile rearing condition and quantity. Water extraction from Little Valley should also be evaluated and compliance with State Water Law determined. Campbell Timberland Management has initiated some beneficial "passive" restoration efforts in Little Valley a number of years ago. These efforts have consisted of removing all cattle and ceasing agricultural activities in the floodplain and terrace. The grassland meadows are no longer moved in an effort to allow riparian vegetation to recolonize the riparian terrace and valley. According to Campbell's analysis of historical aerial photography, the entire Little Valley Creek stream channel was ditched and straightened in the 1950s/1960s. Most sinuous reaches were bypassed but can still be observed in present aerial photos.
PC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
PC-CCC-3.1.1.1	Action Step	Habitat Complexity	Implement a large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (CDFG 2004).	1	5	Campbell Timberland Management, CDFG, Trout Unlimited	150.00					150	It is anticipated that significant cost savings (and ecological benefits) would be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used over engineered structures. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the watershed was allowed to stay in place. These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity and shelter rating values in potential rearing and migration reaches. Some large woody debris supplementation has already occurred in the watershed. Supplementation programs that are a part of future timber harvest plans may result in significantly reduced costs. Cost based on treating 6 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-3.1.1.2	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	Campbell Timberland Management, CDFG, RWQCB, USACE						In-Kind	Evaluate road relocation as an option prior to initiating stream bank stabilization in Pudding Creek watershed. This recommendation should be standard practice for current or future stream bank protection projects.
PC-CCC-3.1.1.3	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	3	100	Campbell Timberland Management, CDFG, NMFS						In-Kind	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure.
PC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating and percent primary pools										
PC-CCC-3.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	20	Campbell Timberland Management, CDFG, NMFS, Private Landowners						In-Kind	Cost of initial dialog is expected to be minimal.
PC-CCC-3.1.2.2	Action Step	Habitat Complexity	Protect existing riparian areas to maintain LWD supply and canopy.	3	20	Campbell Timberland Management, CDFG, NMFS, Private Landowners						In-Kind	
PC-CCC-3.1.2.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	60	Campbell Timberland Management, CDFG, NMFS, Private Landowners						In-Kind	
PC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with road density										
PC-CCC-5.1.1.1	Action Step	Landscape Patterns	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	10	CalFire, Campbell Timberland Management, Private Landowners	115.00	115.00				230	Costs may be significant and benefits should be weighed against additional upland disturbance and overall costs. This recommendation is more feasible within Pudding Creek watershed because a large portion of the watershed in owned by one landowner. Cost based on decommissioning 19 miles of road network at a rate of $12,000/mile.
PC-CCC-5.1.2	Recovery Action	Landscape Patterns	Prevent landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-5.1.2.1	Action Step	Landscape Patterns	Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems	3	100	Campbell Timberland Management, NMFS, Private Landowners						In-Kind	
PC-CCC-5.1.2.2	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	3	100	Campbell Timberland Management, NMFS, Private Landowners						In-Kind	
PC-CCC-5.1.2.3	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	3	100	Campbell Timberland Management, NMFS, Private Landowners						In-Kind	
PC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter										
PC-CCC-8.1.1.1	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Campbell Timberland Management	102.50	102.50				205	Historical logging practices effectively removed all of the original conifer overstory (principally redwood) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost based on treating 1.8 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,442/acre. Cost could be minimal if incorporated into ongoing timber harvest plans.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-8.1.2	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	Campbell Timberland Management, CDFG	401.25	401.25	401.25	401.25		1,605	Most of the riparian areas along mainstem Pudding Creek is under forest management and do not require replanting. However, if restoration of the Little Valley is anticipated, efforts should be directed at replanting the areas along riparian corridors in Little Valley. Little Valley was cleared for agricultural purposes and cattle grazing. Currently, cattle grazing is a minor land use in the area. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.
PC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
PC-CCC-9.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels.
PC-CCC-9.1.1.2	Action Step	Sediment	Decommission Slaughterhouse Gulch riparian road.	3	10	CalFire, California Geological Survey, Campbell Timberland Management, RWQCB	25.00	25.00				50	Total cost is not expected to exceed $50K. Slaughterhouse Gulch was identified as IP-km (lower value) and it is currently a subwatershed where spawning occurs. However, juvenile rearing is unlikely in all but the wettest water years.
PC-CCC-9.1.1.3	Action Step	Sediment	Evaluate all roads and skid trails throughout the winter period on their lands.	2	60	CDFG, NMFS, RWQCB						In-Kind	This should be considered a standard business practice.
PC-CCC-9.1.1.4	Action Step	Sediment	Permitting agencies should evaluate all authorized erosion control measures during the winter period.	2	60	CalFire, CDFG, RWQCB						In-Kind	This recommendation should be considered standard practice.
PC-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
PC-CCC-10.1.1	Recovery Action	Viability	Increase spawner density										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-10.1.1.1	Action Step	Viability	Continue ongoing life cycle monitoring station at Pudding Creek dam (CDFG 2004). Establish consistent reporting methods to ensure ESU-wide consistency.	1	10	Campbell Timberland Management, CDFG, NMFS, Trout Unlimited	117.30	117.30				235	Cost for life cycle monitoring station estimated at $234,600.
PC-CCC-10.1.1.2	Action Step	Viability	Re-evaluate spawner density targets pending completion of Little Valley habitat suitability report.	3	10	NMFS	110.00	110.00				220	Overall quantity of IP-km in Pudding Creek may need adjustment if it is determined that Little Valley did not provide adequate summer rearing habitat historically. Cost based on conducting spawner surveys for 18.9 km of High IP at a rate of $1,150/km.
PC-CCC-10.1.1.3	Action Step	Viability	Continue juvenile monitoring originally initiated by CDFG in 1980's near the Slaughterhouse Gulch confluence.	1	10	Campbell Timberland Management, CDFG	60.00	60.00				120	This location is a long-term monitoring site and should be continued. Cost based on juvenile outmigration monitoring at a cost of $58,404/year.
PC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-11.1.1	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
PC-CCC-11.1.1.1	Action Step	Water Quality	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Include County of Mendocino in regards to inclusion of Sherwood Ridge Road.	2	5	CalFire, CalTrans, Campbell Timberland Management, CDFG, Mendocino County Department of Public Works, Private Landowners						TBD	This rapid implementation of this recommendation is more feasible within the Pudding Creek watershed because a large portion of the watershed in owned by one landowner.
PC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
PC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										
PC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Campbell Timberland Management						In-Kind	Timber harvest remains a threat to coho salmon habitat in Pudding Creek watershed, but at diminished levels compared to historical practices. Even with application of new California Forest Practice Rules this threat is anticipated to continue.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to habitat complexity										
PC-CCC-19.1.2.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Campbell Timberland Management						In-Kind	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
PC-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PC-CCC-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Campbell Timberland Management						In-Kind	This recommendation should be a standard practice.
PC-CCC-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Campbell Timberland Management						In-Kind	This recommendation should be a standard practice.
PC-CCC-19.1.3.3	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, Campbell Timberland Management	17.00	17.00				34	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identify areas for prioritization. Cost based on erosion assessment monitoring (assume 25% of total watershed acres) at a rate of $12/acre.
PC-CCC-19.1.4	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
PC-CCC-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Campbell Timberland Management						In-Kind	
PC-CCC-19.1.5	Recovery Action	Logging	Prevent increased landscape disturbance										
PC-CCC-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	3	100	CalFire, Campbell Timberland Management						In-Kind	
PC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
PC-CCC-19.2.1.1	Action Step	Logging	Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	10	NMFS						In-Kind	The need for this action may change if the California Forest Practice Rules change and reach a no-take standard or the state receives incidental take authorization through the HCP process.
PC-CCC-19.2.1.2	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.	2	100	CalFire, Campbell Timberland Management							Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
PC-CCC-19.2.1.3	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CDFG, Mendocino County, RWQCB, SWRCB						In-Kind	
PC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PC-CCC-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, Campbell Timberland Management, Private Landowners						TBD	Legacy roads from past logging activity continue to impact Pudding Creek watershed.
PC-CCC-23.1.1.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Campbell Timberland Management						In-Kind	Many roads in the watershed have inside ditches. Cost should be considered part of road maintenance costs.
PC-CCC-23.1.1.3	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Campbell Timberland Management, Private Landowners						TBD	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct an assessment of number and extent of dissipaters to determine cost for upgrade.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-23.1.1.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Campbell Timberland Management, Private Landowners						TBD	Sediment traps will require a significant maintenance commitment.
PC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
PC-CCC-23.1.2.1	Action Step	Roads/Railroads	Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a) and appropriate barrier databases when developing new or retrofitting existing road crossings.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	
PC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
PC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
PC-CCC-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This action is part of ongoing road maintenance and should be directed at the entire road network.
PC-CCC-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Campbell Timberland Management, Mendocino County, Mendocino Redwood Company, Private Landowners						In-Kind	Due to proximity of Fort Bragg to Pudding Creek, unauthorized trial use by off road vehicles is a common occurrence. Implement measures to ensure Sherwood Ridge Road remains closed during the winter period. The Noyo Watershed Alliance has worked to maintain winter closures. Ongoing management practices in the watershed include maintenance of existing gate and other forms of road closure.
PC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
PC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
PC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies.	3	10	CDFG, Mendocino County, RWQCB, SWRCB						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
PC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. Consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	CalFire, Campbell Timberland Management, CDFG, RWQCB, SWRCB	31.50	31.50				63	Few if any water diversions are present along mainstem Pudding Creek aside from the diversion lower in the watershed at the Pudding Creek dam. Cost based on stream flow gauging at a cost of $63,005..
PC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
PC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Ensure Pudding Creek fish ladder to performing sufficiently to pass migrating fish during drought conditions.	2	20	Campbell Timberland Management, CDFG, Georgia-Pacific	178.00	178.00	178.00	178.00		712	Evaluation should include an evaluation of existing maintenance requirements and development of landowner agreements where appropriate. Cost based on escapement monitoring at a cost of $35,563.
PC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
PC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalFire, Campbell Timberland Management						In-Kind	This recommendation should be considered standard practice.
PC-CCC-24.1.3.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, Campbell Timberland Management						TBD	Conduct an assessment of high-risk shallow-seeded landslide areas to determine extent and protective measures.

Redwood Creek

Location	•Marin County
Watershed Area	• 9.0 Square Miles
Potential Habitat	•6.8 Stream Miles
Vegetation	•31% Coniferous, 32% Shrubland, 18% Riparian or Montane Forest, 12% Grassland
Erodability	•Low to Moderate
Ownership Patterns	•5% Private; 95% Public
Dominant Land Uses	•Recreational
Housing Density	•Low
TMDL Pollutants	•None

Redwood Creek
Photo provided by KRIS Information System, and is used with permission

Redwood Creek Coho Salmon: Nearly Extirpated

Recovery Goals

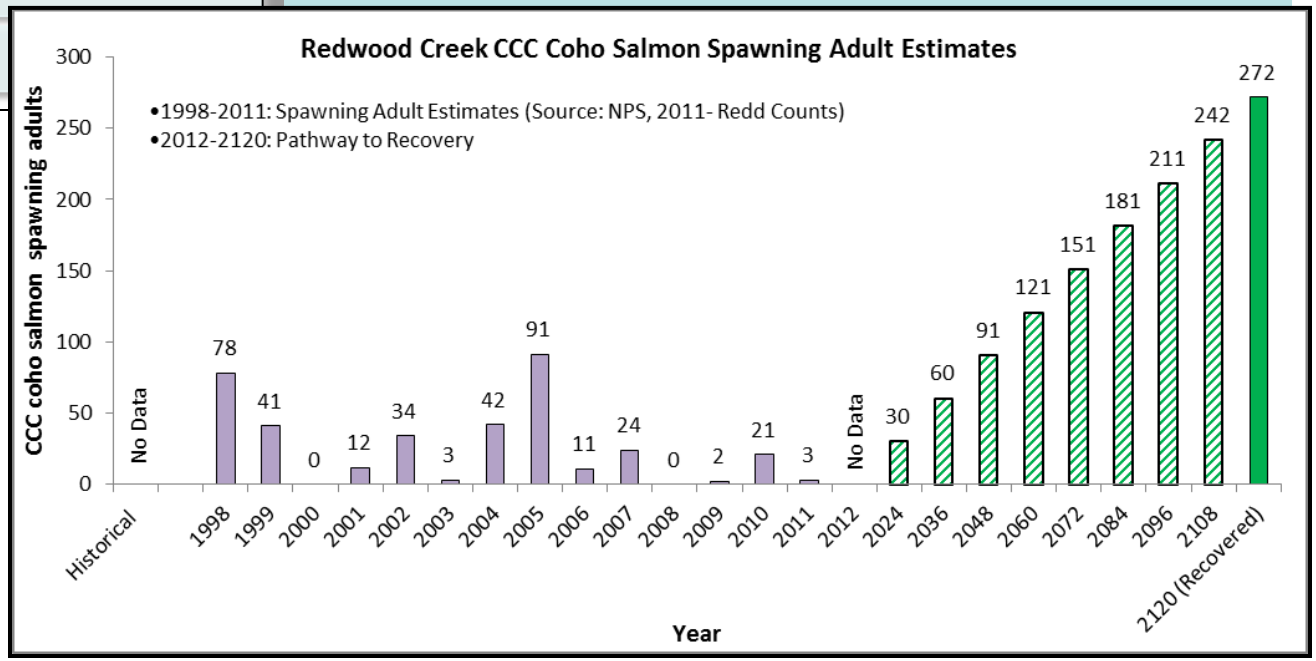
✓ Conduct monitoring to track population response to recovery action implementation

Redwood Creek Adult Spawner Targets

Downlisting to Threatened
136

Recovery
272

STEELHEAD: YES
CHINOOK SALMON: NO



Redwood Creek

Potential Habitat: 6.8 miles
Recovery Target: 272 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	FAIR	GOOD	VERY GOOD	POOR	POOR	GOOD	POOR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population
- Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the Coastal Diversity Stratum.

Priority 2 & 3: Long-Term Restoration Actions

- Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707
- Promote off-channel storage to reduce impacts of water diversion
- Promote conjunctive use of water with water projects whenever possible
- Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream)
- Decommission, upgrade, or re-locate riparian roads to upslope locations
- Evaluate and reduce nutrient and pathogen loading from upstream areas to minimize oxygen demand

MARIN RESOURCE CONSERVATION DISTRICT

Recovery Partners

CALIFORNIA STATE PARKS SINCE 1864

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH&GAME

Photo Courtesy from left to right: Josh Fuller, NMFS, Gualala River Watershed Council, Campbell Timberland, Eli Asarian and Morgan Bond, SWFSC

Redwood Creek

Potential Habitat: 6.8 miles
Recovery Target: 272 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	HIGH	MEDIUM	MEDIUM	LOW	NA	MEDIUM	LOW	LOW	MEDIUM	HIGH	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Restore habitat complexity in modified channel areas
- Implement relevant high priority treatments from the PWA assessment, and make new recommendations for treatment. Encourage decommissioning where feasible.
- Support efforts to remove levees on the Banducci property to create backwater and alcove habitat

A volunteer planting riparian vegetation along Redwood Creek *Photo provided by KRIS Information System, and is used with permission*

Priority 2 & 3: Long-Term Threat Abatement Actions

- Recreational trails should be set back from the creek and built to reduce erosion and minimize stream crossings
- Eliminate horse access to creeks for watering or as fords
- Remove levees along Big Lagoon and Pacific Way. Address issues with culverts, road network, and development within the Big Lagoon Area
- Work with NPS and State Parks on emergency drought operations and contingency plans
- Work with water managers on regulated streams and other diverters to assure adequate and proper consideration is given to fish needs.
- Adequately screen water diversions to prevent juvenile salmonid mortalities

Conservation Highlights

- Estuary and floodplain restoration activities
- Agricultural Best Management Practices have been developed and implemented in the watershed
- Acquisition of key areas for the conservation of habitat
- Annual juvenile abundance surveys conducted by National Park Service provides important population data on coho salmon in the Redwood Creek watershed

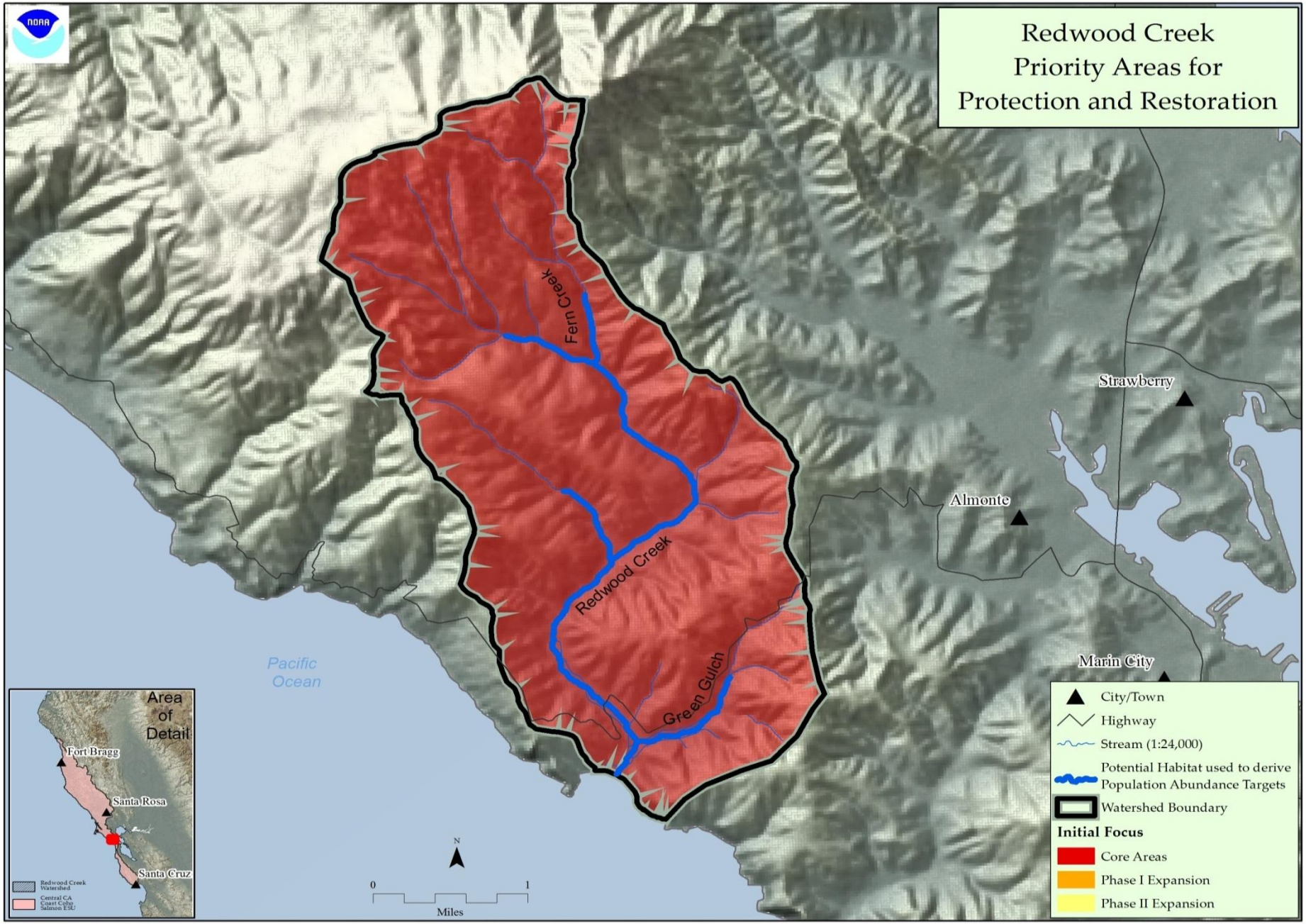


Figure 1: Map of Redwood Creek

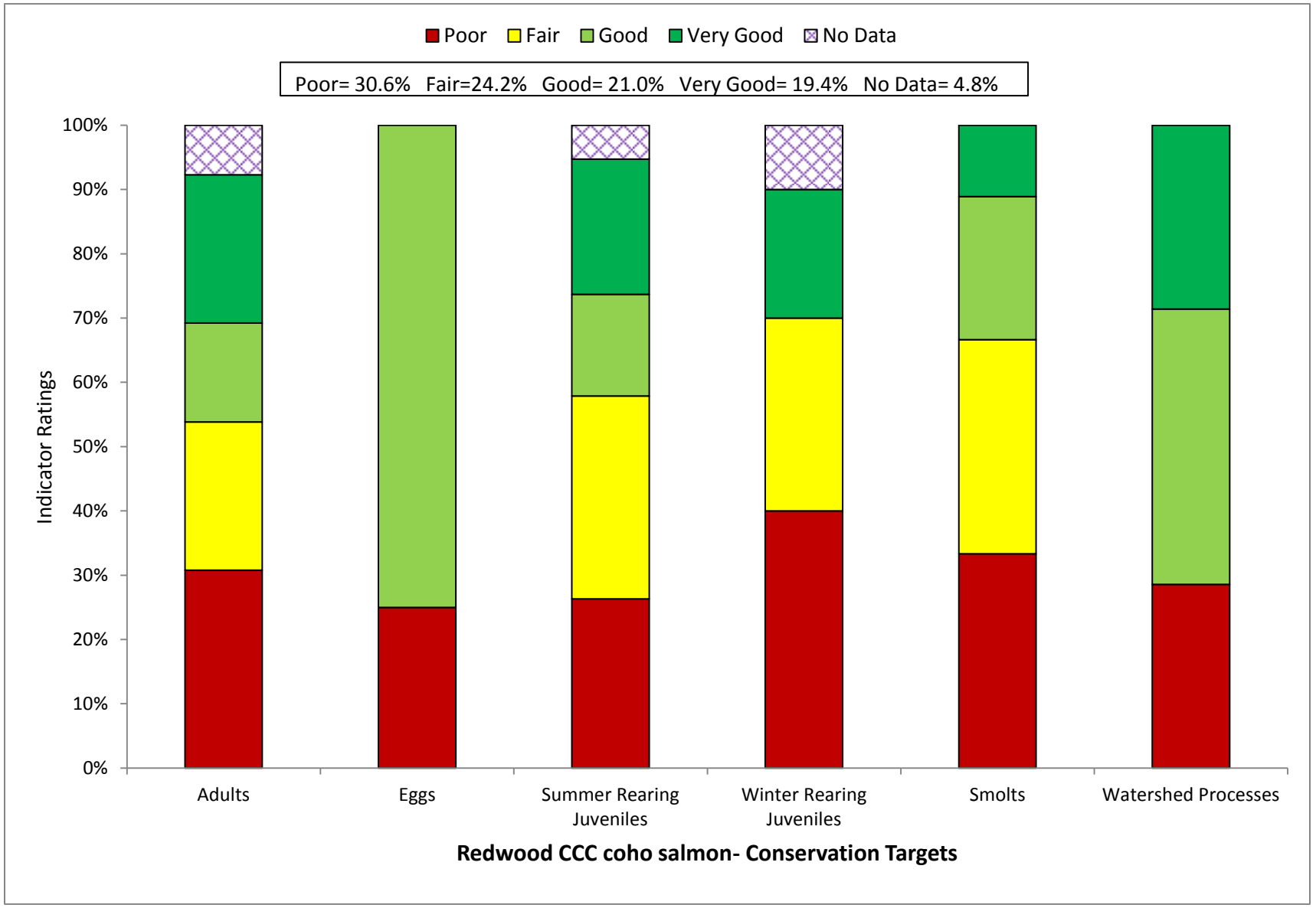


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Redwood Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**14.6 Key Pieces/100m**	Very Good	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**ND**	0	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**12-14% (0.85mm) and <30% (6.4mm)**	Good	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**0% streams 0% IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**14.6 Key Pieces/100m**	Very Good	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**ND**	0	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**0% streams 0% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =51-75**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**8.76 Diversions/10 IP-km**	Poor	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**100% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**96% of streams/ IP-km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP-km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**50-74% of Historical Range**	Fair	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**14.6 Key Pieces/100m**	Very Good	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**ND**	0	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% to 74% of streams/ IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**<50% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**1.1 - 5 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**100% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**1.3% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.88% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**25-15% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**9% of watershed >1 unit/20 acres**	Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Intact Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**4.1 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.9 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Redwood Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Medium	Medium	Medium	Medium	High	Medium
2	Channel Modification	High	Medium	Medium	High	Medium	High	High
3	Disease, Predation and Competition	Medium	-	Medium	Medium	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Medium	Low	Medium	Medium
5	Fishing and Collecting	Medium	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Medium	Medium	Medium	Medium	Medium	Medium	Medium
8	Logging and Wood Harvesting	Low	Low	Low	Low	Low	Medium	Low
9	Mining	Low	Low	Low	Low	Low	Medium	Low
10	Recreational Areas and Activities	Low	Low	Medium	Medium	Low	Low	Medium
11	Residential and Commercial Development	Medium	Medium	High	High	Medium	Medium	High
12	Roads and Railroads	Medium	High	Medium	High	High	High	High
13	Severe Weather Patterns	Medium	Medium	High	High	Medium	High	High
14	Water Diversion and Impoundments	Medium	Low	High	Medium	Medium	Medium	Medium
Threat Status for Targets and Project		High	High	High	High	High	High	High

Central CA Coast Coho Salmon ~ Redwood Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Improve the quality and extent of freshwater lagoon habitat

1.1.1.1. **Action Step:** Enhance and restore estuary function by improving complex habitat features.

1.1.1.2. **Action Step:** Continue restoration efforts on Big Lagoon to benefit coho salmon during all life stages and seasons.

1.1.1.3. **Action Step:** Where appropriate, remove structures and/or modify practices which impair or reduce the historical tidal prism and/or estuarine function where feasible and where benefits to coho salmon and/or the estuarine environment are predicted.

1.1.1.4. **Action Step:** Support efforts of NPS to restore functional floodplain and lagoon habitat in the lower portion of the watershed.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity.

2.1.1.1. **Action Step:** Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.

2.1.1.2. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

2.1.1.3. **Action Step:** Purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

2.1.1.4. **Action Step:** Evaluate, develop solutions and implement immediate needs to address problems resulting from channelization.

2.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

2.2.1. **Recovery Action:** Increase and enhance velocity refuge

2.2.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.2.1.2. **Action Step:** Target habitat restoration and enhancement that will function between winter base flow and flood stage.

2.2.1.3. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.2.1.4. **Action Step:** Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.

2.2.1.5. **Action Step:** Support efforts to remove levees on the Banducci property to create backwater and alcove habitat by having the county raise the lower section of Muir Woods road where it meets Highway One. Raising the road will address flooding and create vital off channel habitat in this section of creek. Coordinate with the NMFS and/or CDFG geomorphologist on design features and implementation techniques.

2.2.1.6. **Action Step:** Restore connectivity and enhance habitat in Green Gulch.

2.2.1.7. **Action Step:** Remove riprap and gabion rock at lowest end of watershed.

2.2.1.8. **Action Step:** Continue to monitor restored reaches in the "Bowling Alley" and "Upper Alley" sections to promote off channel habitat formation. Consult with NMFS and or CDFG geomorphologist before and during the design and implementation phase.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency (BFW 0-10 meters)

3.1.1.1. **Action Step:** Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).

3.1.1.2. **Action Step:** Place unsecured LWD in the stream and monitor how it is distributed in the watershed.

3.1.1.3. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

3.1.1.4. **Action Step:** Assess and prioritize restoration of channelized sections to enhance pool depths in Redwood Creek through Muir Woods while maintaining the historic resource to the greatest degree possible.

3.1.1.5. **Action Step:** Engage in riprap removal and LWD placement to restore channel processes within the Muir Woods National Monument as per Kimbell and Kondolf, 2002.

3.1.2. **Recovery Action:** Improve habitat complexity

3.1.2.1. **Action Step:** Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations

3.1.3. **Recovery Action:** Improve shelter rating

3.1.3.1. **Action Step:** Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

3.2.1. **Recovery Action:** Prevent the loss of habitat complexity

3.2.1.1. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.

3.2.1.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

3.2.1.3. **Action Step:** Fully implement the Programmatic Section 7 consultation for restoration projects administered by the NOAA Restoration Center that permits placement of instream large woody debris.

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Assess and map water diversions (CDFG 2004).

4.1.1.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon.

4.1.1.3. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.1.2. **Recovery Action:** Improve passage flows

4.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.2.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.2.1.1. **Action Step:** Maintain water operations agreements between NPS, CDFG, and MBCSD to operate in a manner that does not alter summer surface flow

4.2.1.2. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.2.1.3. **Action Step:** Promote conjunctive use of water with water projects whenever possible to maintain or restore coho salmon habitat.

4.2.1.4. **Action Step:** Identify and eliminate depletion of summer base flows from unauthorized water uses.

4.2.1.5. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

4.2.2. **Recovery Action:** Improve passage flows

4.2.2.1. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

4.2.2.2. **Action Step:** Evaluate requests for on-stream dams above coho migratory reaches for effects on the natural hydrograph and the supply of spawning gravel for recruitment downstream (CDFG 2004).

4.2.2.3. **Action Step:** Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).

8.1.1.2. **Action Step:** Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).

8.1.1.3. **Action Step:** Locate water sources away from riparian areas.

8.1.1.4. **Action Step:** Plant native vegetation to promote streamside shade.

8.1.1.5. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. where critical infrastructure is located) for bank hardening projects.

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.

8.1.2.3. **Action Step:** Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.

8.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

8.2.1. **Recovery Action:** Protect existing riparian areas

8.2.1.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

8.2.1.2. **Action Step:** Review and develop preferred protocols for Pierce's Disease Control that would maintain a native riparian corridor and develop an outreach program (CDFG 2004).

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

9.1.1.2. **Action Step:** Address high and medium priority sediment delivery sites

9.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

9.1.1.4. **Action Step:** Establish and/or maintain continuous native riparian buffers.

9.1.1.5. **Action Step:** Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).

9.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

9.2.1. **Recovery Action:** Improve instream gravel quality

9.2.1.1. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

9.2.1.2. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population.

10.1.1.2. **Action Step:** Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the DS, while minimizing departure from the genetic profile that historically existed in the population.

10.1.2. **Recovery Action:** Monitor population status.

10.1.2.1. **Action Step:** Conduct upslope watershed assessments to define limiting factors. Encourage all major landowners to participate

10.1.2.2. **Action Step:** Conduct an instream habitat assessment to develop restoration recommendations

10.1.3. **Recovery Action:** Increase spawner density

10.1.3.1. **Action Step:** Develop and implement a monitoring program to evaluate the performance of recovery efforts.

10.1.4. **Recovery Action:** Increase spatial structure and diversity

10.1.4.1. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.4.2. **Action Step:** Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.

10.1.4.3. **Action Step:** Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream water quality conditions

11.1.1.1. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

11.1.1.2. **Action Step:** Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.

11.1.1.3. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

11.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

11.2.1. **Recovery Action:** Improve stream water quality conditions

11.2.1.1. **Action Step:** Evaluate and reduce nutrient and pathogen loading from upstream areas to minimize oxygen demand in lower Redwood Creek.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment of floodplain connectivity

13.1.1.1. **Action Step:** Conduct education with public works staff in this area relative to Fishnet 4C Roads Manual

13.1.1.2. **Action Step:** Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.

13.1.1.3. **Action Step:** Prevent additional channel modification or utilize BMP's to address flood control or bank stabilization issue

13.1.1.4. **Action Step:** Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.

13.1.1.5. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. except where critical infrastructure is located) for bank hardening projects.

13.1.1.6. **Action Step:** Restore habitat complexity in modified channel areas

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

15.1.1.1. **Action Step:** Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.

15.1.1.2. **Action Step:** Conduct fuel load monitoring and compare the results to estimated historical fuel loads.

15.1.2. **Recovery Action:** Prevent impairment to water quality

15.1.2.1. **Action Step:** Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.

15.1.3. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

15.1.3.1. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

21.1. **Objective:** Address the present of threatened destruction, modification or curtailment of the species habitat or range

21.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

21.1.1.1. **Action Step:** Evaluate trail crossings to ensure bridges are constructed to support horses.

21.1.1.2. **Action Step:** Eliminate horse access to creeks for watering or as fords.

21.1.1.3. **Action Step:** Increase education to the equestrian community regarding impacts to riparian and instream habitat from horse manure and hooves.

21.1.1.4. **Action Step:** Recreational trails should be set back from the creek and built to reduce erosion and minimize stream crossings.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

22.1.1.1. **Action Step:** Implement actions in ROADS and RAILROADS

22.1.1.2. **Action Step:** Implement DS level Actions

22.1.2. **Recovery Action:** Prevent impairment to floodplain connectivity

22.1.2.1. **Action Step:** Implement actions in FLOODPLAIN

22.1.2.2. **Action Step:** Implement DS level actions

22.1.3. **Recovery Action:** Prevent impairment to riparian species and composition

22.1.3.1. **Action Step:** Implement actions in RIPARIAN

22.1.4. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.4.1. **Action Step:** Implement actions in WATER DIVERSIONS

22.1.4.2. **Action Step:** Implement DS level actions

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

22.2.1. **Recovery Action:** Prevent increased landscape disturbance

22.2.1.1. **Action Step:** Implement DS level actions and BMP's

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, dams, etc.)

23.1.1.1. **Action Step:** Revaluate the high priority treatment recommendations for unpaved roads from the PWA assessment, and implement recommended treatments if they are still relevant. If not, reassess and make new recommendations for treatment. Push for decommissioning when feasible.

23.1.1.2. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.2. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.1.2.1. **Action Step:** NMFS and other stakeholders will work with RCD or NRCS to encourage hiring of consultants to conduct road assessments (first for subwatersheds in Core areas, then for Phase I areas).

23.1.2.2. **Action Step:** Address sediment sources from road networks and other actions that deliver sediment to stream channels.

23.1.2.3. **Action Step:** Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.3. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

23.1.3.1. **Action Step:** Support efforts to remove levees on the Banducci property to create backwater and alcove habitat by having the county raise the lower section of Muir Woods road where it meets Highway One. Raising the road will address flooding and create vital off channel habitat in this section of creek. Coordinate with the NMFS and/or CDFG geomorphologist on design features and implementation techniques.

23.1.3.2. **Action Step:** Remove levees along Big Lagoon and Pacific Way. Address issues with culverts, road network, and development within the Big Lagoon Area.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

23.2.1.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Work with NPS and State Parks on emergency drought operations and contingency plans (i.e. fish rescues etc.)

24.1.1.2. **Action Step:** Work with CDFG, Counties, other agencies, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.

24.1.1.3. **Action Step:** Work with water managers on regulated streams to assure adequate and proper consideration is given to fish needs. Develop agreements, which will minimize water-use conflicts and impacts on fish and wildlife resources during drought conditions.

24.1.1.4. **Action Step:** Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Work with the Muir Beach CSD and Green Gulch farm to eliminate water diversions that affect flow within Redwood Creek.

25.1.1.2. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

25.1.2. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.2.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

25.2.1.2. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

25.2.1.3. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Table ~ Redwood Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat										
ReC-CCC-1.1.1.1	Action Step	Estuary	Enhance and restore estuary function by improving complex habitat features.	2	10	Marin County, NPS	163.50	163.50				327	Cost based on treating 10% of 12 acres of estuarine habitat at a rate of $272,120/acre.
ReC-CCC-1.1.1.2	Action Step	Estuary	Continue restoration efforts on Big Lagoon to benefit coho salmon during all life stages and seasons.	2	10	NPS	2,500	2,500				5,000	Cost could be incorporated with above action step.
ReC-CCC-1.1.1.3	Action Step	Estuary	Where appropriate, remove structures and/or modify practices which impair or reduce the historical tidal prism and/or estuarine function where feasible and where benefits to coho salmon and/or the estuarine environment are predicted.	2	60	NPS						TBD	
ReC-CCC-1.1.1.4	Action Step	Estuary	Support efforts of NPS to restore functional floodplain and lagoon habitat in the lower portion of the watershed.	2	60	Marin County, Marin RCD, NPS						In-Kind	
ReC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Prevent impairment to floodplain connectivity.										
ReC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.	2	60	Marin County, NPS						TBD	Cost difficult to determine because of willingness of landowner participation.
ReC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	2	60	Marin County, NPS						In-Kind	This recommendation should be considered standard practice.
ReC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	3	60	CDFG, NMFS, NPS, USFWS						TBD	Cost difficult to determine because of fair market value and rate of turnover.
ReC-CCC-2.1.1.4	Action Step	Floodplain Connectivity	Evaluate, develop solutions and implement immediate needs to address problems resulting from channelization.	3	10	Marin County, Marin RCD, NPS	36.00	36.00				72	Cost based on riparian monitoring estimated at $71,436/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-2.2	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
ReC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	20	NPS							Cost accounted for in above action steps.
ReC-CCC-2.2.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	60	CDFG, Marin County, Marin RCD, NMFS, NPS							Cost accounted for in above action steps.
ReC-CCC-2.2.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	60	Marin County, Marin RCD, NPS						TBD	Cost accounted for in above action steps.
ReC-CCC-2.2.1.4	Action Step	Floodplain Connectivity	Identify potential sites for construction/restoration of alcoves, backwaters, etc. based on land use and geomorphic constraints.	2	60	Marin County, Marin RCD, NPS						TBD	Cost accounted for in above action steps.
ReC-CCC-2.2.1.5	Action Step	Floodplain Connectivity	Support efforts to remove levees on the Banducci property to create backwater and alcove habitat by having the county raise the lower section of Muir Woods road where it meets Highway One. Raising the road will address flooding and create vital off channel habitat in this section of creek. Coordinate with the NMFS and/or CDFG geomorphologist on design features and implementation techniques.	2	10	Marin County, NPS	5,000	5,000				10,000	
ReC-CCC-2.2.1.6	Action Step	Floodplain Connectivity	Restore connectivity and enhance habitat in Green Gulch.	2	10	CDFG, NOAA RC, Private Landowners	200.00	200.00				400	
ReC-CCC-2.2.1.7	Action Step	Floodplain Connectivity	Remove riprap and gabion rock at lowest end of watershed.	3	20	Marin County, Marin RCD, NPS						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-2.2.1.8	Action Step	Floodplain Connectivity	Continue to monitor restored reaches in the "Bowling Alley" and "Upper Alley" sections to promote off channel habitat formation. Consult with NMFS and or CDFG geomorphologist before and during the design and implementation phase.	3	20	NPS	125.00	125.00	125.00	125.00		500	
ReC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)										
ReC-CCC-3.1.1.1	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	60	Marin County, Marin RCD, NPS, State Parks						TBD	
ReC-CCC-3.1.1.2	Action Step	Habitat Complexity	Place unsecured LWD in the stream and monitor how it is distributed in the watershed.	2	10	Marin County, Marin RCD, NPS, State Parks	125.00	125.00				250	Cost based on treating 10 miles (assume 1 project/mile in 50% of High IP) at a rate of $25,000/mile.
ReC-CCC-3.1.1.3	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	20	Marin County, Marin RCD, NPS, State Parks						TBD	Cost encumbered in place unsecured LWD in the stream.
ReC-CCC-3.1.1.4	Action Step	Habitat Complexity	Assess and prioritize restoration of channelized sections to enhance pool depths in Redwood Creek through Muir Woods while maintaining the historic resource to the greatest degree possible.	2	10		56.00	56.00				112	Cost based on fish/habitat restoration effectiveness monitoring estimated at $111,192/project.
ReC-CCC-3.1.1.5	Action Step	Habitat Complexity	Engage in riprap removal and LWD placement to restore channel processes within the Muir Woods National Monument as per Kimbell and Kondolf, 2002.	2	10	NPS, State Parks						In-Kind	
ReC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve habitat complexity										
ReC-CCC-3.1.2.1	Action Step	Habitat Complexity	Evaluate the potential and specific locations (e.g. State and Federal lands) for the re-location and re-introduction of beaver populations	2	10		5.00	5.00				10	Cost based on beaver reintroduction estimated at $10,000/beaver family translocation.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve shelter rating										
ReC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	20							TBD	Cost likely accounted for in increase pools, riffles, and LWD frequency.
ReC-CCC-3.2	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-3.2.1	Recovery Action	Habitat Complexity	Prevent the loss of habitat complexity										
ReC-CCC-3.2.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.	3	20	Marin County, Marin RCD, NPS, Private Landowners, State Parks						In-Kind	
ReC-CCC-3.2.1.2	Action Step	Habitat Complexity	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-3.2.1.3	Action Step	Habitat Complexity	Fully implement the Programmatic Section 7 consultation for restoration projects administered by the NOAA Restoration Center that permits placement of instream large woody debris.	3	60	Marin County, Marin RCD, NMFS PRD, NOAA RC, NPS, State Parks						In-Kind	
ReC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
ReC-CCC-4.1.1.1	Action Step	Hydrology	Assess and map water diversions (CDFG 2004).	2	5	Marin County, Marin RCD, NPS, State Parks						TBD	Cost accounted for in action step below.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-4.1.1.2	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon.	2	10	CDFG, DWR, Marin County, Marin RCD, NMFS, NPS, RWQCB, State Parks, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project. This recommendation should also map and identify water diversions.
ReC-CCC-4.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	2	60	CDFG, DWR, RWQCB, State Parks, SWRCB						TBD	Cost difficult to determine because of landowner participation.
ReC-CCC-4.1.2	Recovery Action	Hydrology	Improve passage flows										
ReC-CCC-4.2	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-4.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
ReC-CCC-4.2.1.1	Action Step	Hydrology	Maintain water operations agreements between NPS, CDFG, and MBCSD to operate in a manner that does not alter summer surface flow	2	60	CDFG, MBCSD, NPS, State Parks						In-Kind	
ReC-CCC-4.2.1.2	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	60	Marin County, Marin RCD, NPS, State Parks						TBD	Cost difficult to determine because of landowner participation and extent of off-channel storage needed to reduce impacts. Stream flow model should address this concern.
ReC-CCC-4.2.1.3	Action Step	Hydrology	Promote conjunctive use of water with water projects whenever possible to maintain or restore coho salmon habitat.	2	60	Marin County, Marin RCD, NPS, NRCS, State Parks						In-Kind	
ReC-CCC-4.2.1.4	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	2	30	CDFG, DWR, Marin County, Marin RCD, NMFS, RWQCB, SWRCB						TBD	Cost accounted for in stream flow model.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-4.2.1.5	Action Step	Hydrology	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	3	60	CA Coastal Commission, CDFG, DWR, Farm Bureau, Marin County, Marin RCD, NPS, RWQCB, State Parks, SWRCB						In-Kind	
ReC-CCC-4.2.2	Recovery Action	Hydrology	Improve passage flows										
ReC-CCC-4.2.2.1	Action Step	Hydrology	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	2	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-4.2.2.2	Action Step	Hydrology	Evaluate requests for on-stream dams above coho migratory reaches for effects on the natural hydrograph and the supply of spawning gravel for recruitment downstream (CDFG 2004).	3	60	CDFG, DWR, NMFS PRD, RWQCB, SWRCB						In-Kind	
ReC-CCC-4.2.2.3	Action Step	Hydrology	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	3	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ReC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
ReC-CCC-8.1.1.1	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	3	20	State Parks	792	792	792	792		3,166	Cost for riparian monitoring accounted for in above action steps. Cost to treat 1 mile of exotic vegetation (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $39,574/acre.
ReC-CCC-8.1.1.2	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	2	20	Marin County, Marin RCD, NPS, State Parks	250.00	250.00	250.00	250.00		1,000	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-8.1.1.3	Action Step	Riparian	Locate water sources away from riparian areas.	2	60	Marin County, NPS, State Parks						In-Kind	
ReC-CCC-8.1.1.4	Action Step	Riparian	Plant native vegetation to promote streamside shade.	3	20	Marin County, Marin RCD, NPS, State Parks	402.50	402.50	402.50	402.50		1,610	Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $20,057/acre.
ReC-CCC-8.1.1.5	Action Step	Riparian	Promote bio-engineering solutions as appropriate (e.g. where critical infrastructure is located) for bank hardening projects.	3	60	CDFG, Marin County, Marin RCD, NMFS, NPS, State Parks						In-Kind	
ReC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
ReC-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	30	Marin County, MMWD						TBD	Cost likely accounted for in above action steps.
ReC-CCC-8.1.2.2	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.	2	20	Marin County, MMWD						TBD	Cost likely accounted for in above action steps.
ReC-CCC-8.1.2.3	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	2	10	Marin RCD, MMWD						In-Kind	
ReC-CCC-8.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-8.2.1	Recovery Action	Riparian	Protect existing riparian areas										
ReC-CCC-8.2.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-8.2.1.2	Action Step	Riparian	Review and develop preferred protocols for Pierce's Disease Control that would maintain a native riparian corridor and develop an outreach program (CDFG 2004).	3	60	Marin County, NPS, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
ReC-CCC-9.1.1.1	Action Step	Sediment	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	5	Marin County, Marin RCD, NPS, State Parks	48.00					48	Cost for road inventory estimated at $927/mile (assume 75% of road network) and sediment assessment (assume 25% of total watershed acres) estimated at $12/acre.
ReC-CCC-9.1.1.2	Action Step	Sediment	Address high and medium priority sediment delivery sites	2	20	Marin County, Marin RCD, NPS, State Parks							Cost likely accounted for in sediment assessment.
ReC-CCC-9.1.1.3	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	Marin County, Marin RCD, NPS, State Parks	42.00	42.00				84	Cost based on decommissioning 7 miles of riparian road at a rate of $12,000/mile.
ReC-CCC-9.1.1.4	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	3	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-9.1.1.5	Action Step	Sediment	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	3	30	Marin County, Marin RCD, NPS, State Parks						TBD	
ReC-CCC-9.2	**Objective**	**Sediment**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-9.2.1	Recovery Action	Sediment	Improve instream gravel quality										
ReC-CCC-9.2.1.1	Action Step	Sediment	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	60	Marin County, NPS, State Parks						In-Kind	
ReC-CCC-9.2.1.2	Action Step	Sediment	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
ReC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
ReC-CCC-10.1.1.1	Action Step	Viability	Develop a plan to re-establish abundance, while minimizing departure from the genetic profile that historically existed in the population.	1		CDFG, NMFS PRD, NPS, State Parks						In-Kind	This recommendation will require coordination with partners.
ReC-CCC-10.1.1.2	Action Step	Viability	Evaluate supplementation strategies utilizing the existing population, or locally adapted nearby populations within the DS, while minimizing departure from the genetic profile that historically existed in the population.	1		CDFG, NPS, State Parks, Tomales Bay Watershed Council						In-Kind	
ReC-CCC-10.1.2	Recovery Action	Viability	Monitor population status.										
ReC-CCC-10.1.2.1	Action Step	Viability	Conduct upslope watershed assessments to define limiting factors. Encourage all major landowners to participate	2	20	CDFG, NPS							Cost accounted for in above action steps.
ReC-CCC-10.1.2.2	Action Step	Viability	Conduct an instream habitat assessment to develop restoration recommendations	2	60	NPS						TBD	Cost accounted for fish/habitat monitoring.
ReC-CCC-10.1.3	Recovery Action	Viability	Increase spawner density										
ReC-CCC-10.1.3.1	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.										
ReC-CCC-10.1.4	Recovery Action	Viability	Increase spatial structure and diversity										
ReC-CCC-10.1.4.1	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, MMWD, NMFS						In-Kind	Existing operations
ReC-CCC-10.1.4.2	Action Step	Viability	Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.	1	10	CDFG, USACE						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-10.1.4.3	Action Step	Viability	Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed	2	5	CDFG, Marin RCD, NMFS						In-Kind	
ReC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream water quality conditions										
ReC-CCC-11.1.1.1	Action Step	Water Quality	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	NPS, State Parks	57.00	57.00				114	Cost based on treating 1 mile (assume 80 acres/mile in 15% High IP with 1 mile minimum) at a rate of $1,422/acre.
ReC-CCC-11.1.1.2	Action Step	Water Quality	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extend the distance of a site potential tree height from the outer edge of a channel, and by adding LWD.	2	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-11.1.1.3	Action Step	Water Quality	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (CDFG 2004).	3	60	Marin County, NPS, State Parks						In-Kind	
ReC-CCC-11.2	**Objective**	**Water Quality**	**Address the inadequacy of existing regulatory mechanisms.**										
ReC-CCC-11.2.1	Recovery Action	Water Quality	Improve stream water quality conditions										
ReC-CCC-11.2.1.1	Action Step	Water Quality	Evaluate and reduce nutrient and pathogen loading from upstream areas to minimize oxygen demand in lower Redwood Creek.	2	2	NPS	3.30					3	Cost to conduct water quality monitoring estimated at $657/site. Assume minimum of 5 sites for High IP. Cost does not account for data management or reporting requirements.
ReC-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment of floodplain connectivity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-13.1.1.1	Action Step	Channel Modification	Conduct education with public works staff in this area relative to Fishnet 4C Roads Manual	2	20	FishNet 4C						In-Kind	
ReC-CCC-13.1.1.2	Action Step	Channel Modification	Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.	3	60	Marin County, Marin RCD, NPS, State Parks						TBD	
ReC-CCC-13.1.1.3	Action Step	Channel Modification	Prevent additional channel modification or utilize BMP's to address flood control or bank stabilization issue	3	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-13.1.1.4	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	3	20	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-13.1.1.5	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. except where critical infrastructure is located) for bank hardening projects.	3	20	Marin County						In-Kind	
ReC-CCC-13.1.1.6	Action Step	Channel Modification	Restore habitat complexity in modified channel areas	2	10	Marin County, Marin RCD, NPS, State Parks	37.50	37.50				75	Cost based on treating 50% of IP at a rate of $25,000/mile.
ReC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent adverse alterations to riparian species composition and structure										
ReC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Identify historical fire frequency, intensities and durations and manage fuel loads in a manner consistent with historical parameters.	3	60	NPS, State Parks						In-Kind	
ReC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Conduct fuel load monitoring and compare the results to estimated historical fuel loads.	3	10	NPS, State Parks	41.50	41.50				83	Cost for effects of wildfire on ecosystem process estimated at $83,153/project.
ReC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.	2	50							In-Kind	
ReC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ReC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	NPS, State Parks						In-Kind	
ReC-CCC-21.1	**Objective**	**Recreation**	**Address the present of threatened destruction, modification or curtailment of the species habitat or range**										
ReC-CCC-21.1.1	Recovery Action	Recreation	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ReC-CCC-21.1.1.1	Action Step	Recreation	Evaluate trail crossings to ensure bridges are constructed to support horses.	2	50	NPS, State Parks						In-Kind	
ReC-CCC-21.1.1.2	Action Step	Recreation	Eliminate horse access to creeks for watering or as fords.	2	20	NPS, State Parks						TBD	Cost are difficult to determine without knowledge of number of access points.
ReC-CCC-21.1.1.3	Action Step	Recreation	Increase education to the equestrian community regarding impacts to riparian and instream habitat from horse manure and hooves.	3		NPS, State Parks						In-Kind	
ReC-CCC-21.1.1.4	Action Step	Recreation	Recreational trails should be set back from the creek and built to reduce erosion and minimize stream crossings.	2	50	NPS, State Parks						In-Kind	
ReC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ReC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
ReC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Implement actions in ROADS and RAILROADS	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Implement DS level Actions	3									
ReC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity										
ReC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Implement actions in FLOODPLAIN	2									
ReC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Implement DS level actions	3									
ReC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										
ReC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Implement actions in RIPARIAN	2									
ReC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
ReC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Implement actions in WATER DIVERSIONS	2									
ReC-CCC-22.1.4.2	Action Step	Residential/Commercial Development	Implement DS level actions	3									
ReC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms.**										
ReC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
ReC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Implement DS level actions and BMP's	3									
ReC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ReC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent alterations to sediment transport (road condition/density, dams, etc.)										

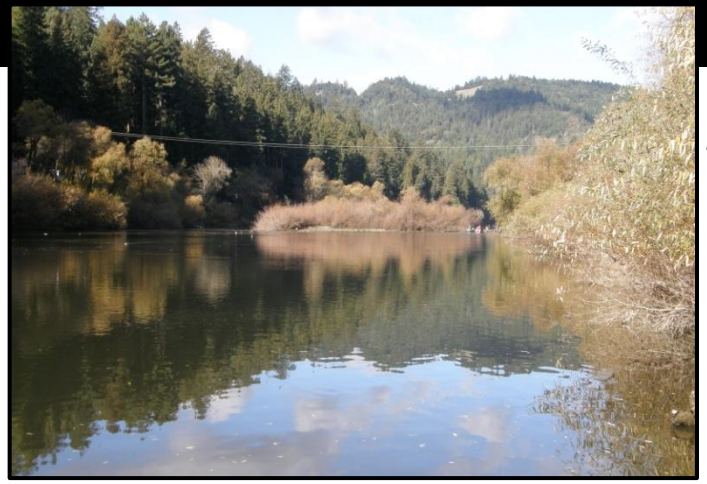
Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-23.1.1.1	Action Step	Roads/Railroads	Revaluate the high priority treatment recommendations for unpaved roads from the PWA assessment, and implement recommended treatments if they are still relevant. If not, reassess and make new recommendations for treatment. Push for decommissioning when feasible.	2	10		235.00	235.00				470	Cost based on treating 14 miles of road network at $21,000/mile. Cost to decommission road network to viability targets is $168,000.
ReC-CCC-23.1.1.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	50							In-Kind	
ReC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ReC-CCC-23.1.2.1	Action Step	Roads/Railroads	NMFS and other stakeholders will work with RCD or NRCS to encourage hiring of consultants to conduct road assessments (first for subwatersheds in Core areas, then for Phase I areas).	2	50							In-Kind	
ReC-CCC-23.1.2.2	Action Step	Roads/Railroads	Address sediment sources from road networks and other actions that deliver sediment to stream channels.	2	50							TBD	Cost accounted for in other action steps.
ReC-CCC-23.1.2.3	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	3	10		22.00	22.00				44	Cost based on decommissioning 4 miles of road network at $12,000/mile.
ReC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to the estuary (impaired quality and extent)										
ReC-CCC-23.1.3.1	Action Step	Roads/Railroads	Support efforts to remove levees on the Banducci property to create backwater and alcove habitat by having the county raise the lower section of Muir Woods road where it meets Highway One. Raising the road will address flooding and create vital off channel habitat in this section of creek. Coordinate with the NMFS and/or CDFG geomorphologist on design features and implementation techniques.	2	30							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-23.1.3.2	Action Step	Roads/Railroads	Remove levees along Big Lagoon and Pacific Way. Address issues with culverts, road network, and development within the Big Lagoon Area.	2	10		555	555				1,110	Cost based on treating 1,500 linear feet of levee at $70/linear foot plus road treatment at a cost of $21,000/mile.
ReC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
ReC-CCC-23.2.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3	100							In-Kind	
ReC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
ReC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Work with NPS and State Parks on emergency drought operations and contingency plans (i.e. fish rescues etc.)	2	60	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Work with CDFG, Counties, other agencies, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.	3	100	Marin County, Marin RCD, NPS, State Parks						In-Kind	
ReC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Work with water managers on regulated streams to assure adequate and proper consideration is given to fish needs. Develop agreements, which will minimize water-use conflicts and impacts on fish and wildlife resources during drought conditions.	2	60	CDFG, DWR, Marin County, Marin RCD, NPS, RWQCB, State Parks, SWRCB						In-Kind	
ReC-CCC-24.1.1.4	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	3	60	Marin County, Marin RCD, NPS, State Parks, SWRCB						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ReC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ReC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
ReC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Work with the Muir Beach CSD and Green Gulch farm to eliminate water diversions that affect flow within Redwood Creek.	2	20							TBD	
ReC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	3	50							TBD	
ReC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										
ReC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100							In-Kind	This recommendation should be considered standard practice.
ReC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
ReC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
ReC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	3	100							In-Kind	
ReC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	3	100							In-Kind	
ReC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	3	100							In-Kind	

Russian River

Location	•Mendocino and Sonoma Counties
Watershed Area	•1,483.0 Square Miles
Potential Habitat	•457.5 Stream Miles
Vegetation	•12% Coniferous, 40% Montane Hardwood, 18% Grassland, 13% Agricultural
Erodability	•Moderate to High
Ownership Patterns	•99% Private
Dominant Land Uses	•Urbanization, Agriculture, Ranching, Gravel Mining
Housing Density	•Moderate to High
TMDL Pollutants	•Sediment, Temperature, Nutrients, Pathogens, Metals



Russian River
Photo by Joe Pecharich

Russian River Coho Salmon: Nearly Extirpated

Recovery Goals

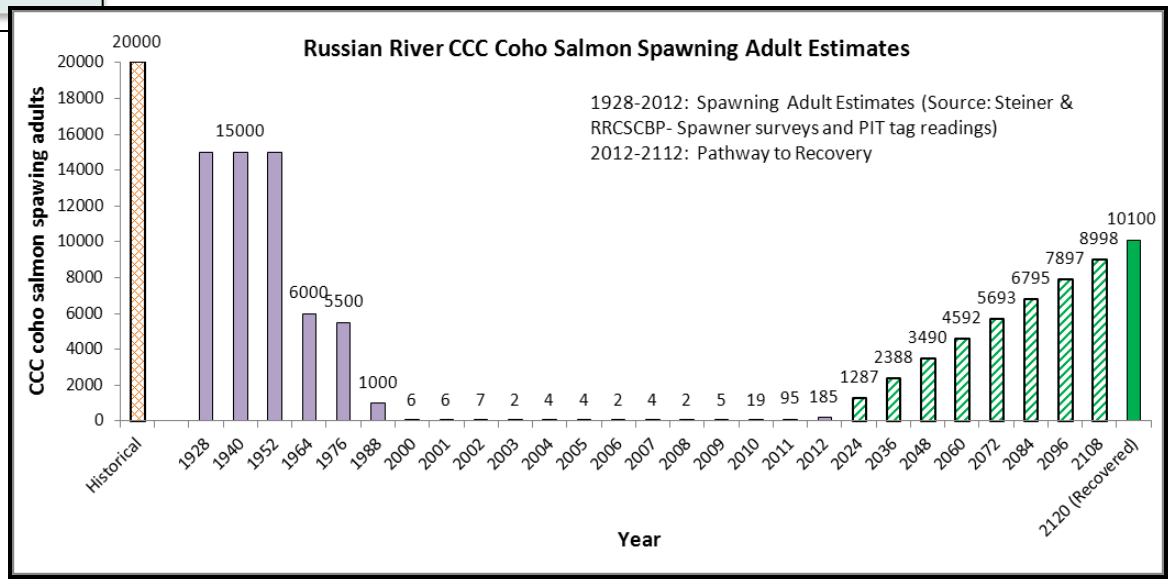
- ✓ Continue and expand captive broodstock program
- ✓ Encourage establishment and use of conservation banks
- ✓ Expand fish and habitat monitoring programs
- ✓ Increase enforcement and outreach and education to prevent take

Russian River Adult Spawner Targets

Downlisting to Threatened
5,050

Recovery
10,100

STEELHEAD: YES
CHINOOK SALMON: YES



Russian River

Potential Habitat: 457.5 miles
Recovery Target: 10,100 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	POOR	GOOD	POOR	POOR	POOR	POOR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Continue and expand operation and rearing capacity of the Coho Salmon Captive Broodstock Program
- Use surplus broodstock to repopulate nearby watersheds (within diversity strata) where populations are extirpated
- Conduct outreach with landowners to expand broodstock releases within Core, then remaining Phase 1 and Phase 2 areas
- Remove or modify the flashboard dam on lower Mill Creek near the confluence with Wallace Creek
- Install continuous water quality monitoring stations in lower Green Valley and Atascadero Creeks

Priority 2 & 3: Long-Term Restoration Actions

- Restore estuarine habitat and the associated wetlands and sloughs
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Evaluate the potential to reconstruct historical lakes in northern Laguna de Santa Rosa
- Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth
- Investigate the feasibility of beaver re-location and re-introductions
- Address season of diversion, off-stream reservoirs, and bypass flows to be more protective of coho salmon

Sonoma County Water Agency | US Army Corps of Engineers | NRCS Natural Resources Conservation Service | Trout Unlimited | Sonoma County Agriculture Industry Recreation California

Recovery Partners
CDFG, MCRRFCD, RWQCB, Sonoma Grapegrowers, Russian River Property Association, and Mendocino United Winegrowers

Sotoyome Resource Conservation District | Mendocino County | University of California | Gold Ridge RCD | National Fish and Wildlife Foundation

Photo courtesy from left from right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, KRIS Information System and Eli Asarian

Russian River

Potential Habitat: 457.5 miles
Recovery Target: 10,100 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
HIGH	HIGH	MEDIUM	LOW	MEDIUM	LOW	HIGH	MEDIUM	HIGH	LOW	VERY HIGH	HIGH	HIGH	Very HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Enforce requirements of local regulations and riparian/setbacks
- Implement water conservation strategies such as off-stream water storage and rooftop water storage
- Implement exclusion fencing in riparian zones
- Implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high sediment sources

Priority 2 & 3: Long-Term Threat Abatement Actions

- Maintain and enhance functional riparian stream buffers that provide desirable stream canopy cover adjacent to agricultural land
- Minimize interception of CCC coho salmon during the trout and steelhead freshwater sport fishing season
- Develop sustainable gravel mining practices which create and promote habitat development and maintenance
- Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment
- Identify and remediate upstream pollution sources which contribute to poor water quality conditions in the estuary
- Adequately screen water diversions to prevent juvenile salmonid mortalities

Low flow conditions in a tributary to the Russian River
Photo by Joe Pecharich

Conservation Highlights

- Conservation Hatchery
- Fish Friendly Farming Program
- Citizen Monitoring
- Agricultural BMP's

Monitoring on Mill Creek *Photo by Joe Pecharich*

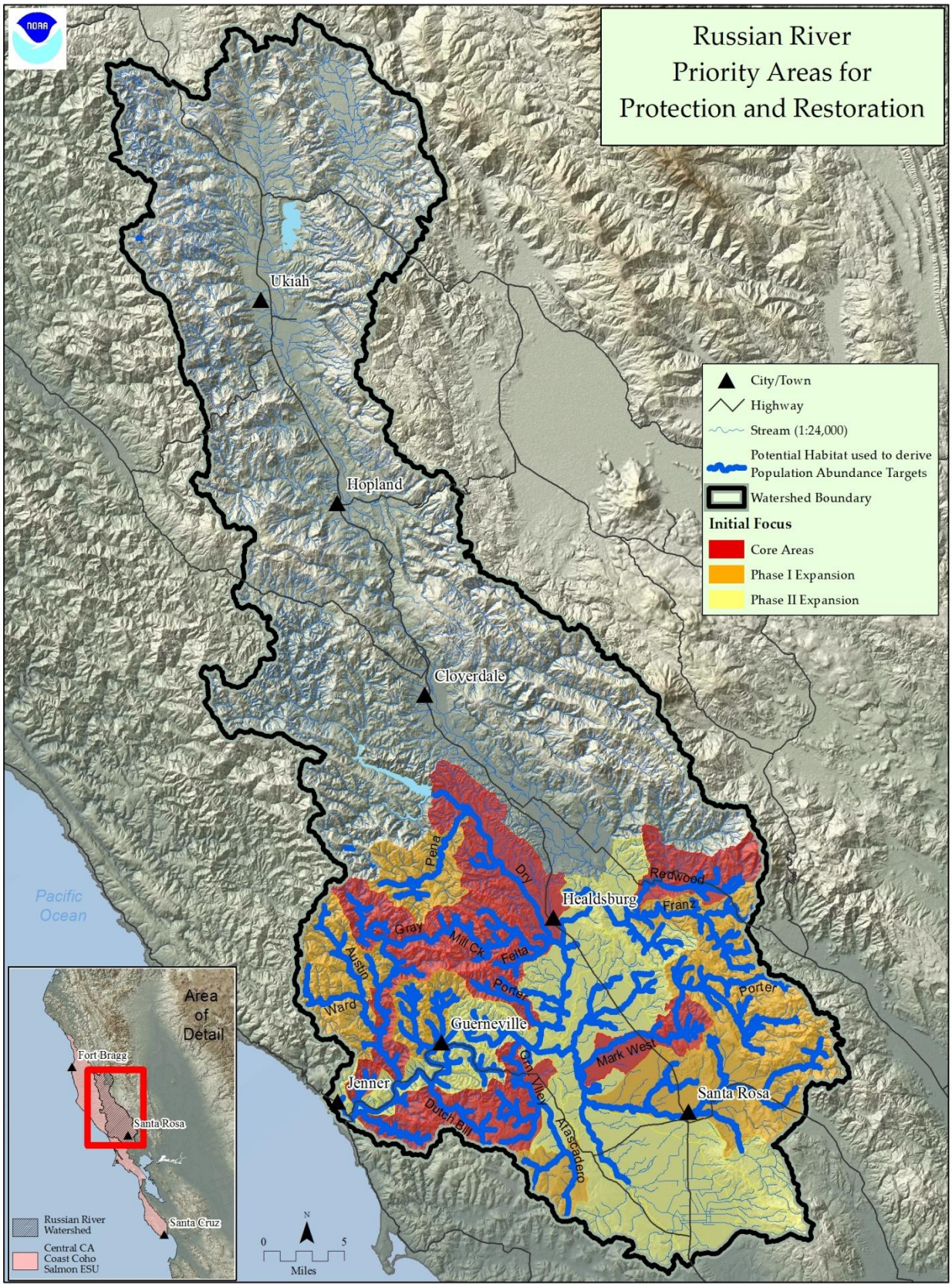


Figure 1: Map of Russian River

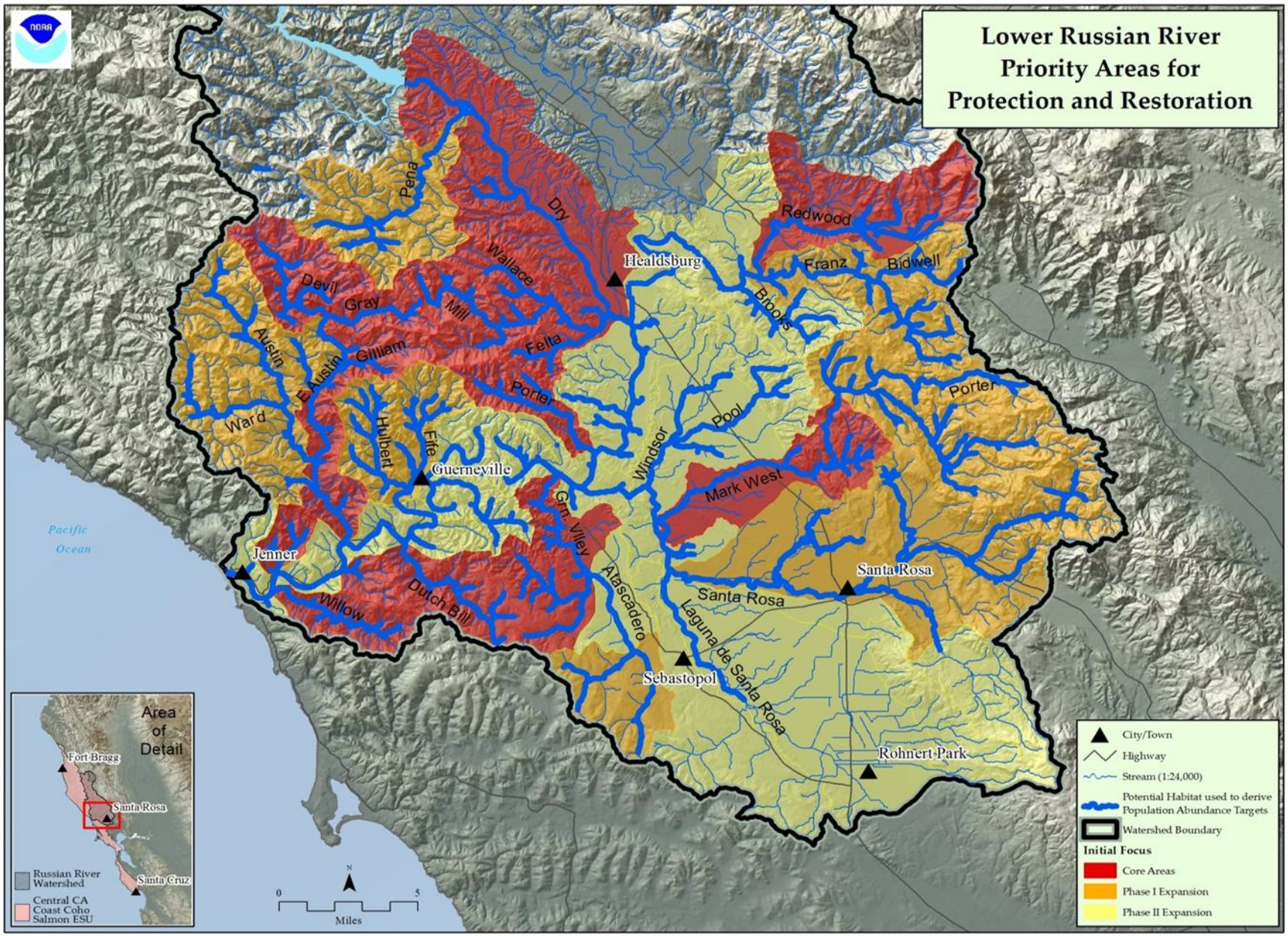


Figure 2: Map of Lower Russian River

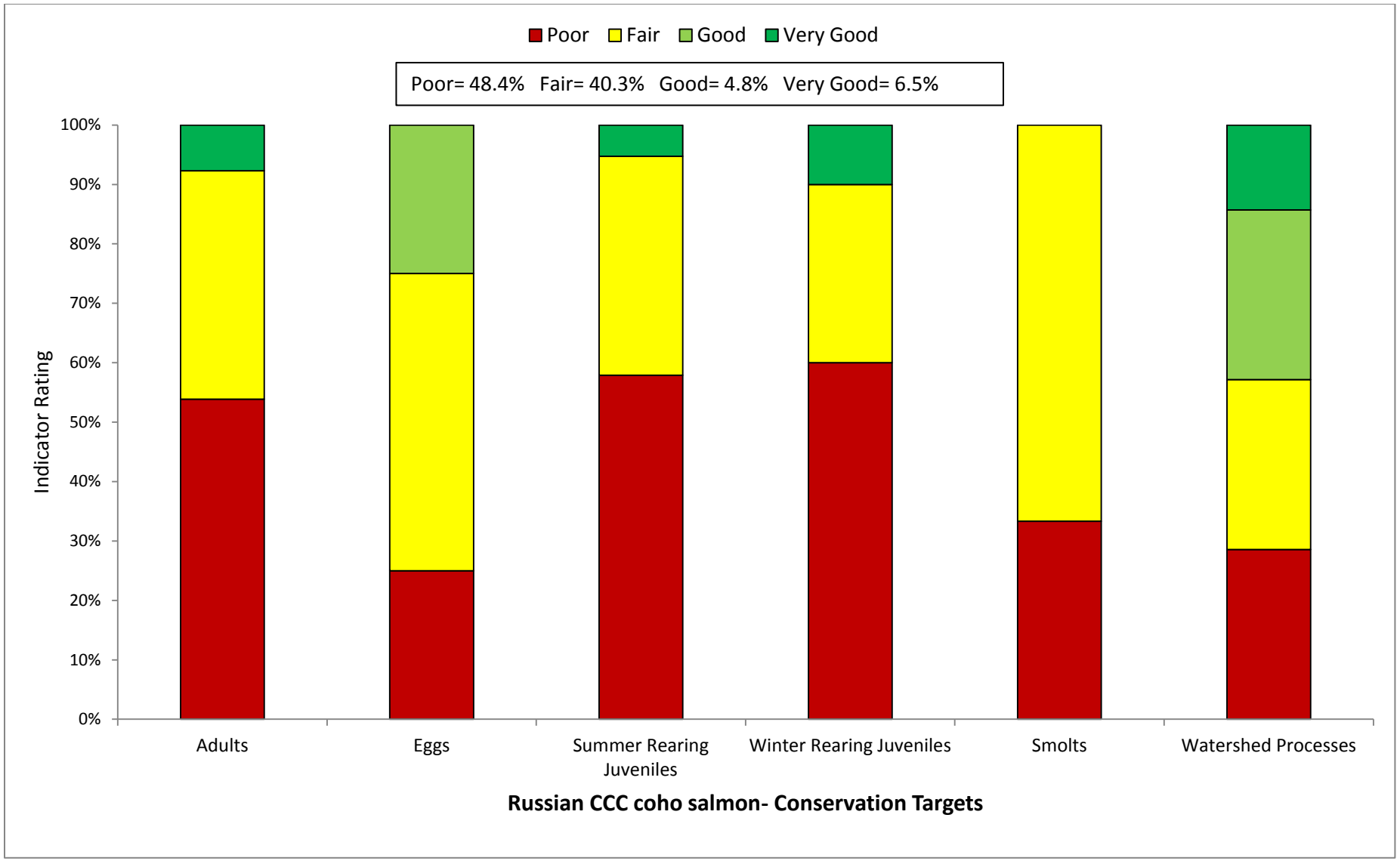


Figure 3: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Russian River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**2 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0.6 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**49% stream; 46% IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**12% streams; 9% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**96% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**7% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =67**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =83**	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**12-14% (0.85mm) and <30% (6.4mm)**	Good	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**56% streams; 36% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**2 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.6 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**31% stream; 38% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**49% stream; 46% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**12% streams; 9% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =92**	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =83**	Poor	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.99 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**96% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**50% to 74% of streams/ IP-km (>85% average stream canopy)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**7% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**56% streams; 36% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**<50% IP-km (<16 C MWMT)**	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**50-74% of Historical Range**	Fair	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**2 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.6 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**49% stream; 46% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**12% streams 9% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**96% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**7% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**56% streams; 36% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**12% streams; 9% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.99 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =81**	Poor	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**50-74% IP-km (>6 and <16 C)**	Fair	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**3-6% of Watershed in Impervious Surfaces**	Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**10-19% of Watershed in Agriculture**	Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**2% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**19% of watershed >1 unit/20 acres**	Fair	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**25-50% Historical Species Composition**	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**4.4 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.2 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Russian River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Medium	Very High	Medium	Low	High	High
2	Channel Modification	High	High	High	High	Medium	High	High
3	Disease, Predation and Competition	Medium	-	Medium	Low	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	High	-	Low	-	Low	-	Medium
6	Hatcheries and Aquaculture	Medium	-	Low	Low	Low	-	Low
7	Livestock Farming and Ranching	Medium	High	Medium	Medium	Medium	Medium	High
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Low	Medium	Medium
9	Mining	Medium	Low	Medium	Medium	High	High	High
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Medium	Very High	High	Medium	Very High	Very High
12	Roads and Railroads	High	High	Medium	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	High	Very High	High	Medium	Medium	High
14	Water Diversion and Impoundments	Medium	Medium	Very High	High	High	High	Very High
Threat Status for Targets and Project		High	High	Very High	High	High	Very High	Very High

Central CA Coast Coho Salmon ~ Russian River

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present of threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).

1.1.1.2. **Action Step:** Per the Russian River Biological Opinion, utilize adaptive management to guide future management and development of above guidelines

1.1.1.3. **Action Step:** Restore and enhance estuary habitat in the watershed.

1.1.1.4. **Action Step:** Develop Estuary Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.

1.1.2. **Recovery Action:** Rehabilitate natural river mouth dynamics

1.1.2.1. **Action Step:** Evaluate alterations to river mouth dynamics (e.g. jetty at the mouth) and implement changes to restore natural function

1.1.3. **Recovery Action:** Rehabilitate inner estuarine hydrodynamics

1.1.3.1. **Action Step:** Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen) and the practice of artificial breaching, through implementation of the Russian River estuary management program, as described within NMFS' Russian River Biological Opinion.

1.1.3.2. **Action Step:** Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements

1.1.3.3. **Action Step:** Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary

1.1.4. **Recovery Action:** Reduce extent of estuarine shoreline development

1.1.4.1. **Action Step:** Where appropriate, remove structures and/or modify practices which impair or reduce the historical tidal prism and/or estuarine function where feasible and where benefits to coho salmon and/or the estuarine environment are predicted.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.1.1. **Recovery Action:** Increase and enhance velocity refuge

2.1.1.1. **Action Step:** Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

2.1.1.2. **Action Step:** Avoid new development within riparian zones and the 100 year floodprone zones.

2.1.1.3. **Action Step:** Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.

2.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

2.2.1. **Recovery Action:** Increase and enhance velocity refuge

2.2.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.2.1.2. **Action Step:** Identify areas where floodplain connectivity can be re-established in low gradient response reaches

2.2.1.3. **Action Step:** Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).

2.2.1.4. **Action Step:** Target habitat restoration and enhancement that will function between summer base flows and flood stage.

2.2.1.5. **Action Step:** Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats

2.2.1.6. **Action Step:** Support landowners in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).

2.2.1.7. **Action Step:** Improve over-winter and summer survival by increasing the frequency and functionality of off-channel habitats.

2.2.1.8. **Action Step:** Investigate the potential role of the Laguna de Santa Rosa in supporting floodplain and off-channel habitat.

2.2.2. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.2.2.1. **Action Step:** Evaluate the potential to improve winter rearing habitat, and upstream and downstream migration in the Laguna de Santa Rosa channel between River Road and the channel's confluence with Mark West Creek by planting riparian vegetation and deepening the channel

2.2.2.2. **Action Step:** Evaluate the potential to reconstruct historic lakes in northern Laguna de Santa Rosa, upstream of the confluence of Laguna Channel & Mark West Creek to enhance overwintering habitat and to improve passage opportunities for upstream migration during dry winters; plant riparian tree species around ponds; debris removal

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency (BFW 0-10 meters)

3.1.1.1. **Action Step:** Increase large wood frequency to 75% of streams within the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.1.1.2. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in all reaches of Green Valley, Purrington, Atascadero, Redwood, Jonive, Castellini and Sexton Creeks

3.1.1.3. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Bearpen, Black Rock, Kidd, Kohute Gulch, Clear, Pole Mtn, Blue Jay, Tiny, and Holmes Canyon Creeks

3.1.1.4. **Action Step:** Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in select reaches of Austin and Ward Creeks

3.1.1.5. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Mark West, Dry, and Maacama Creeks

3.1.2. **Recovery Action:** Increase frequency of primary pools

3.1.2.1. **Action Step:** Increase pool frequency to 75% of streams within the watershed to improve conditions for adults, and summer/winter juveniles

3.1.2.2. **Action Step:** Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in all reaches of Purrington, Atascadero, and Castellini Creeks

3.1.2.3. **Action Step:** Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Austin, Bear Pen, Black Rock, Blue Jay, Conshea, Devils, Gray, Holmes Canyon, Kidd, Kohute Gulch, Pole Mtn, and Schoolhouse Creeks

3.1.2.4. **Action Step:** Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Dry, Maacama, and Mark West Creeks

3.1.2.5. **Action Step:** Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Priority streams include Redwood Creek, Foote Creek, Kellogg Creek, and Yellowjacket Creek.

3.1.2.6. **Action Step:** Where feasible, increase woody cover in the pool and flatwater habitat units throughout the Mark West watershed, focusing on a combination of cover/scour structures constructed with boulders and woody debris within flatwater and pool locations. Work should be done in conjunction with stream bank stabilization to prevent erosion (CDFG habitat inventory reports).

3.1.3. **Recovery Action:** Improve shelter rating

3.1.3.1. **Action Step:** Increase shelter ratings to 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.1.3.2. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in all reaches of Green Valley, Purrington, Atascadero, Redwood, Jonive, Castellini and Sexton Creeks

3.1.3.3. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in select reaches of Austin, Bearpen, Black Rock, Kidd, Kohute Gulch, Clear, Ward, Pole Mtn, Blue Jay, Tiny, and Ward Creeks and Holmes Canyon Creeks

3.1.3.4. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in select reaches of Dry, Mark West and Maacama Creeks

3.1.3.5. **Action Step:** Increase shelter rating on the following streams : tributaries of and including Dry Creek, Forsythe Creek, Willow Creek, Sheephouse Creek, Porter Creek, Dutch Bill Creek, Redwood Creek, Foote Creek, Kellogg Creek, Wine Creek and Yellowjacket Creek.

3.1.4. **Recovery Action:** Improve pool/riffle/flatwater ratios (hydraulic diversity)

3.1.4.1. **Action Step:** Increase the frequencies to 75% of the streams within the watershed

3.1.4.2. **Action Step:** Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Green Valley, Atascadero, Jonive, Castellini and Sexton Creeks

3.1.4.3. **Action Step:** Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Austin Creek.

3.1.4.4. **Action Step:** Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Mark West, Dry and Maacama Creeks

3.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

3.2.1. **Recovery Action:** Improve Habitat Complexity

3.2.1.1. **Action Step:** Investigate the feasibility of beaver re-location and re-introductions to Sonoma (specifically Austin, Green Valley, lower Russian River independent populations and Salmon Creek) to promote channel complexity, improve baseflows and provide rearing habitat

4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Develop rearing habitat curves to identify optimal base flow conditions

4.1.1.2. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

4.1.1.3. **Action Step:** Avoid and/or minimize the adverse effects of water diversion on coho salmon by establishing: a more natural hydrograph, by-pass flows, season of diversion, and off-stream storage

4.1.2. **Recovery Action:** Improve flow conditions (instantaneous conditions)

4.1.2.1. **Action Step:** Reduce the rate of frost protection and domestic drawdown in the spring

4.1.2.2. **Action Step:** Assess and map water diversions (CDFG 2004).

4.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

4.2.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.2.1.1. **Action Step:** Develop cooperative projects with private landowners to conserve summer flows based on results of the NFWF efforts

4.2.1.2. **Action Step:** Support the water conservation training conducted by the Occidental Arts and Ecology Center Water Institute, Gold Ridge RCD, and Salmon Creek Watershed Council.

4.2.1.3. **Action Step:** Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).

4.2.2. **Recovery Action:** Improve flow conditions (instantaneous conditions)

4.2.2.1. **Action Step:** Work with SWRCB and landowners to improve over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently impacted by water use.

4.2.2.2. **Action Step:** Work with SWRCB and landowners to improve flow regimes for adult migration to spawning habitats and smolt outmigration.

4.2.2.3. **Action Step:** Promote alternative frost protection strategies.

4.2.3. **Recovery Action:** Minimize redd scour

4.2.3.1. **Action Step:** Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.1.1. **Recovery Action:** Prevent increased landscape disturbance

5.1.1.1. **Action Step:** Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems

5.1.1.2. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.1.3. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

5.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.2.1. **Recovery Action:** Improve sediment transport by implementing DS level actions

5.2.2. **Recovery Action:** Improve watershed hydrology by implementing DS level actions

5.2.3. **Recovery Action:** Conserve hydrology by implementing DS level actions

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Rehabilitate and enhance passage into tributaries (aggradation/degradation)

6.1.1.1. **Action Step:** Improve passage in the mainstem and confluences of Austin Creek

6.1.1.2. **Action Step:** Continue restoration projects which employ improved gravel mining practices upstream of mile 1 on Austin Creek

6.1.2. **Recovery Action:** Modify or remove physical passage barriers

6.1.2.1. **Action Step:** Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).

6.1.2.2. **Action Step:** Remove or modify the flashboard dam on lower Mill Creek near the confluence with Wallace Creek. This barrier is the highest priority barrier within the Russian River population for remediation.

6.1.2.3. **Action Step:** Investigate passage at multiple sites along Atascadero Creek and tributaries and implement improvements

6.1.2.4. **Action Step:** Improve passage at existing County culvert barriers on Pole Mountain Creek, Kid Creek and Kohute Gulch.

6.1.2.5. **Action Step:** Assess the old flashboard dam on Bear Pen Creek, and implement recommendations to improve passage.

6.1.2.6. **Action Step:** Assess the log jam/slide barrier on Gilliam and Schoolhouse Creeks and implement recommendations to improve passage

6.1.2.7. **Action Step:** Improve passage at sites identified in Mill, Pena and Grape Creek. The falls on lower Mill Creek and on lower Felta Creek need to be evaluated for passage periodically and improved/maintained if necessary. (CDFG 2004).

6.1.2.8. **Action Step:** Investigate passage barriers on Dutcher Creek, Felta Creek (CDFG survey reach 2), Foss Creek, Mill Creek, Norton Creek, Pine Ridge Canyon Creek, Schoolhouse Creek, West Slough, and Wine Creek (CDFG stream survey reports). Pena Creek tributaries should also be investigated.

6.1.2.9. **Action Step:** Several large barriers exist on Dutcher Creek. Fish passage specialists should investigate the cost/benefit of improving passage at these locations. If advantageous, the barriers should be addressed. (CDFG 2004).

6.1.2.10. **Action Step:** Log-jams in the Chapman Branch and Pena Creek need to be monitored/investigated for passage. Prior to removing logjams, consult with NMFS and CDFG fish passage specialists (CDFG 2004).

6.1.2.11. **Action Step:** Barriers on mainstem Russian River (memorial beach and Willow Water District Dam) should be assessed by a fish passage specialist and modified if needed.

6.1.2.12. **Action Step:** Evaluate and implement passage opportunities in the Maacama Creek subwatershed and its tributaries. Priority streams include Redwood Creek, Foote Creek, Kellogg Creek and Yellowjacket Creek.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** In the upper Austin Creek sub-basin reforestation to a conifer forest should be a long term strategy to return the area to fully functioning condition. Implementing this type of strategy will need to employ incentives and assistance to landowners

8.1.1.2. **Action Step:** Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream). Watersheds identified by CDFG include Porter, Foote, Grub, Franz, and Franchi.

8.1.1.3. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate. High priority areas for consideration may include Austin Creek, and upper Briggs Creek and upper Bidwell Creek (Laurel Marcus and Associates 2004).

8.1.1.4. **Action Step:** In Willow Creek there is a limited supply of large diameter, riparian redwood and Douglas-fir in the watershed. Promote growth of conifers in the riparian zone for later in-channel recruitment.

8.1.2. **Recovery Action:** Improve canopy cover

8.1.2.1. **Action Step:** Increase tree diameter within 40% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Plant native riparian species and native conifers/hardwoods in the riparian zone within the Upper and Lower Gray Creek sub-basin to increase overall tree diameter

8.1.2.3. **Action Step:** Plant native riparian species and native conifers/hardwoods throughout riparian zones within the eastern and southern portions of Green Valley Creek watershed to increase overall tree diameter

8.1.2.4. **Action Step:** Mark West Tributaries, specifically Humbug, Porter, Horse Hill and Weeks Creeks are high priority creeks for riparian restoration

8.1.2.5. **Action Step:** Work with landowners to evaluate any existing conservation easements that exist within the Maacama watershed. Changes in these easements to better protect riparian habitat should be investigated (Laurel Marcus and Associates 2004).

8.1.2.6. **Action Step:** Focus riparian restoration within Santa Rosa, Matanzas, Brush/Rincon, Piner, Paulin, Windsor and Pool Creeks. Where appropriate, riparian surveys should be continued above CDFG survey section. Santa Rosa Creek work should focus on survey reach 1 and the channelized section. Matanzas Creek work would benefit from utilizing bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel (CDFG stream survey reports).

8.1.2.7. **Action Step:** Increase canopy cover levels within the Dry Creek watershed. Priority streams include Fall Creek (reach 1), Felta Creek (reach 2,3), Foss Creek, Mill Creek, Norton Creek, Pechaco Creek (reach 1,2,3), Pena Creek, West Slough, Wine Creek (reach 1), and Woods Creek (reach 1,2,3) (CDFG stream survey reports).

8.1.2.8. **Action Step:** Restore and protect riparian vegetation in Turtle Creek, Fife Creek, Porter Creek, Bluejay Creek, Fisher Creek, Grub Creek, and Corral Creek (CDFG stream survey reports).

8.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

8.2.1. **Recovery Action:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)

9.1.1.2. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004). High priority streams identified by CDFG habitat reports include Sheephouse Creek, Austin and East Austin Creeks, Pena Creek, Porter Creek, Kidd Creek, Sexton Creek, Gilliam Creek, Hobson

Creek, Conshea Creek, Crane Creek, and Schoolhouse Creek (http://coastalwatersheds.ca.gov/).

9.1.1.3. **Action Step:** In Purrington Creek several stream crossings exist in Reach 1. These crossings should be improved to eliminate active soil erosion and runoff.

9.1.1.4. **Action Step:** Maintenance of ditches, culverts, and inboard cutbank slides should be improved to decrease the potential of sediment delivery to Dutchbill and Grub Creeks.

9.1.1.5. **Action Step:** In the East Austin Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsloping roads, ditch relief culverts, and installing rolling dips.

9.1.1.6. **Action Step:** Implement recommendations of completed sediment source surveys in Austin and East Austin Creek mainstems, Gray Creek, and Pole Mountain Creeks (See ROADS for specific actions)

9.1.1.7. **Action Step:** Implement recommendations of completed sediment source surveys in Mark West, Dry Creek and Green Valley and Purrington Creeks (See ROADS for specific actions)

9.1.1.8. **Action Step:** Conduct instream and upslope sediment source surveys in Atascadero, Mark West, and Maacama Creeks to identify existing sources of high sediment yield using accepted protocols and implement recommendations

9.1.1.9. **Action Step:** Conduct sediment source surveys in Black Rock Creek, Kidd Creek and other tributaries to identify existing sources of high sediment yield using accepted protocols and implement recommendations

9.1.1.10. **Action Step:** Initiate sediment assessments and landslide mapping in the Dry Creek watershed. High priority streams include Crane Creek, Felta Creek (reach 3,4), Grape Creek, Mill Creek, Palmer Creek, Pena Creek, Pine Ridge Canyon Creek, Wallace Creek, Wine Creek and Woods Creek (CDFG stream survey reports).

9.1.2. **Recovery Action:** Improve and expand instream gravel quantity

9.1.2.1. **Action Step:** Develop habitat enhancement projects to establish additional riffle habitat and import spawning gravel from mining operations in the Russian River basin to select reaches of Green Valley, Atascadero, Jonive, Castelini and Sexton Creeks

9.1.2.2. **Action Step:** Debris jams are potentially trapping sediment and eroding adjacent banks within Schoolhouse Creek, Wine Creek, and Woods Creek. The jams should be analyzed for possible removal or modification (CDFG stream survey reports).

9.1.2.3. **Action Step:** Spawning gravel is limited within Dutcher Creek (reach 1), Fall Creek, Felta Creek, Grape Creek, and Wine Creek (upper and lower reaches) (CDFG stream habitat reports). Implement actions to improve spawning gravel abundance and quality within these stream.

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Continue the operation of the Captive Broodstock Program

10.1.1.2. **Action Step:** Improve and expand rearing capacity of the Coho Salmon Captive Broodstock facility.

10.1.1.3. **Action Step:** Continue and expand the existing coho salmon life-cycle monitoring efforts.

10.1.1.4. **Action Step:** Minimize departure from the genetic profile that historically existed in the population.

10.1.1.5. **Action Step:** Use surplus broodstock to repopulate nearby watersheds (within diversity strata) where populations have extirpated.

10.1.1.6. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.1.7. **Action Step:** Implement recovery actions where indicators rated poor or fair in streams which are currently receiving broodstock as a priority .

10.1.1.8. **Action Step:** Monitor the effectiveness and maintenance of watershed restoration projects and augment inventories as needed (CDFG 2004).

10.1.1.9. **Action Step:** Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions

10.1.1.10. **Action Step:** Conduct habitat surveys to monitor change in key habitat variables. Specific locations to be monitored will be determined through implementation of the Coastal Salmonid Monitoring Plan

10.1.1.11. **Action Step:** Utilize the hatchery criteria and assessment guidance provided in Spence et al. 2008 when evaluating the risks and benefits of proposed and ongoing hatchery operations

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery.

10.1.2.2. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.1.2.3. **Action Step:** Increase size at release to attain 160 mm at emigration, to enhance marine survival and increasing adult returns

10.1.2.4. **Action Step:** Establish a release imprinting station on Mill Creek and Green Valley Creeks, and other smolt release streams, so that smolts can be held for a minimum two week period

prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

10.1.2.5. **Action Step:** Increase coho salmon smolt production at the Russian River Coho Salmon Broodstock facility to a level where consistent returns can be incorporated reliably into the spawning matrix

10.1.2.6. **Action Step:** Continue to utilize surplus fish in additional recovery opportunities (adult releases, releases to extirpated watersheds) and evaluate such actions in the context of recovering coho in the Russian River, extirpated watersheds, and the contribution to the diversity stratum

10.1.2.7. **Action Step:** Utilize different marking method to identify program coho salmon from wild coho salmon to facilitate monitoring while reducing adult mortality. Transition away from adipose clipping broodstock program coho salmon to reduce by catch of adult coho salmon during the recreational steelhead season (only adipose clipped steelhead can be legally harvested and coho salmon can be confused for steelhead).

10.1.3. **Recovery Action:** Increase spatial structure and diversity

10.1.3.1. **Action Step:** Conduct outreach with landowners to expand broodstock releases within core, then remaining phase 1, then phase 2 streams within the watershed.

10.1.3.2. **Action Step:** Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock in Russian River, Walker and Salmon Creeks.

10.1.3.3. **Action Step:** Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.

10.1.3.4. **Action Step:** Evaluate the tailwater section of the upper Russian River below Lake Mendocino in its capacity to serve as rearing habitat for juvenile and smolt coho salmon

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Increase the canopy by planting native species where shade canopy is not at acceptable levels within middle Salmon Creek, Nolan, and Coleman Valley Creeks.

11.1.1.2. **Action Step:** Plant native vegetation to promote streamside shade: increase the canopy by planting native species where shade canopy is not at acceptable levels.

11.1.1.3. **Action Step:** Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extends from the outer edge of the channel out to the site potential of tree height to allow LWD recruitment.

11.1.1.4. **Action Step:** Develop site-specific recommendations, including incentives, to remedy high temperatures and implement (CDFG 2004) initially in core areas, following with phase 1 and 2 areas.

11.1.2. **Recovery Action:** Improve stream water quality conditions

11.1.2.1. **Action Step:** Install continuous water quality monitoring stations in lower Green Valley and Atascadero Creeks

11.1.2.2. **Action Step:** Work with livestock and ranch owners to implement BMP's to control sediment and nitrates

11.1.2.3. **Action Step:** Domestic garbage along Purrington Creek should be cleaned up and existing illegal dump sites along the road should be posted to reduce the possibility of toxic substances entering the creek. These dump sites appear to be routinely visited and periodic patrols by local law enforcement should be encouraged.

11.1.2.4. **Action Step:** Assess the number of septic systems or other wastewater producers that deliver toxics to the lower mainstem Russian River and tributaries (such as Dutchbill Creek and others). Work with cities and Sonoma County to eliminate these sources of toxic input.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.1.1. **Recovery Action:** Prevent increased landscape disturbance

12.1.1.1. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to watercourses

12.1.1.2. **Action Step:** Develop legislation that will fund county planning for environmentally sound agricultural growth and water supply

12.1.2. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

12.1.2.1. **Action Step:** Enforce requirements of local regulations and riparian/setbacks

12.1.2.2. **Action Step:** Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.

12.1.2.3. **Action Step:** Enforce existing building permit programs to minimize unpermitted construction.

12.1.2.4. **Action Step:** Encourage the purchase of land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities and corridors.

12.1.2.5. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

12.1.2.6. **Action Step:** Continue to educate and encourage the County of Mendocino to adopt a grading ordinance that meets NMFS, RWQCB, and CDFG approval.

12.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

12.2.1. **Recovery Action:** Prevent increased landscape disturbance

12.2.1.1. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

12.2.1.2. **Action Step:** Streamline permit processing where landowners are conducting actions aligned with recovery priorities.

12.2.1.3. **Action Step:** Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with salmon recovery priorities.

12.2.2. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

12.2.2.1. **Action Step:** Improve water temperature conditions for migrating smolts and summer rearing juveniles throughout 35% of watershed by increasing the canopy by planting native species where shade canopy is not at acceptable levels .

13. Threat- Channel Modification

13.1. **Objective:** Address inadequacies of regulatory mechanisms

13.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity

13.1.1.1. **Action Step:** All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.

13.1.1.2. **Action Step:** Channel modifying projects should be designed to ensure potential effects to salmonid habitat are fully minimized or mitigated, and where possible, existing poor conditions should be remediated.

13.1.1.3. **Action Step:** Ensure that all future and existing channel designed for flood conveyance incorporate features that enhance salmonid migration under high and low flow conditions.

13.1.1.4. **Action Step:** Modify city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, within the 100-year flood prone zones

13.1.1.5. **Action Step:** Develop a mitigation policy that requires in-kind replacement of removed large woody debris at a 3:1 ratio.

13.1.1.6. **Action Step:** Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.

13.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity

13.2.1.1. **Action Step:** Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.

13.2.1.2. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.

13.2.1.3. **Action Step:** Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows, (see FLOODPLAIN for specific actions).

13.2.1.4. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.

13.2.1.5. **Action Step:** Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the overutilization for commercial, recreational, scientific or educational purposes

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Work with CDFG to improve the Fishing Regulation manual to clearly identify differences in body morphology of all potentially present adult salmonids with color photos of diagnostic features (e.g., caudal fin spotting, caudal fin shape, coloration of lower jaw, peduncle width, etc.).

16.1.1.2. **Action Step:** Install/construct permanent signs at major public fishing access points along the Russian River (below Dry Creek) that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).

16.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.2.1.1. **Action Step:** Minimize interception of CCC coho salmon during the trout and steelhead freshwater sport fishing season.

16.2.1.2. **Action Step:** NMFS and CDFG will work to improve the California Freshwater Sport Fishing Regulations to minimize interception of adult salmonids.

16.2.1.3. **Action Step:** NMFS will work with CDFG to modify low flow restrictions under Article 4. Supplemental Regulations, Section 8.00 (a).

16.2.1.4. **Action Step:** NMFS and CDFG will work to improve the marking strategy of the coho captive broodstock recovery program to decrease confusion with allowable harvested hatchery steelhead.

16.2.1.5. **Action Step:** Promote CalTip to discourage poaching (CDFG 2004).

17. Threat- Hatcheries

17.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

17.1.1. **Recovery Action:** Increase spatial structure and diversity

17.1.1.1. **Action Step:** Continue the operation of the Captive Broodstock Program

17.1.1.2. **Action Step:** Utilize the hatchery criteria and assessment guidance provided in Spence et al. 2008 when evaluating the risks and benefits of proposed and ongoing hatchery operations

17.1.1.3. **Action Step:** Preserve the remaining genetic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce risk of extirpation.

17.1.1.4. **Action Step:** Utilize resources to increase genetic variability in Captive Programs as well as for adult re-introduction efforts in barren Marin and Sonoma County streams (Walker and Salmon Creek Programs are models for others)

18. Threat- Livestock

18.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

18.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.1.1.1. **Action Step:** Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.

18.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

18.2.1.1. **Action Step:** Encourage riparian restoration to regain riparian corridors damaged from livestock and other causes.

18.2.1.2. **Action Step:** To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes

18.2.1.3. **Action Step:** Where necessary, establish predetermined stream crossings when herding cattle between pastures.

18.2.1.4. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

18.2.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

18.2.2.1. **Action Step:** Aid landowners willing to fence off riparian areas with development of offstream alternative water sources

18.2.2.2. **Action Step:** Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.

18.2.3. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.2.3.1. **Action Step:** Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.

18.2.3.2. **Action Step:** Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.

18.2.3.3. **Action Step:** Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.

18.2.3.4. **Action Step:** Manage rotational grazing to aid in the reduction of noxious weeds.

18.2.3.5. **Action Step:** Fence riparian areas within the Dry Creek watershed from grazing by using fencing standards that excludes cattle but allows other wildlife to access the stream. High priority stream reaches include Pechaco Creek (reach 1 and 2) and Pena Creek (reach 3) (CDFG stream survey reports).

18.2.3.6. **Action Step:** Fence riparian areas within the Mark West watershed from grazing by using fencing standards that allow other wildlife to access the stream.

18.2.3.7. **Action Step:** Fence riparian areas within the Maacama Creek watershed from grazing by using fencing standards that allow other wildlife to access the stream. Combine fencing with appropriate riparian regeneration projects when possible. High priority streams include Bear, Ingall, McDonnell, Lower Briggs, Little Briggs, and Coon Creek (Laurel Marcus and Associates 2004).

18.2.3.8. **Action Step:** Exclusion fencing and off-stream water development should be explored and implemented within the McDonnell Creek watershed to address livestock damage in riparian areas.

19. Threat- Logging

19.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.1.1. **Recovery Action:** Prevent future impacts to habitat complexity

19.1.1.1. **Action Step:** Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations

19.1.1.2. **Action Step:** Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels

19.1.1.3. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.1.4. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).

19.1.1.5. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within high value habitat areas

19.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.2.1.1. **Action Step:** Develop a Transportation Plan and adequately upgrade necessary roads, and relocate and/or decommission riparian or unnecessary roads (see ROADS for specific actions/areas)

19.2.1.2. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes problem sites and outlines implementation and a timeline of necessary actions.

19.2.1.3. **Action Step:** Utilize BMP's to properly construct roads for storm proofing and Avoid the construction of roads in the riparian zone.

20. Threat- Mining

20.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

20.1.1. **Recovery Action:** Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)

20.1.1.1. **Action Step:** Utilize NMFS guidelines and geomorphic considerations in developing sustainable mining practices which create and promote habitat development and maintenance

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

22.1.1.1. **Action Step:** Modify Federal, State, local processes, and County General Plans, to eliminate provisions allowing new construction in undeveloped areas within the 100-year flood prone zone

22.1.1.2. **Action Step:** Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.1.3. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.1.1.4. **Action Step:** As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.

22.1.2. **Recovery Action:** Prevent impairment to water quality

22.1.2.1. **Action Step:** Implement performance standards in Stormwater Management Plans.

22.1.2.2. **Action Step:** Disperse discharge from commercial and residential areas into a spatially distributed network rather than a few point discharges.

22.1.2.3. **Action Step:** Improve water quality where necessary by addressing residential and commercial pollutant sources.

22.1.2.4. **Action Step:** Implement performance standards in Stormwater Management Plans.

22.1.3. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.1.3.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

22.1.3.2. **Action Step:** Enforce requirements of local regulations and riparian/setbacks

22.1.3.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.1.3.4. **Action Step:** Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating steelhead.

22.1.3.5. **Action Step:** Address failing septic systems in rural areas

22.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.2.1.1. **Action Step:** Utilize native plants when landscaping and discourage the use of exotic invasives

22.2.1.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

22.2.1.3. **Action Step:** Explore the use of conservation easements to provide incentives for private landowners to preserve riparian corridors

22.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.2.1. **Action Step:** Encourage the use and provide incentives for rooftop water storage and other conservation devices

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.1.1.2. **Action Step:** In the Russian River watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsloping roads, ditch relief culverts, and installing rolling dips.

23.1.1.3. **Action Step:** Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.1.1.4. **Action Step:** Implement DS level recommendations

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2.2. **Action Step:** Reduce riparian road densities by 10 percent over the next 10 years, prioritizing high risk areas in Core CCC coho salmon watersheds.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanism

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Work with CDFG, County of Sonoma, State Parks, municipalities, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.

24.1.1.2. **Action Step:** Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).

24.1.1.3. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

24.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.2.1. **Recovery Action:** Prevent impairment to hydrology

24.2.1.1. **Action Step:** Minimize water use and seek alternatives during droughts.

24.2.1.2. **Action Step:** Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.

24.2.1.3. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

24.2.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.2.2.1. **Action Step:** Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas (See WATER QUALITY for specific actions/areas

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.1.1.2. **Action Step:** Promote water conservation by the public, water agencies, agriculture, private industry, and the citizenry.

25.1.1.3. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).

25.1.1.4. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

25.1.1.5. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

25.1.1.6. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.1.7. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.1.1.8. **Action Step:** Promote water conservation best practices such as drip irrigation for vineyards.

25.1.2. **Recovery Action:** Prevent impairment to estuary

25.1.2.1. **Action Step:** Identify upstream pollution sources which contribute to poor water quality conditions in the estuary

25.1.3. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.3.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Russian River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-1.1	**Objective**	**Estuary**	**Address the present of threatened destruction, modification or curtailment of the species habitat or range**										
RR-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
RR-CCC-1.1.1.1	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).	2	20	CA Coastal Commission, California Coastal Conservancy, CDFG, Private Landowners	2,650	2,650	2,650	2,650		10,600	Cost based on treating 38 acres (assume 5% of total estuarine habitat) at a rate of $272,120/acre.
RR-CCC-1.1.1.2	Action Step	Estuary	Per the Russian River Biological Opinion, utilize adaptive management to guide future management and development of above guidelines	2	15	NMFS, Sonoma County Water Agency						In-Kind	Sonoma County Water Agency will incur most of this cost.
RR-CCC-1.1.1.3	Action Step	Estuary	Restore and enhance estuary habitat in the watershed.	2	40	CalFire, California Geological Survey, CalTrans, CDFG, Mendocino Redwood Company, NRCS, Private Landowners, Public, RCD, RWQCB						TBD	Cost accounted for in above action step.
RR-CCC-1.1.1.4	Action Step	Estuary	Develop Estuary Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.	3	10	CDFG, NMFS, NRCS, Private Consultants	136.50	136.50				273	Cost for estuary use/residence time estimated at $273,120/project.
RR-CCC-1.1.2	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
RR-CCC-1.1.2.1	Action Step	Estuary	Evaluate alterations to river mouth dynamics (e.g. jetty at the mouth) and implement changes to restore natural function	3	20							In-Kind	
RR-CCC-1.1.3	Recovery Action	Estuary	Rehabilitate inner estuarine hydrodynamics										
RR-CCC-1.1.3.1	Action Step	Estuary	Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen) and the practice of artificial breaching, through implementation of the Russian River estuary management program, as described within NMFS' Russian River Biological Opinion.	2								In-Kind	
RR-CCC-1.1.3.2	Action Step	Estuary	Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements	3								TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-1.1.3.3	Action Step	Estuary	Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary	3									
RR-CCC-1.1.4	Recovery Action	Estuary	Reduce extent of estuarine shoreline development										
RR-CCC-1.1.4.1	Action Step	Estuary	Where appropriate, remove structures and/or modify practices which impair or reduce the historical tidal prism and/or estuarine function where feasible and where benefits to coho salmon and/or the estuarine environment are predicted.	3	10	CA Coastal Commission, California Coastal Conservancy, CDFG						TBD	Costs associated with removal of structures will depend on the number and type of structures identified and cannot be accurately determined at this time.
RR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
RR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	3	20	CDFG, Gold Ridge RCD, NOAA RC						In-Kind	This recommendation should be considered standard practice.
RR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Avoid new development within riparian zones and the 100 year floodprone zones.	3	30	CDFG, NMFS, Sonoma County						In-Kind	
RR-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.	3	10	County Planning, Land Trusts, Private Landowners, RCD						TBD	Cost difficult to determine because of landowner participation.
RR-CCC-2.2	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	3	10	CalFire, California Coastal Conservancy, California Geological Survey, CalTrans, CDFG, Laguna Foundation, Mendocino Redwood Company, NMFS, NRCS, Private Landowners, RCD, RWQCB	103.50	103.50				207	Cost based on wetland restoration estimated at $206,493/project.
RR-CCC-2.2.1.2	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches	3		Farm Bureau, NMFS HCD, Public Works, RCD							Cost accounted for in above action step.
RR-CCC-2.2.1.3	Action Step	Floodplain Connectivity	Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).	3	5	Private Consultants, Private Landowners, Sonoma County	63.00					63	Cost for stream flow model estimated at $63,005/project.
RR-CCC-2.2.1.4	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between summer base flows and flood stage.	2	10	CDFG, NMFS, NRCS, Sonoma County Water Agency	55.50	55.50				111	Cost for fish/habitat restoration estimated at $111,192/project.
RR-CCC-2.2.1.5	Action Step	Floodplain Connectivity	Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats	2	10	California Coastal Conservancy, MMWD, NMFS HCD, RCD	153.50	153.50				307	Cost to treat 85 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
RR-CCC-2.2.1.6	Action Step	Floodplain Connectivity	Support landowners in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).	3	60	Gold Ridge RCD, Private Landowners						In-Kind	
RR-CCC-2.2.1.7	Action Step	Floodplain Connectivity	Improve over-winter and summer survival by increasing the frequency and functionality of off-channel habitats.	2	2	CDFG, NMFS, Private Landowners, Sonoma County Water Agency						TBD	Cost will include GIS and validation in the field.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-2.2.1.8	Action Step	Floodplain Connectivity	Investigate the potential role of the Laguna de Santa Rosa in supporting floodplain and off-channel habitat.	3								In-Kind	
RR-CCC-2.2.2	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
RR-CCC-2.2.2.1	Action Step	Floodplain Connectivity	Evaluate the potential to improve winter rearing habitat, and upstream and downstream migration in the Laguna de Santa Rosa channel between River Road and the channel's confluence with Mark West Creek by planting riparian vegetation and deepening the channel	3								TBD	
RR-CCC-2.2.2.2	Action Step	Floodplain Connectivity	Evaluate the potential to reconstruct historic lakes in northern Laguna de Santa Rosa, upstream of the confluence of Laguna Channel & Mark West Creek to enhance overwintering habitat and to improve passage opportunities for upstream migration during dry winters; plant riparian tree species around ponds; debris removal	2								TBD	
RR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
RR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)			CDFG, NOAA RC, Private Landowners, RCD, Sonoma County, Sonoma County Water Agency, USACE							
RR-CCC-3.1.1.1	Action Step	Habitat Complexity	Increase large wood frequency to 75% of streams within the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	15		143.33	143.33	143.33			430	Cost based on treating 170 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.
RR-CCC-3.1.1.2	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in all reaches of Green Valley, Purrington, Atascadero, Redwood, Jonive, Castellini and Sexton Creeks	2									
RR-CCC-3.1.1.3	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Bearpen, Black Rock, Kidd, Kohute Gulch, Clear, Pole Mtn, Blue Jay, Tiny, and Holmes Canyon Creeks	2									
RR-CCC-3.1.1.4	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in select reaches of Austin and Ward Creeks	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-3.1.1.5	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Mark West, Dry, and Maacama Creeks	2									
RR-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools		5	CDFG, NOAA RC, Sonoma County, Sonoma County Water Agency	87.50					88	Cost estimates for placement of LWD range from $20K to $30K per mile. Assuming proximally half the ~7stream miles require treatment, costs would be approximately $25K per mile.
RR-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase pool frequency to 75% of streams within the watershed to improve conditions for adults, and summer/winter juveniles	2	15		143.33	143.33	143.33			430	Cost based on treating 170 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile. If ELJ used, cost estimated at $171,904,000.
RR-CCC-3.1.2.2	Action Step	Habitat Complexity	Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in all reaches of Purrington, Atascadero, and Castellini Creeks	2									
RR-CCC-3.1.2.3	Action Step	Habitat Complexity	Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Austin, Bear Pen, Black Rock, Blue Jay, Conshea, Devils, Gray, Holmes Canyon, Kidd, Kohute Gulch, Pole Mtn, and Schoolhouse Creeks	2									
RR-CCC-3.1.2.4	Action Step	Habitat Complexity	Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Dry, Maacama, and Mark West Creeks	2									
RR-CCC-3.1.2.5	Action Step	Habitat Complexity	Install or enhance existing LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth (CDFG 2004). Priority streams include Redwood Creek, Foote Creek, Kellogg Creek, and Yellowjacket Creek.	2									
RR-CCC-3.1.2.6	Action Step	Habitat Complexity	Where feasible, increase woody cover in the pool and flatwater habitat units throughout the Mark West watershed, focusing on a combination of cover/scour structures constructed with boulders and woody debris within flatwater and pool locations. Work should be done in conjunction with stream bank stabilization to prevent erosion (CDFG habitat inventory reports).	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve shelter rating		5	CDFG, NOAA RC, Sonoma County, Sonoma County Water Agency	700					700	Estimate 35 structures at ~20K per structure. Structures have already been placed in some areas.
RR-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase shelter ratings to 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	20							TBD	Cost should be accounted for in increase LWD frequency and primary pools.
RR-CCC-3.1.3.2	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in all reaches of Green Valley, Purrington, Atascadero, Redwood, Jonive, Castellini and Sexton Creeks	2									
RR-CCC-3.1.3.3	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in select reaches of Austin, Bearpen, Black Rock, Kidd, Kohute Gulch, Clear, Ward, Pole Mtn, Blue Jay, Tiny, and Ward Creeks and Holmes Canyon Creeks	2									
RR-CCC-3.1.3.4	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in select reaches of Dry, Mark West and Maacama Creeks	2									
RR-CCC-3.1.3.5	Action Step	Habitat Complexity	Increase shelter rating on the following streams : tributaries of and including Dry Creek, Forsythe Creek, Willow Creek, Sheephouse Creek, Porter Creek, Dutch Bill Creek, Redwood Creek, Foote Creek, Kellogg Creek, Wine Creek and Yellowjacket Creek.	2									
RR-CCC-3.1.4	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)		5	CDFG, NOAA RC, Sonoma County, Sonoma County Water Agency	200.00					200	Estimate 10 structures in these reaches would add complexity at $20K per structure.
RR-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase the frequencies to 75% of the streams within the watershed	2	20							TBD	Cost should be accounted for in increase LWD frequency and primary pools.
RR-CCC-3.1.4.2	Action Step	Habitat Complexity	Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Green Valley, Atascadero, Jonive, Castellini and Sexton Creeks	2									
RR-CCC-3.1.4.3	Action Step	Habitat Complexity	Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Austin Creek.	2									
RR-CCC-3.1.4.4	Action Step	Habitat Complexity	Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Mark West, Dry and Maacama Creeks	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-3.2	**Objective**	**Habitat Complexity**	**Address other natural or manmade factors affecting the species' continued existence**										
RR-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve Habitat Complexity										
RR-CCC-3.2.1.1	Action Step	Habitat Complexity	Investigate the feasibility of beaver re-location and re-introductions to Sonoma (specifically Austin, Green Valley, lower Russian River independent populations and Salmon Creek) to promote channel complexity, improve baseflows and provide rearing habitat	2	5		10.00					10	Cost for beaver re-introduction estimated at $10,000/beaver family translocation.
RR-CCC-4.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
RR-CCC-4.1.1.1	Action Step	Hydrology	Develop rearing habitat curves to identify optimal base flow conditions	3	10	CDFG, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project. This cost may be accounted for in FLOODPLAIN CONNECTIVITY.
RR-CCC-4.1.1.2	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	3	60	Private Landowners, RCD						tbd	
RR-CCC-4.1.1.3	Action Step	Hydrology	Avoid and/or minimize the adverse effects of water diversion on coho salmon by establishing: a more natural hydrograph, by-pass flows, season of diversion, and off-stream storage	2	20	Private Consultants, Private Landowners, RCD, Sonoma County	125.00	125.00	125.00	125.00		500	
RR-CCC-4.1.2	Recovery Action	Hydrology	Improve flow conditions (instantaneous conditions)										
RR-CCC-4.1.2.1	Action Step	Hydrology	Reduce the rate of frost protection and domestic drawdown in the spring	2	10	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, Private Consultants, Private Landowners, RCD, SWRCB, UC Extension						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-4.1.2.2	Action Step	Hydrology	Assess and map water diversions (CDFG 2004).	2	20	California Coastal Conservancy, CDFG, NMFS, NOAA RC, Private Landowners, Sonoma County, Sonoma County Water Agency							Stream flow model should identify water diversions.
RR-CCC-4.2	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-4.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
RR-CCC-4.2.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows based on results of the NFWF efforts	2	20	CDFG, NFWF, NMFS HCD, Private Consultants, Private Landowners, RCD						In-Kind	
RR-CCC-4.2.1.2	Action Step	Hydrology	Support the water conservation training conducted by the Occidental Arts and Ecology Center Water Institute, Gold Ridge RCD, and Salmon Creek Watershed Council.	3	20	Gold Ridge RCD, Private Consultants, Private Landowners, Sonoma County						In-Kind	
RR-CCC-4.2.1.3	Action Step	Hydrology	Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	2	5	Sonoma County Water Agency, USACE						TBD	Changes in flow management may incur costs to diverters and water delivery systems, but costs are unknown.
RR-CCC-4.2.2	Recovery Action	Hydrology	Improve flow conditions (instantaneous conditions)										
RR-CCC-4.2.2.1	Action Step	Hydrology	Work with SWRCB and landowners to improve over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently impacted by water use.	2	10	RWQCB						TBD	Costs to adjudicate and enforce water allocations cannot be determined at this time.
RR-CCC-4.2.2.2	Action Step	Hydrology	Work with SWRCB and landowners to improve flow regimes for adult migration to spawning habitats and smolt outmigration.	2	10	Private Landowners, Sonoma County Water Agency						TBD	Costs to water users may be substantial, but cannot be determined.
RR-CCC-4.2.2.3	Action Step	Hydrology	Promote alternative frost protection strategies.	3	60	CDFG, Private Landowners, Sonoma County, SWRCB						In-Kind	These costs will likely be included as part of the ongoing 1600 agreement requirements per DFG.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-4.2.3	Recovery Action	Hydrology	Minimize redd scour										
RR-CCC-4.2.3.1	Action Step	Hydrology	Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries	2	10	California Conservations Corps, CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						TBD	Cost likely accounted for in other action steps.
RR-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-5.1.1	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										
RR-CCC-5.1.1.1	Action Step	Landscape Patterns	Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems	3									
RR-CCC-5.1.1.2	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	3									
RR-CCC-5.1.1.3	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	3									
RR-CCC-5.2	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-5.2.1	Recovery Action	Landscape Patterns	Improve sediment transport by implementing DS level actions	3		Private Landowners, RCD						240,000	Cost based on decommissioning 20 miles of riparian road at a rate of $12,000/mile
RR-CCC-5.2.2	Recovery Action	Landscape Patterns	Improve watershed hydrology by implementing DS level actions	3		Private Landowners, Public Works, RCD						420,000	Cost based on upgrading 20 miles of road network at a rate of $21,000/mile.
RR-CCC-5.2.3	Recovery Action	Landscape Patterns	Conserve hydrology by implementing DS level actions	3									
RR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
RR-CCC-6.1.1	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)			CDFG, County Planning, NMFS, NMFS HCD, RCD							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-6.1.1.1	Action Step	Passage	Improve passage in the mainstem and confluences of Austin Creek	2	20		7,225	7,225	7,225	7,225		28,900	Cost based on treating 16 impassable barriers on mainstem streams at a rate of $914,769/barrier and for treating 31 partial barriers at a rate of $457,382/barrier.
RR-CCC-6.1.1.2	Action Step	Passage	Continue restoration projects which employ improved gravel mining practices upstream of mile 1 on Austin Creek	2								TBD	Cost difficult to determine based on level of completion of restoration projects.
RR-CCC-6.1.2	Recovery Action	Passage	Modify or remove physical passage barriers			CalTrans, CDFG, NMFS, NMFS HCD, Private Consultants, Private Landowners, Public Works, RCD							
RR-CCC-6.1.2.1	Action Step	Passage	Identify high priority barriers and restore passage per NMFS' Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001a).	2	30							In-Kind	
RR-CCC-6.1.2.2	Action Step	Passage	Remove or modify the flashboard dam on lower Mill Creek near the confluence with Wallace Creek. This barrier is the highest priority barrier within the Russian River population for remediation.	1									Cost accounted for in above action step.
RR-CCC-6.1.2.3	Action Step	Passage	Investigate passage at multiple sites along Atascadero Creek and tributaries and implement improvements	2								TBD	Cost accounted for in above action step.
RR-CCC-6.1.2.4	Action Step	Passage	Improve passage at existing County culvert barriers on Pole Mountain Creek, Kid Creek and Kohute Gulch.	2								TBD	Cost accounted for in above action step.
RR-CCC-6.1.2.5	Action Step	Passage	Assess the old flashboard dam on Bear Pen Creek, and implement recommendations to improve passage.	2								TBD	Cost accounted for in above action step.
RR-CCC-6.1.2.6	Action Step	Passage	Assess the log jam/slide barrier on Gilliam and Schoolhouse Creeks and implement recommendations to improve passage	2								TBD	Cost difficult to determine at this time.
RR-CCC-6.1.2.7	Action Step	Passage	Improve passage at sites identified in Mill, Pena and Grape Creek. The falls on lower Mill Creek and on lower Felta Creek need to be evaluated for passage periodically and improved/maintained if necessary. (CDFG 2004).	2								TBD	Cost accounted for in above action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-6.1.2.8	Action Step	Passage	Investigate passage barriers on Dutcher Creek, Felta Creek (CDFG survey reach 2), Foss Creek, Mill Creek, Norton Creek, Pine Ridge Canyon Creek, Schoolhouse Creek, West Slough, and Wine Creek (CDFG stream survey reports). Pena Creek tributaries should also be investigated.	2								TBD	Cost accounted for in above action steps.
RR-CCC-6.1.2.9	Action Step	Passage	Several large barriers exist on Dutcher Creek. Fish passage specialists should investigate the cost/benefit of improving passage at these locations. If advantageous, the barriers should be addressed. (CDFG 2004).	3								TBD	
RR-CCC-6.1.2.10	Action Step	Passage	Log-jams in the Chapman Branch and Pena Creek need to be monitored/investigated for passage. Prior to removing logjams, consult with NMFS and CDFG fish passage specialists (CDFG 2004).	2								TBD	
RR-CCC-6.1.2.11	Action Step	Passage	Barriers on mainstem Russian River (memorial beach and Willow Water District Dam) should be assessed by a fish passage specialist and modified if needed.	2								TBD	Cost likely accounted for in above action steps.
RR-CCC-6.1.2.12	Action Step	Passage	Evaluate and implement passage opportunities in the Maacama Creek subwatershed and it's tributaries. Priority streams include: Redwood Creek, Foote Creek, Kellogg Creek and Yellowjacket Creek.	2									
RR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
RR-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter	2	10	CDFG, RCD, Sonoma County, Sonoma County Water Agency						TBD	Costs depend on assessment methods and extent and types of programs implemented.
RR-CCC-8.1.1.1	Action Step	Riparian	In the upper Austin Creek sub-basin reforestation to a conifer forest should be a long term strategy to return the area to fully functioning condition. Implementing this type of strategy will need to employ incentives and assistance to landowners	3	20	CDFG, NOAA RC, Private Landowners, RCD, Sonoma County, Sonoma County Water Agency	135.00	135.00	135.00	135.00		540	DFG estimated the cost of riparian planting at about $180 K per mile (2004), and assumption was that as much as 3 miles will require treatment. Implementation will take advantage of existing programs and will reduce costs somewhat.
RR-CCC-8.1.1.2	Action Step	Riparian	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream). Watersheds identified by CDFG include Porter, Foote, Grub, Franz, and Franchi.	2	10	CDFG, NMFS, NOAA RC, Private Landowners, RCD, Sonoma County, Sonoma County Water Agency, USACE	50.00	50.00				100	Cost based on 10K for 10 years.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-8.1.1.3	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate. High priority areas for consideration may include Austin Creek, and upper Briggs Creek and upper Bidwell Creek (Laurel Marcus and Associates 2004).	3	20		1,450	1,450	1,450	1,450		5,800	Cost based on treating 50 miles (assume 80 acres/mile in 15% High IP) at a rate of $1422/acre.
RR-CCC-8.1.1.4	Action Step	Riparian	In Willow Creek there is a limited supply of large diameter, riparian redwood and Douglas-fir in the watershed. Promote growth of conifers in the riparian zone for later in-channel recruitment.	3									
RR-CCC-8.1.2	Recovery Action	Riparian	Improve canopy cover		30	Mendocino County, Private Landowners, RCD, Sonoma County							
RR-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 40% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	3	20		6,825	6,825	6,825	6,825		27,300	Cost based on treating 17 miles (assume 80 acres/mile in 5% High IP) are a rate of $20,057/acre.
RR-CCC-8.1.2.2	Action Step	Riparian	Plant native riparian species and native conifers/hardwoods in the riparian zone within the Upper and Lower Gray Creek sub-basin to increase overall tree diameter	2									
RR-CCC-8.1.2.3	Action Step	Riparian	Plant native riparian species and native conifers/hardwoods throughout riparian zones within the eastern and southern portions of Green Valley Creek watershed to increase overall tree diameter	2									
RR-CCC-8.1.2.4	Action Step	Riparian	Mark West Tributaries, specifically Humbug, Porter, Horse Hill and Weeks Creeks are high priority creeks for riparian restoration	2									
RR-CCC-8.1.2.5	Action Step	Riparian	Work with landowners to evaluate any existing conservation easements that exist within the Maacama watershed. Changes in these easements to better protect riparian habitat should be investigated (Laurel Marcus and Associates 2004).	3									
RR-CCC-8.1.2.6	Action Step	Riparian	Focus riparian restoration within Santa Rosa, Matanzas, Brush/Rincon, Piner, Paulin, Windsor and Pool Creeks. Where appropriate, riparian surveys should be continued above CDFG survey section. Santa Rosa Creek work should focus on survey reach 1 and the channelized section. Matanzas Creek work would benefit from utilizing bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel (CDFG stream survey reports).	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-8.1.2.7	Action Step	Riparian	Increase canopy cover levels within the Dry Creek watershed. Priority streams include Fall Creek (reach 1), Felta Creek (reach 2,3), Foss Creek, Mill Creek, Norton Creek, Pechaco Creek (reach 1,2,3), Pena Creek, West Slough, Wine Creek (reach 1), and Woods Creek (reach 1,2,3) (CDFG stream survey reports).	2									
RR-CCC-8.1.2.8	Action Step	Riparian	Restore and protect riparian vegetation in Turtle Creek, Fife Creek, Porter Creek, Bluejay Creek, Fisher Creek, Grub Creek, and Corral Creek (CDFG stream survey reports).	2									
RR-CCC-8.2	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-8.2.1	Recovery Action	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	60	CDFG, Farm Bureau, Mendocino County, NMFS, NRCS, Private Landowners, RCD, Sonoma County						TBD	Cost is dependent on the specific conservation measures implemented.
RR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
RR-CCC-9.1.1.1	Action Step	Sediment	Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)	3									
RR-CCC-9.1.1.2	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004). High priority streams identified by CDFG habitat reports include Sheephouse Creek, Austin and East Austin Creeks, Pena Creek, Porter Creek, Kidd Creek, Sexton Creek, Gilliam Creek, Hobson Creek, Conshea Creek, Crane Creek, and Schoolhouse Creek (http://coastalwatersheds.ca.gov/).	2	15	CDFG, Private Landowners, RCD, Sonoma County, Sonoma County Water Agency, State Parks	280.00	280.00	280.00			840	Costs cannot be accurately determined due to an unknown extent and types of treatments required, however, road treatment or decommissioning in the Russian River has been estimated at approximately $7,027,012.00 (DFG 2004). Cost based on decommissioning 70 miles of riparian road network at a rate of $12,000/mile.
RR-CCC-9.1.1.3	Action Step	Sediment	In Purrington Creek several stream crossings exist in Reach 1. These crossings should be improved to eliminate active soil erosion and runoff.	2	10	CDFG, RCD, Sonoma County	335.00	335.00				670	Cost based on treating 3 crossings (assume bottomless/open bottom arch) at a rate of $223,051/crossing.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-9.1.1.4	Action Step	Sediment	Maintenance of ditches, culverts, and inboard cutbank slides should be improved to decrease the potential of sediment delivery to Dutchbill and Grub Creeks.	2	10	CDFG, Sonoma County	59.91	59.91				120	Costs cannot be accurately determined due to an unknown extent and type of treatment required, however, road treatment in the Russian River has been estimated at approximately $78,933,524.00 (DFG 2004). Costs associated with this action were estimated by multiplying the approximately 10 stream miles by the per mile cost ($11,982) provided in DFG 2004.
RR-CCC-9.1.1.5	Action Step	Sediment	In the East Austin Creek watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsloping roads, ditch relief culverts, and installing rolling dips.	2	10	CDFG, NOAA RC, Private Landowners, RCD, Sonoma County	59.91	59.91				120	Road treatment in the Russian River has been estimated at approximately $78,933,524.00 (DFG 2004). Costs associated with this action were estimated by multiplying the approximately 10 stream miles by the per mile cost ($11,982) provided in DFG 2004.
RR-CCC-9.1.1.6	Action Step	Sediment	Implement recommendations of completed sediment source surveys in Austin and East Austin Creek mainstems, Gray Creek, and Pole Mountain Creeks (See ROADS for specific actions)	2									
RR-CCC-9.1.1.7	Action Step	Sediment	Implement recommendations of completed sediment source surveys in Mark West, Dry Creek and Green Valley and Purrington Creeks (See ROADS for specific actions)	2								TBD	
RR-CCC-9.1.1.8	Action Step	Sediment	Conduct instream and upslope sediment source surveys in Atascadero, Mark West, and Maacama Creeks to identify existing sources of high sediment yield using accepted protocols and implement recommendations	2	10		1,600	1,600				3,200	Cost for fish/habitat restoration monitoring estimated at $111,192/project and for erosion assessment (assume 25% of total watershed acres) at a rate of $12.22/acre.
RR-CCC-9.1.1.9	Action Step	Sediment	Conduct sediment source surveys in Black Rock Creek, Kidd Creek and other tributaries to identify existing sources of high sediment yield using accepted protocols and implement recommendations	2									
RR-CCC-9.1.1.10	Action Step	Sediment	Initiate sediment assessments and landslide mapping in the Dry Creek watershed. High priority streams include Crane Creek, Felta Creek (reach 3,4), Grape Creek, Mill Creek, Palmer Creek, Pena Creek, Pine Ridge Canyon Creek, Wallace Creek, Wine Creek and Woods Creek (CDFG stream survey reports).	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-9.1.2	Recovery Action	Sediment	Improve and expand instream gravel quantity		30	California Coastal Conservancy, California Geological Survey, Mendocino County, NMFS, NOAA RC, Private Landowners, Public, RCD, Sonoma County, State Parks						TBD	Costs cannot be determined until appropriate assessments have been conducted. Costs may vary significantly depending on type of road related problems and whether roads are closed or decommissioned.
RR-CCC-9.1.2.1	Action Step	Sediment	Develop habitat enhancement projects to establish additional riffle habitat and import spawning gravel from mining operations in the Russian River basin to select reaches of Green Valley, Atascadero, Jonive, Castelini and Sexton Creeks	2									
RR-CCC-9.1.2.2	Action Step	Sediment	Debris jams are potentially trapping sediment and eroding adjacent banks within Schoolhouse Creek, Wine Creek, and Woods Creek. The jams should be analyzed for possible removal or modification (CDFG stream survey reports).	2									
RR-CCC-9.1.2.3	Action Step	Sediment	Spawning gravel is limited within Dutcher Creek (reach 1), Fall Creek, Felta Creek, Grape Creek, and Wine Creek (upper and lower reaches) (CDFG stream habitat reports). Implement actions to improve spawning gravel abundance and quality within these stream.	2	15							TBD	Cost difficult to determine because lack of information regarding extent and volume of spawning gravel needed. Spawning gravel supplementation estimated at $32/cubic yard.
RR-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
RR-CCC-10.1.1.1	Action Step	Viability	Continue the operation of the Captive Broodstock Program	1									
RR-CCC-10.1.1.2	Action Step	Viability	Improve and expand rearing capacity of the Coho Salmon Captive Broodstock facility.	1	30	CDFG, USACE						TBD	This action is partially funded through the USACE Biological Opinion.
RR-CCC-10.1.1.3	Action Step	Viability	Continue and expand the existing coho salmon life-cycle monitoring efforts.	3	25	CDFG, NMFS, Sonoma County Water Agency, USACE	1,325	1,325	1,325	1,325	1,325	6,625	The cost can vary depending on the number of stations within the watershed. Recent funding for the Freshwater Creek (Humboldt County) life-cycle monitoring station was $265,000 per season.
RR-CCC-10.1.1.4	Action Step	Viability	Minimize departure from the genetic profile that historically existed in the population.	1	5	NOAA SWFSC						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-10.1.1.5	Action Step	Viability	Use surplus broodstock to repopulate nearby watersheds (within diversity strata) where populations have extirpated.	1	30	CDFG, NMFS, Sonoma County Water Agency, USACE						TBD	Specific plan needed to estimate cost.
RR-CCC-10.1.1.6	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, Gold Ridge RCD, NMFS, Trout Unlimited							Existing operations
RR-CCC-10.1.1.7	Action Step	Viability	Implement recovery actions where indicators rated poor or fair in streams which are currently receiving broodstock as a priority .	2									
RR-CCC-10.1.1.8	Action Step	Viability	Monitor the effectiveness and maintenance of watershed restoration projects and augment inventories as needed (CDFG 2004).	3	20	CDFG, Gold Ridge RCD, NMFS							Cost accounted for in other action steps.
RR-CCC-10.1.1.9	Action Step	Viability	Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions	3	10	NMFS						TBD	
RR-CCC-10.1.1.10	Action Step	Viability	Conduct habitat surveys to monitor change in key habitat variables. Specific locations to be monitored will be determined through implementation of the Coastal Salmonid Monitoring Plan	3	10	CDFG, NMFS	91.00	91.00				182	Cost for habitat surveys estimated at $333/IP km.
RR-CCC-10.1.1.11	Action Step	Viability	Utilize the hatchery criteria and assessment guidance provided in Spence et al. 2008 when evaluating the risks and benefits of proposed and ongoing hatchery operations	3	30	CDFG, USACE						0	Action not expected to result in significant additional cost.
RR-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
RR-CCC-10.1.2.1	Action Step	Viability	Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery.	2	10	CDFG						TBD	
RR-CCC-10.1.2.2	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20	CDFG, Gold Ridge RCD, NMFS	320.00	320.00	320.00	320.00		1,280	Cost for annual spawner ground surveys estimated at $64,040/year.
RR-CCC-10.1.2.3	Action Step	Viability	Increase size at release to attain 160 mm at emigration, to enhance marine survival and increasing adult returns	2	30	USACE							
RR-CCC-10.1.2.4	Action Step	Viability	Establish a release imprinting station on Mill Creek and Green Valley Creeks, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	2		CDFG, Private Landowners, Trout Unlimited, UC Extension, USACE						TBD	Cost cannot be determined at this time. More specific methods in development will determine cost.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-10.1.2.5	Action Step	Viability	Increase coho salmon smolt production at the Russian River Coho Salmon Broodstock facility to a level where consistent returns can be incorporated reliably into the spawning matrix	2	30	CDFG, USACE						0	The action is already funded by the USACE as a result of the Russian River Biological Opinion.
RR-CCC-10.1.2.6	Action Step	Viability	Continue to utilize surplus fish in additional recovery opportunities (adult releases, releases to extirpated watersheds) and evaluate such actions in the context of recovering coho in the Russian River, extirpated watersheds, and the contribution to the diversity stratum	1	30	CDFG, NMFS						existing operations	
RR-CCC-10.1.2.7	Action Step	Viability	Utilize different marking method to identify program coho salmon from wild coho salmon to facilitate monitoring while reducing adult mortality. Transition away from adipose clipping broodstock program coho salmon to reduce by catch of adult coho salmon during the recreational steelhead season (only adipose clipped steelhead can be legally harvested and coho salmon can be confused for steelhead).	2									
RR-CCC-10.1.3	Recovery Action	Viability	Increase spatial structure and diversity										
RR-CCC-10.1.3.1	Action Step	Viability	Conduct outreach with landowners to expand broodstock releases within core, then remaining phase 1, then phase 2 streams within the watershed.	1	2	CDFG, NMFS						TBD	
RR-CCC-10.1.3.2	Action Step	Viability	Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock in Russian River, Walker and Salmon Creeks.	1	10	CDFG						tbd	
RR-CCC-10.1.3.3	Action Step	Viability	Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.	3	20	CDFG, Gold Ridge RCD, NMFS	300.00	300.00	300.00	300.00		1,200	Cost for smolt outmigration monitoring estimated at $58,404/year.
RR-CCC-10.1.3.4	Action Step	Viability	Evaluate the tailwater section of the upper Russian River below Lake Mendocino in it's capacity to serve as rearing habitat for juvenile and smolt coho salmon	2									
RR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
RR-CCC-11.1.1.1	Action Step	Water Quality	Increase the canopy by planting native species where shade canopy is not at acceptable levels within middle Salmon Creek, Nolan, and Coleman Valley Creeks.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-11.1.1.2	Action Step	Water Quality	Plant native vegetation to promote streamside shade: increase the canopy by planting native species where shade canopy is not at acceptable levels.	2	10	Mendocino County, Private Landowners, RCD, Sonoma County						TBD	
RR-CCC-11.1.1.3	Action Step	Water Quality	Improve riparian and instream conditions in rearing habitats by establishing riparian protection zones that extends from the outer edge of the channel out to the site potential of tree height to allow LWD recruitment.	2	60	Board of Forestry, CalFire, CDFG, Private Landowners						TBD	Costs depend on the size of the buffer area, the level of technical assistance provided and the types of projects proposed.
RR-CCC-11.1.1.4	Action Step	Water Quality	Develop site-specific recommendations, including incentives, to remedy high temperatures and implement (CDFG 2004) initially in core areas, following with phase 1 and 2 areas.		5	CDFG, NMFS, Private Landowners						TBD	Cannot estimate at this time.
RR-CCC-11.1.2	Recovery Action	Water Quality	Improve stream water quality conditions										
RR-CCC-11.1.2.1	Action Step	Water Quality	Install continuous water quality monitoring stations in lower Green Valley and Atascadero Creeks	1	5	NMFS, Private Landowners, RWQCB	10.00					10	Cost for continuous water quality monitoring stations estimated at $5,000/station. Cost does not account for maintenance or data management.
RR-CCC-11.1.2.2	Action Step	Water Quality	Work with livestock and ranch owners to implement BMP's to control sediment and nitrates	1		NRCS, Private Landowners, RCD							
RR-CCC-11.1.2.3	Action Step	Water Quality	Domestic garbage along Purrington Creek should be cleaned up and existing illegal dump sites along the road should be posted to reduce the possibility of toxic substances entering the creek. These dump sites appear to be routinely visited and periodic patrols by local law enforcement should be encouraged.	3	10	CDFG Law Enforcement, NMFS, NMFS OLE, Private Landowners, Sonoma County						TBD	cost is difficult to estimate at this time.
RR-CCC-11.1.2.4	Action Step	Water Quality	Assess the number of septic systems or other wastewater producers that deliver toxics to the lower mainstem Russian River and tributaries (such as Dutchbill Creek and others). Work with cities and Sonoma County to eliminate these sources of toxic input.	3	5	NMFS, Private Landowners, RWQCB, Sonoma County						TBD	cost is difficult to estimate.
RR-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent increased landscape disturbance										
RR-CCC-12.1.1.1	Action Step	Agricultural Practices	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to watercourses	3	60	Private Landowners, RCD, Sonoma County, USACE						In-Kind	Stringent review by permitting agencies is expected to reduce costs associated with poorly planned and poorly located developments.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-12.1.1.2	Action Step	Agricultural Practices	Develop legislation that will fund county planning for environmentally sound agricultural growth and water supply	3		Farm Bureau, NRCS, Sonoma County, UC Extension							
RR-CCC-12.1.2	Recovery Action	Agricultural Practices	Prevent adverse alterations to riparian species composition and structure										
RR-CCC-12.1.2.1	Action Step	Agricultural Practices	Enforce requirements of local regulations and riparian/setbacks	2		City Planning, Sonoma County							
RR-CCC-12.1.2.2	Action Step	Agricultural Practices	Coordinate with the agencies that authorize conversions to minimize conversions in key watersheds and discourage forestland conversions.	3	5	CalFire, CDFG, NMFS, RWQCB, Sonoma County, Sonoma County Water Agency, State Parks						In-Kind	Costs are expected to be minimal.
RR-CCC-12.1.2.3	Action Step	Agricultural Practices	Enforce existing building permit programs to minimize unpermitted construction.	3		Sonoma County							
RR-CCC-12.1.2.4	Action Step	Agricultural Practices	Encourage the purchase of land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities and corridors.	3		Land Trusts, Sonoma County							
RR-CCC-12.1.2.5	Action Step	Agricultural Practices	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	3		CDFG, City Planning, Farm Bureau, NMFS HCD, Sonoma County							
RR-CCC-12.1.2.6	Action Step	Agricultural Practices	Continue to educate and encourage the County of Mendocino to adopt a grading ordinance that meets NMFS, RWQCB, and CDFG approval.	3	5	CDFG, MCRRFCD, Mendocino County, Sonoma County, Sonoma County Water Agency, State Parks						In-Kind	Costs are expected to be minimal to work with the County of Mendocino. Cost to implement and carryout grading ordinance is likely high. Cost estimates should be determined from counties that have grading ordinance such as Sonoma and Napa.
RR-CCC-12.2	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
RR-CCC-12.2.1	Recovery Action	Agricultural Practices	Prevent increased landscape disturbance										
RR-CCC-12.2.1.1	Action Step	Agricultural Practices	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	10	CDFG, Farm Bureau, NMFS, Private Landowners, RCD						TBD	Cost is TBD since the vagaries of the plan are unknown at this time.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-12.2.1.2	Action Step	Agricultural Practices	Streamline permit processing where landowners are conducting actions aligned with recovery priorities.	3	5	CDFG, NMFS, NRCS, RCD, SWRCB, USACE						0	Streamlining permit processing is not expected to cost much, and may save money through future efficiencies.
RR-CCC-12.2.1.3	Action Step	Agricultural Practices	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with salmon recovery priorities.	3	10	CDFG, Farm Bureau, NMFS, NRCS, Private Landowners, RCD						0	Soliciting cooperation not expected to cost much outside of already existing federal and state and local salaries.
RR-CCC-12.2.2	Recovery Action	Agricultural Practices	Prevent adverse alterations to riparian species composition and structure										
RR-CCC-12.2.2.1	Action Step	Agricultural Practices	Improve water temperature conditions for migrating smolts and summer rearing juveniles throughout 35% of watershed by increasing the canopy by planting native species where shade canopy is not at acceptable levels .	2	20	CDFG, NMFS, NOAA RC, NRCS, Private Landowners, RCD							Cost accounted for in other action steps.
RR-CCC-13.1	**Objective**	**Channel Modification**	**Address inadequacies of regulatory mechanisms**										
RR-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity										
RR-CCC-13.1.1.1	Action Step	Channel Modification	All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.	3		NMFS PRD, Sonoma County, USACE							
RR-CCC-13.1.1.2	Action Step	Channel Modification	Channel modifying projects should be designed to ensure potential effects to salmonid habitat are fully minimized or mitigated, and where possible, existing poor conditions should be remediated.	3		NMFS PRD, USACE							
RR-CCC-13.1.1.3	Action Step	Channel Modification	Ensure that all future and existing channel designed for flood conveyance incorporate features that enhance salmonid migration under high and low flow conditions.	3		NMFS PRD, USACE							
RR-CCC-13.1.1.4	Action Step	Channel Modification	Modify city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, within the 100-year flood prone zones	3		City Planning, Sonoma County, USACE							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-13.1.1.5	Action Step	Channel Modification	Develop a mitigation policy that requires in-kind replacement of removed large woody debris at a 3:1 ratio.	3	10	CalTrans, Farm Bureau, FEMA, FishNet 4C, Gold Ridge RCD, NRCS, Private Consultants, Private Landowners, Public, Sonoma County						TBD	Costs may vary significantly depending on level of commitment from local government and private landowners. The majority of the costs would likely include local government and consultant staff time.
RR-CCC-13.1.1.6	Action Step	Channel Modification	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities.	3	10	CDFG, MCRRFCD, RWQCB, Sonoma County Water Agency, State Parks						0	Costs are expected to be minimal as some of these efforts will be part of existing programs, however some technical assistance may be necessary from a variety of agencies.
RR-CCC-13.2	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity										
RR-CCC-13.2.1.1	Action Step	Channel Modification	Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.	3	10	CalTrans, Farm Bureau, FEMA, FishNet 4C, Gold Ridge RCD, NRCS, Private Consultants, Private Landowners, Public, Sonoma County						TBD	Costs may vary significantly depending on level of commitment from local government and private landowners. The majority of the costs would likely include local government and consultant staff time.
RR-CCC-13.2.1.2	Action Step	Channel Modification	Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.	3		RCD, Sonoma County						TBD	Cost accounted for in FLODDPLAIN CONNECTIVITY.
RR-CCC-13.2.1.3	Action Step	Channel Modification	Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows, (see FLOODPLAIN for specific actions).	2		CDFG, NOAA RC, NRCS, Private Landowners, Sonoma County, USACE							
RR-CCC-13.2.1.4	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.	3		CDFG, NMFS PRD, USACE							
RR-CCC-13.2.1.5	Action Step	Channel Modification	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	3	60	USACE						TBD	Estimating cost is difficult at this time since the extent of work is unknown.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the overutilization for commercial, recreational, scientific or educational purposes**										
RR-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
RR-CCC-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFG to improve the Fishing Regulation manual to clearly identify differences in body morphology of all potentially present adult salmonids with color photos of diagnostic features (e.g., caudal fin spotting, caudal fin shape, coloration of lower jaw, peduncle width, etc.).	3	20	CDFG, Counties, FishNet 4C, NMFS, Private Landowners, Sonoma County Water Agency						In-Kind	
RR-CCC-16.1.1.2	Action Step	Fishing/Collecting	Install/construct permanent signs at major public fishing access points along the Russian River (below Dry Creek) that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	3	2	CalFire, CDFG, NMFS						In-Kind	Cost is currently being covered by Sonoma County Fish and Wildlife Commission and other agencies.
RR-CCC-16.2	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-16.2.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
RR-CCC-16.2.1.1	Action Step	Fishing/Collecting	Minimize interception of CCC coho salmon during the trout and steelhead freshwater sport fishing season.	2	60	CDFG, NMFS						TBD	Minimal cost to recreational fishery is expected.
RR-CCC-16.2.1.2	Action Step	Fishing/Collecting	NMFS and CDFG will work to improve the California Freshwater Sport Fishing Regulations to minimize interception of adult salmonids.	2	2	CDFG, NMFS PRD, Public						In-Kind	Cost expected to be minimal.
RR-CCC-16.2.1.3	Action Step	Fishing/Collecting	NMFS will work with CDFG to modify low flow restrictions under Article 4. Supplemental Regulations, Section 8.00 (a).	2	20	CDFG, Counties, FishNet 4C, NMFS, Private Landowners, Sonoma County Water Agency						TBD	Level of promotion that would be effective needs to be determined for accurate cost estimates.
RR-CCC-16.2.1.4	Action Step	Fishing/Collecting	NMFS and CDFG will work to improve the marking strategy of the coho captive broodstock recovery program to decrease confusion with allowable harvested hatchery steelhead.	2	1	CDFG, NMFS						TBD	Cost not determined.
RR-CCC-16.2.1.5	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	3	10	CDFG, FishNet 4C, NOAA RC, NRCS, Private Landowners, RCD						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-17.1	**Objective**	**Hatcheries**	**Address other natural or manmade factors affecting the species' continued existence**										
RR-CCC-17.1.1	Recovery Action	Hatcheries	Increase spatial structure and diversity										
RR-CCC-17.1.1.1	Action Step	Hatcheries	Continue the operation of the Captive Broodstock Program										
RR-CCC-17.1.1.2	Action Step	Hatcheries	Utilize the hatchery criteria and assessment guidance provided in Spence et al. 2008 when evaluating the risks and benefits of proposed and ongoing hatchery operations										
RR-CCC-17.1.1.3	Action Step	Hatcheries	Preserve the remaining genetic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce risk of extirpation.										
RR-CCC-17.1.1.4	Action Step	Hatcheries	Utilize resources to increase genetic variability in Captive Programs as well as for adult re-introduction efforts in barren Marin and Sonoma County streams (Walker and Salmon Creek Programs are models for others)										
RR-CCC-18.1	**Objective**	**Livestock**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-18.1.1	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
RR-CCC-18.1.1.1	Action Step	Livestock	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	2	60	RCD, RWQCB						TBD	
RR-CCC-18.2	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-18.2.1	Recovery Action	Livestock	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
RR-CCC-18.2.1.1	Action Step	Livestock	Encourage riparian restoration to regain riparian corridors damaged from livestock and other causes.	2	30	Farm Bureau, Gold Ridge RCD, NRCS, Private Landowners						TBD	
RR-CCC-18.2.1.2	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes	2	60	NRCS, RCD						TBD	
RR-CCC-18.2.1.3	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	3	60	NRCS, RCD						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-18.2.1.4	Action Step	Livestock	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	20	Farm Bureau, Gold Ridge RCD, NRCS, Private Landowners						TBD	
RR-CCC-18.2.2	Recovery Action	Livestock	Prevent impairment to stream hydrology (impaired water flow)										
RR-CCC-18.2.2.1	Action Step	Livestock	Aid landowners willing to fence off riparian areas with development of offstream alternative water sources	3	30	NRCS, RCD						TBD	
RR-CCC-18.2.2.2	Action Step	Livestock	Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.	3	30	Farm Bureau, Gold Ridge RCD, NRCS, Private Landowners						TBD	
RR-CCC-18.2.3	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
RR-CCC-18.2.3.1	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	3	60	NRCS, RCD						TBD	
RR-CCC-18.2.3.2	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	2	30	NRCS, RCD						TBD	
RR-CCC-18.2.3.3	Action Step	Livestock	Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.	3	60	NRCS, RCD						TBD	
RR-CCC-18.2.3.4	Action Step	Livestock	Manage rotational grazing to aid in the reduction of noxious weeds.	3	60	NRCS, RCD						TBD	
RR-CCC-18.2.3.5	Action Step	Livestock	Fence riparian areas within the Dry Creek watershed from grazing by using fencing standards that excludes cattle but allows other wildlife to access the stream. High priority stream reaches include Pechaco Creek (reach 1 and 2) and Pena Creek (reach 3) (CDFG stream survey reports).	2								TBD	
RR-CCC-18.2.3.6	Action Step	Livestock	Fence riparian areas within the Mark West watershed from grazing by using fencing standards that allow other wildlife to access the stream.	2								TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-18.2.3.7	Action Step	Livestock	Fence riparian areas within the Maacama Creek watershed from grazing by using fencing standards that allow other wildlife to access the stream. Combine fencing with appropriate riparian regeneration projects when possible. High priority streams include Bear, Ingall, McDonnell, Lower Briggs, Little Briggs, and Coon Creek (Laurel Marcus and Associates 2004).	2									
RR-CCC-18.2.3.8	Action Step	Livestock	Exclusion fencing and off-stream water development should be explored and implemented within the McDonnell Creek watershed to address livestock damage in riparian areas.	2									
RR-CCC-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-19.1.1	Recovery Action	Logging	Prevent future impacts to habitat complexity										
RR-CCC-19.1.1.1	Action Step	Logging	Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations	3	60	CDFG, NMFS, RCD, Sonoma County, State Parks						TBD	Impossible to anticipate where and how much land will come available for purchase in the future.
RR-CCC-19.1.1.2	Action Step	Logging	Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	3	60	Board of Forestry, NMFS, Private Landowners, Sonoma County, State Parks, US EPA						In-Kind	Recruitment of LWD to the stream is critical. This action is mainly a policy issue, with little or no direct costs.
RR-CCC-19.1.1.3	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	60	Board of Forestry, CDFG, NMFS, Sonoma County, State Parks, USEPA						TBD	Costs cannot be determined at this time, due to an unknown number of variables and research priorities.
RR-CCC-19.1.1.4	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	3	50	CalFire, CDFG, NMFS						In-Kind	Cost is minimal because NMFS/DFG already participate in meetings the Board of Forestry.
RR-CCC-19.1.1.5	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within high value habitat areas	3	10	NMFS						In-Kind	
RR-CCC-19.2	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
RR-CCC-19.2.1	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-19.2.1.1	Action Step	Logging	Develop a Transportation Plan and adequately upgrade necessary roads, and relocate and/or decommission riparian or unnecessary roads (see ROADS for specific actions/areas)	3	5							TBD	
RR-CCC-19.2.1.2	Action Step	Logging	Develop a Road Sediment Reduction Plan that prioritizes problem sites and outlines implementation and a timeline of necessary actions.	3	5	Board of Forestry, CalFire, CDFG, Private Landowners, RCD						TBD	
RR-CCC-19.2.1.3	Action Step	Logging	Utilize BMP's to properly construct roads for stormproofing and Avoid the construction of roads in the riparian zone	3									
RR-CCC-20.1	**Objective**	**Mining**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
RR-CCC-20.1.1	Recovery Action	Mining	Prevent impairment to instream habitat complexity (altered pool complexity and/or pool riffle ratio)										
RR-CCC-20.1.1.1	Action Step	Mining	Utilize NMFS guidelines and geomorphic considerations in developing sustainable mining practices which create and promote habitat development and maintenance	2		CDFG, County Planning, NMFS HCD, Private Consultants, Private Landowners						TBD	
RR-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
RR-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Modify Federal, State, local processes, and County General Plans, to eliminate provisions allowing new construction in undeveloped areas within the 100-year flood prone zone	3	60	California Geological Survey, CalTrans, City of Healdsburg, City of Santa Rosa, City of Ukiah, Mendocino County, NMFS, Private Landowners, Public, Sonoma County						TBD	Effective and consistent implementation of these policies are anticipated to have little cost. Modification of policies may be controversial and costs may be high.
RR-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.	3	60	City Planning, Mendocino County, Sonoma County						In-Kind	This action encourages implementation of many existing policies.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	10	Sonoma County						TBD	This action is basically a policy issue, however additional authorities may be developed to implement the action fully.
RR-CCC-22.1.1.4	Action Step	Residential/Commercial Development	As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	3	25	RWQCB, Sonoma County, Sonoma County Water Agency						TBD	Costs depend on extents and type of mitigation and/or detention proposed, and cannot be determined at this time.
RR-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality										
RR-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Implement performance standards in Stormwater Management Plans.	3	30	RWQCB, Sonoma County						In-Kind	
RR-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Disperse discharge from commercial and residential areas into a spatially distributed network rather than a few point discharges.	3		City Planning, Public Works, Water Agencies						TBD	
RR-CCC-22.1.2.3	Action Step	Residential/Commercial Development	Improve water quality where necessary by addressing residential and commercial pollutant sources.	3	10	Private Landowners, Public Works, RCD, RWQCB						tbd	
RR-CCC-22.1.2.4	Action Step	Residential/Commercial Development	Implement performance standards in Stormwater Management Plans.	3	30	CalTrans, City of Healdsburg, City of Santa Rosa, City of Ukiah, Mendocino County, RWQCB, Sonoma County						TBD	
RR-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
RR-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	3		City Planning, Sonoma County							
RR-CCC-22.1.3.2	Action Step	Residential/Commercial Development	Enforce requirements of local regulations and riparian/setbacks	2		City Planning, Sonoma County							
RR-CCC-22.1.3.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	3		Board of Forestry, CalFire, CDFG, City Planning, Sonoma County							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-22.1.3.4	Action Step	Residential/Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating steelhead.	3		Sonoma County, Sonoma County Water Agency							
RR-CCC-22.1.3.5	Action Step	Residential/Commercial Development	Address failing septic systems in rural areas	3	10	City Planning, County Planning, RWQCB						tbd	
RR-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
RR-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
RR-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Utilize native plants when landscaping and discourage the use of exotic invasives	3		Private Landowners, UC Extension						In-Kind	This recommendation should be considered standard practice.
RR-CCC-22.2.1.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	3		Private Landowners, Sonoma County							
RR-CCC-22.2.1.3	Action Step	Residential/Commercial Development	Explore the use of conservation easements to provide incentives for private landowners to preserve riparian corridors	3		CDFG, Land Trusts, Private Consultants, Private Landowners						TBD	
RR-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
RR-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Encourage the use and provide incentives for rooftop water storage and other conservation devices	2		Private Consultants, Private Landowners, Sonoma County							
RR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
RR-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	10	CalTrans						TBD	Costs associated with assessment and redesign cannot be determined at this time, however some assessment has already been conducted.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-23.1.1.2	Action Step	Roads/Railroads	In the Russian River watershed, implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources. Upgrade and decommission sites and road networks where appropriate. These actions include outsloping roads, ditch relief culverts, and installing rolling dips.	2		Private Consultants, Private Landowners, Public Works, RCD, State Parks						TBD	Cost accounted for in SEDIMENT.
RR-CCC-23.1.1.3	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	2		Private Landowners, Public Works							
RR-CCC-23.1.1.4	Action Step	Roads/Railroads	Implement DS level recommendations	3									
RR-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
RR-CCC-23.1.2.1	Action Step	Roads/Railroads	Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3		Private Landowners, Public Works							
RR-CCC-23.1.2.2	Action Step	Roads/Railroads	Reduce riparian road densities by 10 percent over the next 10 years, prioritizing high risk areas in Core CCC coho salmon watersheds.	3	60	CalFire, City of Healdsburg, City of Santa Rosa, City of Ukiah, Mendocino County, Private Landowners, Sonoma County, State Parks							Cost accounted for in SEDIMENT.
RR-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										
RR-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
RR-CCC-23.2.1.1	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	3	25	Mendocino County, Sonoma County						In-Kind	Costs associated with policy development are expected to be minimal.
RR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
RR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
RR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Work with CDFG, County of Sonoma, State Parks, municipalities, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.	3	20	Cities, Sonoma County, State Parks						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).	3	60	Bodega Land Trust, CalFire, Farm Bureau, FEMA, FishNet 4C, Gold Ridge RCD, NRCS, Private Landowners, RWQCB						TBD	Costs will vary significantly depending on site specific conditions and landowner willingness to have roads addressed.
RR-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	3	10	CDFG, Cities, FEMA, Gold Ridge RCD, NMFS, Sonoma County, USACE						In-Kind	Outreach and education are ongoing, and additional costs are expected to be minimal.
RR-CCC-24.2	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
RR-CCC-24.2.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
RR-CCC-24.2.1.1	Action Step	Severe Weather Patterns	Minimize water use and seek alternatives during droughts.	2	20	Cities, Private Landowners, Sonoma County						TBD	
RR-CCC-24.2.1.2	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	3	20	Gold Ridge RCD, Private Landowners, Sonoma County						TBD	
RR-CCC-24.2.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	3	10	CDFG, MCRRFCD, RWQCB, Sonoma County Water Agency, State Parks						In-Kind	Costs are expected to be minimal as some of these efforts will be part of existing programs, however some technical assistance may be necessary from a variety of agencies.
RR-CCC-24.2.2	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
RR-CCC-24.2.2.1	Action Step	Severe Weather Patterns	Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas (See WATER QUALITY for specific actions/areas	2		CDFG, NOAA RC, Private Landowners, RCD							
RR-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
RR-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Promote the use of reclaimed water for agricultural or other uses.	3	10	Gold Ridge RCD, Private Landowners, RWQCB, Sonoma County, Sonoma County Water Agency						TBD	
RR-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Promote water conservation by the public, water agencies, agriculture, private industry, and the citizenry.	3									
RR-CCC-25.1.1.3	Action Step	Water Diversion/Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	20	CDFG, MCRRFCD, Mendocino County, Private Landowners, RCD, RWQCB, Sonoma County, Sonoma County Water Agency						TBD	Costs are minimal to promote. Costs for implementation will depend on the number of participants.
RR-CCC-25.1.1.4	Action Step	Water Diversion/Impoundment	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	3	10	CDFG, MCRRFCD, RWQCB, Sonoma County Water Agency						In-Kind	Costs are expected to be minimal as some of these efforts will be part of existing programs, however some technical assistance may be necessary from a variety of agencies.
RR-CCC-25.1.1.5	Action Step	Water Diversion/Impoundment	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	3	60	CDFG, MCRRFCD, RCD, Sonoma County Water Agency, State Parks						In-Kind	Costs associated with promoting use of reclaimed water is expected to be minimal.
RR-CCC-25.1.1.6	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	30	MCRRFCD, NMFS, RCD, RWQCB, Sonoma County Water Agency						In-Kind	Costs to promote this action are expected to be minimal.
RR-CCC-25.1.1.7	Action Step	Water Diversion/Impoundment	Promote the use of reclaimed water for agricultural or other uses.	3	60	CDFG, MCRRFCD, RCD, Sonoma County Water Agency, State Parks						In-Kind	Costs associated with promoting use of reclaimed water is expected to be minimal.
RR-CCC-25.1.1.8	Action Step	Water Diversion/Impoundment	Promote water conservation best practices such as drip irrigation for vineyards.	3	20	CDFG, Farm Bureau, MCRRFCD, NRCS, Sonoma County Water Agency						In-Kind	Promoting water conservation best practices is not expected to result in additional costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
RR-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to estuary		10	CDFG, NMFS HCD, SWRCB						TBD	
RR-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Identify upstream pollution sources which contribute to poor water quality conditions in the estuary	2		County Planning, SWRCB, Water Agencies						TBD	
RR-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										
RR-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2									

Salmon Creek

Location	•Sonoma County
Watershed Area	•35.0 Square Miles
Potential Habitat	•35.9 Stream Miles
Vegetation	•42% Coniferous or Montane Forest, 42% Grassland
Erodability	•Low to Moderate
Ownership Patterns	•99% Private
Dominant Land Uses	•Ranching
Housing Density	•Low
TMDL Pollutants	•None

Salmon Creek
Photo by Michael Fawcett

Salmon Creek Coho Salmon: Nearly Extirpated

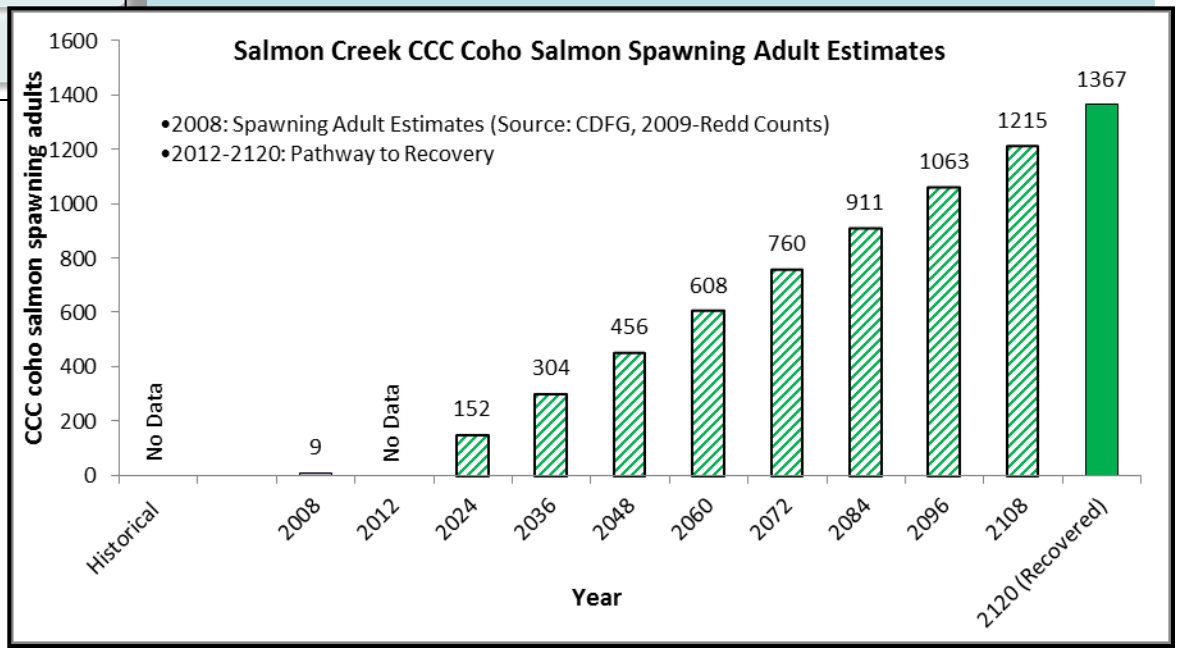
Recovery Goals

- ✓ Continue the operation of the Captive Broodstock Program in Salmon Creek
- ✓ Conduct monitoring to track population response to recovery action implementation

Salmon Creek Adult Spawner Targets

Downlisting to Threatened
684

Recovery
1,367



STEELHEAD: YES
CHINOOK SALMON: NO

Salmon Creek

Potential Habitat: 35.9 miles
Recovery Target: 1,367 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	FAIR	GOOD	POOR	FAIR	FAIR	FAIR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Establish a more natural hydrograph, by-pass flows, seasons of diversion, and off stream storage
- Develop cooperative projects with private landowners to conserve summer flows
- Use surplus broodstock to repopulate remaining extirpated streams within the watershed
- Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats for purposes of broodstock in Salmon Creek

Priority 2 & 3: Long-Term Restoration Actions

- Implement the Salmon Creek Enhancement Plan by regaining as much of the historical capacity and area of the Salmon Creek Estuary as possible
- Restore estuarine wetlands and sloughs
- Avoid new development within riparian zones and the 100 year floodprone zones
- Investigate the feasibility of beaver re-location and re-introductions to promote channel complexity, improve baseflows and provide rearing habitat
- Support the water conservation training conducted by the Occidental Arts and Ecology Center Water Institute, Gold Ridge RCD, and Salmon Creek Watershed Council.

Gold Ridge RCD

Recovery Partners

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, Eli Asarian and Morgan Bond, SWFSC

Salmon Creek

Potential Habitat: 35.9 miles
Recovery Target: 1,367 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	MEDIUM	MEDIUM	LOW	LOW	LOW	HIGH	HIGH	N/A	N/A	HIGH	HIGH	HIGH	HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Encourage riparian restoration to regain riparian corridors damaged from livestock and other causes
- Promote off-channel storage to reduce impacts of water diversion
- Minimize water use and seek alternatives during droughts

Priority 2 & 3: Long-Term Threat Abatement Actions

- Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.
- Aid landowners willing to fence off riparian areas with development of offstream alternative water sources
- Develop and enforce riparian setbacks/buffers
- Identify and remediate upstream pollution sources which contribute to poor water quality conditions in the estuary
- Implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment sources.

Michael Fawcett and Jennifer Michaud monitoring Salmon Creek *Photo by Dan Logan, NMFS*

Conservation Highlights

- Salmon Creek was selected as a location for conservation hatchery out planting of coho salmon progeny.

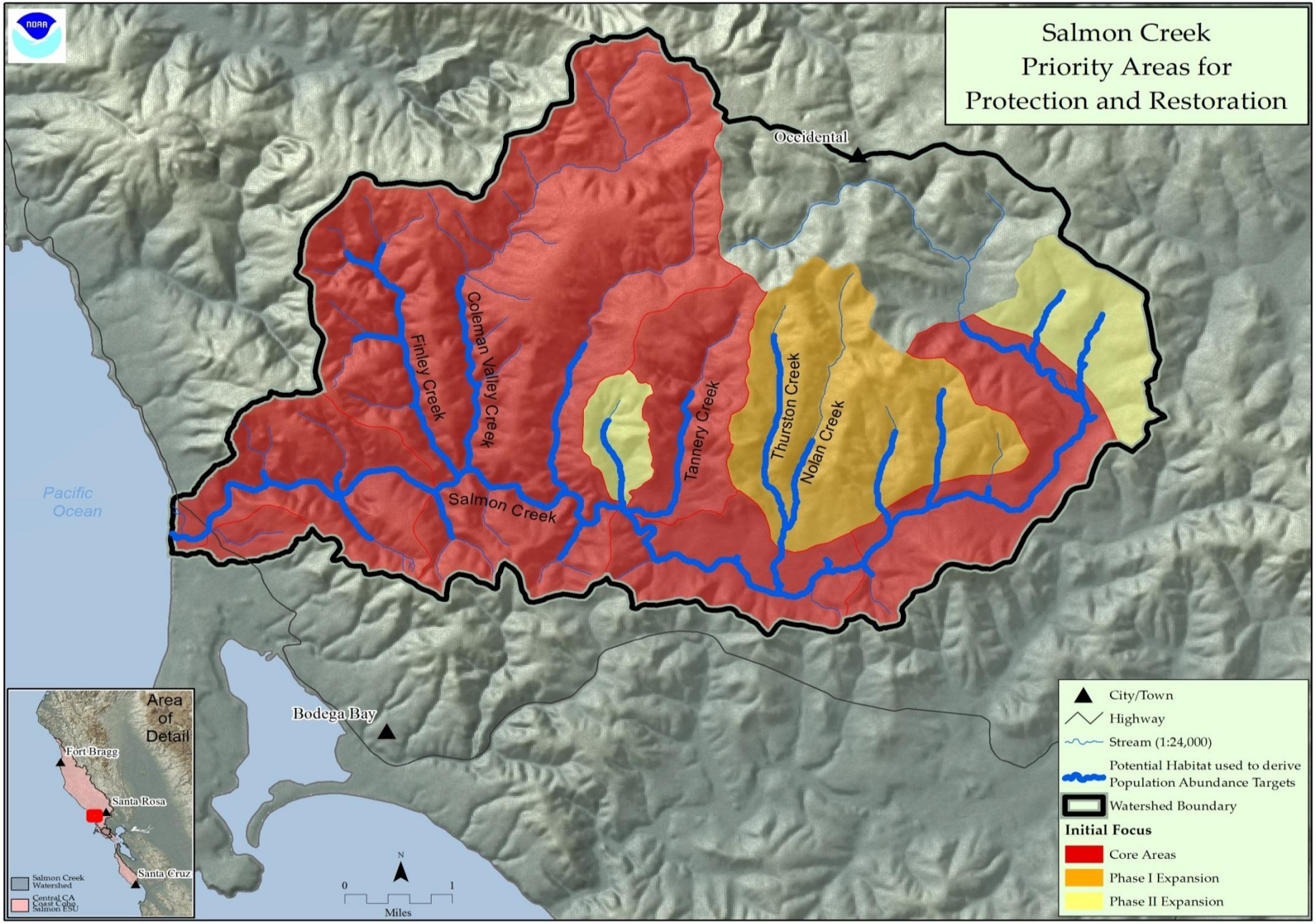


Figure 1: Map of Salmon Creek

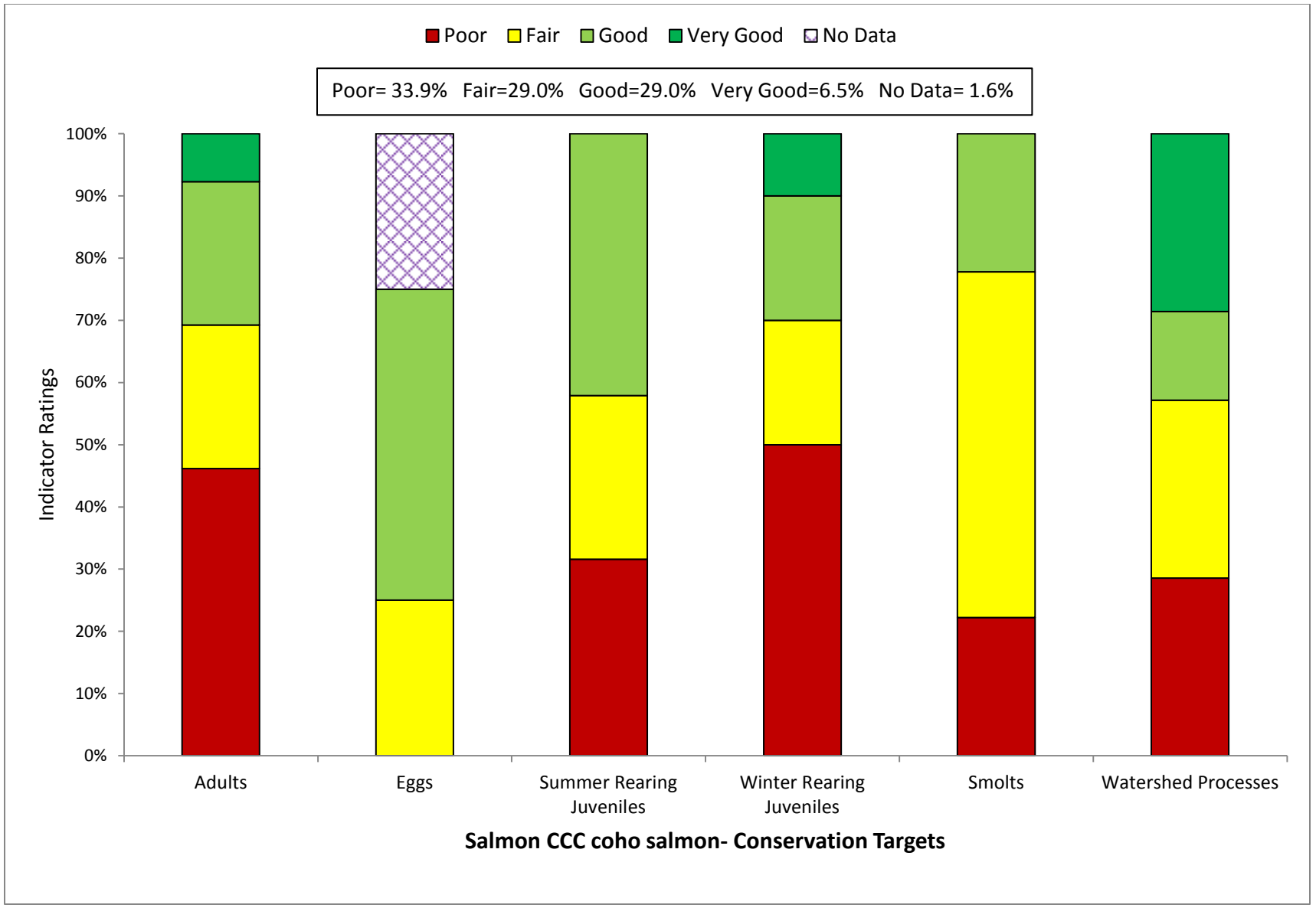


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Salmon Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**0.06 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**14% streams; 59% IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**30% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**na**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risck Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**ND**	0	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**71% streams; 88% IP-km (>50% stream average scores of 1 & 2)**	Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.06 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**86% IP-km; streams 91% IP-km (>49% of pools are primary pools)**	Good	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**14% streams; 59% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =67**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.41 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**50% to 74% of streams/ IP-km (>85% average stream canopy)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**30% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**na**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**71% streams; 88% IP-km (>50% stream average scores of 1 & 2)**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50-74% IP-km (>6 and <14 C)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75 to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.06 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**14% streams; 59% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**30% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**na**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**71% streams; 88% IP-km (>50% stream average scores of 1 & 2)**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.41 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**Risk Factor Score =58**	Fair	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**50-74% IP-km (>6 and <14 C)**	Fair	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.248% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**2.75% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**25-15% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**23% of watershed >1 unit/20 acres**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**25-50% Historical Species Composition**	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**2.9 Miles/Square Mile**	Fair	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.0 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Salmon Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Medium	High	Low	Low	Medium	Medium
2	Channel Modification	Medium	Medium	Medium	Medium	Medium	Medium	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	Low	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Medium	Low	Low	Low	Low
5	Fishing and Collecting	Medium	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	Medium	-	-	-	-	-	Low
7	Livestock Farming and Ranching	Medium	Medium	High	Medium	Medium	Medium	High
8	Logging and Wood Harvesting	Medium	Low	High	Medium	Low	High	High
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	-	-	-	-	-	-	-
11	Residential and Commercial Development	Medium	Low	Very High	High	Medium	High	High
12	Roads and Railroads	Medium	High	Medium	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Low	High	Low	Medium	High	High
14	Water Diversion and Impoundments	Medium	Low	Very High	Low	Medium	Medium	High
Threat Status for Targets and Project		High	Medium	Very High	Medium	Medium	High	Very High

Central CA Coast Coho Salmon ~ Salmon Creek

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

1.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.1.1. **Recovery Action:** Improve the quality and extent of freshwater lagoon habitat (see WQ parameters)

1.1.1.1. **Action Step:** Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen) and the practice of artificial breaching

1.1.1.2. **Action Step:** Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements

1.1.1.3. **Action Step:** Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary

1.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

1.2.1. **Recovery Action:** Increase the physical extent of estuarine habitat

1.2.1.1. **Action Step:** Implement the SCC Salmon Creek Enhancement Plan by regaining as much of the historical capacity and area of the Salmon Creek Estuary as possible.

1.2.1.2. **Action Step:** Restore estuarine wetlands and sloughs, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.

1.2.1.3. **Action Step:** Assess the need to dredge Salmon Creek Estuary to increase capacity of estuarine habitat.

1.2.2. **Recovery Action:** Improve freshwater inflow

1.2.2.1. **Action Step:** Restore estuary function by increasing in-stream flow in Salmon Creek and tributaries that will provide greater freshwater input into the estuary.

1.2.2.2. **Action Step:** Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary

1.2.3. **Recovery Action:** Improve the quality of each estuarine habitat zone

1.2.3.1. **Action Step:** Restore estuary function by reducing fine sediment input from the upper watershed.

1.2.3.2. **Action Step:** Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).

1.2.3.3. **Action Step:** Monitor the habitat use of various life stages of coho salmon in the Salmon Creek estuary and associated wetlands.

1.2.4. **Recovery Action:** Increase and enhance habitat complexity features

1.2.4.1. **Action Step:** Restore estuary function in Salmon Creek Estuary by improving complex habitat features and restoring historical flooding patterns where possible.

1.2.4.2. **Action Step:** Develop Estuary Enhancement Projects to improve rearing habitat for juveniles and smolts (e.g. habitat features such as LWD, vegetative cover, deeper habitat, etc.)

1.2.4.3. **Action Step:** Monitor the effectiveness of LWD structures and other restoration projects in the estuary

1.2.5. **Recovery Action:** Increase the rate of lagoon formation and/or freshwater conversion

1.2.5.1. **Action Step:** Evaluate alterations to river mouth dynamics and implement changes to restore natural function

2. Restoration- Floodplain Connectivity

2.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.1.1. **Recovery Action:** Increase and enhance velocity refuge

2.1.1.1. **Action Step:** Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

2.1.1.2. **Action Step:** Avoid new development within riparian zones and the 100 year floodprone zones.

2.1.1.3. **Action Step:** Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.

2.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

2.2.1. **Recovery Action:** Increase and enhance velocity refuge

2.2.1.1. **Action Step:** Identify areas where floodplain connectivity can be re-established in low gradient response reaches

2.2.1.2. **Action Step:** Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).

2.2.1.3. **Action Step:** Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats in lower Salmon Creek.

2.2.1.4. **Action Step:** Support landowners and the Gold Ridge RCD in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

3.1.1. **Recovery Action:** Improve shelter rating

3.1.1.1. **Action Step:** Promote growth of larger diameter trees where appropriate.

3.1.1.2. **Action Step:** Protect existing riparian areas to maintain LWD supply and canopy.

3.1.1.3. **Action Step:** Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.2.1. **Recovery Action:** Increase frequency of primary or staging pools.

3.2.1.1. **Action Step:** Increase pool frequency across 60% of watershed to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Nolan, Tannery, Fay, and Thurston Creeks

3.2.1.2. **Action Step:** Where feasible, design and engineer pool enhancement structures to increase the number of pools (Gold Ridge Resource Conservation District and Prunuske Chatham, Inc., 2007; CDFG 2004).

3.2.2. **Recovery Action:** Increase large wood frequency (BFW 0-10 meters)

3.2.2.1. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Fay, Tannery, Finley, and Thurston Creeks

3.2.2.2. **Action Step:** Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in Salmon Creek

3.2.3. **Recovery Action:** Improve shelter rating

3.2.3.1. **Action Step:** Increase shelter ratings in 75% of watershed to optimal conditions (>80 pool shelter value) in select reaches of Fay, Tannery, Finley, Thurston and Salmon Creeks

3.2.4. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.2.4.1. **Action Step:** Increase riffle frequency in 50% of watershed to achieve optimal conditions (20% riffles) by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Coleman Valley, Fay and Finley Creeks

3.3. **Objective:** Address other natural or manmade factors affecting the species' continued existence

3.3.1. **Recovery Action:** Improve habitat complexity

3.3.1.1. **Action Step:** Investigate the feasibility of beaver re-location and re-introductions to promote channel complexity, improve baseflows and provide rearing habitat

4. Restoration- Hydrology

4.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Develop rearing habitat curves to identify optimal base flow conditions

4.1.1.2. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

4.1.1.3. **Action Step:** Avoid and/or minimize the adverse effects of water diversion on coho salmon by establishing: a more natural hydrograph, by-pass flows, season of diversion, and off-stream storage (BM-HU-04 in CDFG 2004).

4.1.2. **Recovery Action:** Improve flow conditions (instantaneous conditions)

4.1.2.1. **Action Step:** Reduce the rate of frost protection and domestic drawdown in the spring

4.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

4.2.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.2.1.1. **Action Step:** Develop cooperative projects with private landowners to conserve summer flows

4.2.1.2. **Action Step:** Support the water conservation training conducted by the Occidental Arts and Ecology Center Water Institute, Gold Ridge RCD, and Salmon Creek Watershed Council.

4.2.2. **Recovery Action:** Minimize redd scour

4.2.2.1. **Action Step:** Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

5.1.1. **Recovery Action:** Prevent increased landscape disturbance

5.1.1.1. **Action Step:** Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems

5.1.1.2. **Action Step:** Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas

5.1.1.3. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

5.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.2.1. **Recovery Action:** Conserve water resources

5.2.1.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources

5.2.1.2. **Action Step:** Livestock and Ranch Managers should utilize Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California (MRCD, 2007), and Management Tips to Enhance Land & Water Quality for Small Acreage Properties (Sotoyome Resource Conservation District 2007a), and The Grazing Handbook (Sotoyome Resource Conservation District 2007b)

5.2.1.3. **Action Step:** Agricultural users should utilize BMP's in Vineyard Frost Protection: A guide for Northern Coastal California (Sotoyome Resource Conservation District 2011)

5.2.2. **Recovery Action:** Improve sediment transport within the watershed

5.2.2.1. **Action Step:** Decommission and or re-locate riparian roads upslope to achieve desirable riparian road density criteria (<0.1 to 0.4 Miles/Square Mile)

5.2.2.2. **Action Step:** Upgrade roads (and skid trails on forestlands) to reduce surface and ditch erosion into adjacent watercourses, eliminate or upgrade ditch relief culverts, and upgrade stream crossing culverts to improve spawning gravel transport (CDFG 2004).

5.2.3. **Recovery Action:** Prevent increased landscape disturbance

5.2.3.1. **Action Step:** Implement DS level actions

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).

8.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.2.1. **Recovery Action:** Increase tree diameter within 25% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.2.1.1. **Action Step:** Plant native riparian species and native conifers/hardwoods in the riparian zone within the southern portion of the watershed (Salmon Creek mainstem) to increase overall tree diameter

8.2.1.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.

8.2.1.3. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).

8.2.2. **Recovery Action:** Improve canopy cover in 25% of streams within the watershed

8.2.2.1. **Action Step:** Increase the average stream canopy to a minimum of 80% within select reaches of Salmon, Nolan and Coleman Valley Creeks.

8.2.2.2. **Action Step:** Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).

8.2.2.3. **Action Step:** Encourage the cultivation and availability of locally indigenous riparian plants for use in restoration and bank stabilization (CDFG 2004)

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Continue to implement erosion control projects that were assessed and inventoried in sediment assessment plans (CDFG 2004).

9.1.1.2. **Action Step:** Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.

9.1.1.3. **Action Step:** Address sources from slides and gullies that deliver sediment and runoff to stream channels.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Continue the operation of the Captive Broodstock Program in Salmon Creek.

10.1.1.2. **Action Step:** Minimize departure from the genetic profile that historically existed in the population.

10.1.1.3. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.1.4. **Action Step:** Implement recovery actions where indicators rated poor or fair in high potential value areas.

10.1.1.5. **Action Step:** Monitor the effectiveness and maintenance of watershed restoration projects and augment inventories as needed (CDFG 2004).

10.1.1.6. **Action Step:** Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions

10.1.1.7. **Action Step:** Conduct habitat surveys to monitor change in key habitat variables. Specific locations to be monitored will be determined through implementation of the Coastal Salmonid Monitoring Plan

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Fund monitoring actions in Salmon Creek to evaluate success of adult reintroductions towards salmon recovery.

10.1.2.2. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.1.3. **Recovery Action:** Increase spatial structure and diversity

10.1.3.1. **Action Step:** Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed.

10.1.3.2. **Action Step:** Use surplus broodstock to repopulate remaining extirpated streams within the watershed.

10.1.3.3. **Action Step:** Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock in Russian River, Walker and Salmon Creeks.

10.1.3.4. **Action Step:** Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Increase the canopy by planting native species where shade canopy is not at acceptable levels within middle Salmon Creek, Nolan, and Coleman Valley Creeks.

11.1.2. **Recovery Action:** Improve stream water quality conditions

11.1.2.1. **Action Step:** Install continuous water quality monitoring stations in lower Salmon Creek

11.1.2.2. **Action Step:** Work with livestock and ranch owners to implement BMP's to control sediment and nitrates

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

11.1.3.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

11.1.3.3. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

THREAT ABATEMENT ACTIONS

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

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11.1.3.3. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

12.1.1. **Recovery Action:** Prevent increased landscape disturbance

12.1.1.1. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

12.1.1.2. **Action Step:** Streamline permit processing where landowners are conducting actions aligned with recovery priorities.

12.1.1.3. **Action Step:** Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with salmon recovery priorities.

12.1.2. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

12.1.2.1. **Action Step:** Improve water temperature conditions for migrating smolts and summer rearing juvenile salmonids throughout 35% of watershed by increasing the canopy by planting native species where shade canopy is not at acceptable levels within middle Salmon Creek, Nolan, and Coleman Valley Creeks.

12.1.2.2. **Action Step:** Monitor instream water temperatures to determine baseline conditions and judge the efficacy of restoration actions. High priority streams include tributary and mainstem reaches within Salmon and Walker Creeks (CDFG stream survey reports).

13. Threat- Channel Modification

13.1. **Objective:** Address inadequacies of regulatory mechanisms

13.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity

13.1.1.1. **Action Step:** All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.

13.1.1.2. **Action Step:** Channel modifying projects should be designed to ensure potential effects to salmonid habitat are fully minimized or mitigated, and where possible, existing poor conditions should be remediated.

13.1.1.3. **Action Step:** Ensure that all future and existing channel designed for flood conveyance incorporate features that enhance salmonid migration under high and low flow conditions.

13.1.1.4. **Action Step:** Modify city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones

13.1.1.5. **Action Step:** Develop a mitigation policy that requires in-kind replacement of removed large woody debris at a 3:1 ratio.

13.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity

13.2.1.1. **Action Step:** Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.

13.2.1.2. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.

13.2.1.3. **Action Step:** Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows, (see FLOODPLAIN for specific actions).

13.2.1.4. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

18.1.1. **Recovery Action:** Establish conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.

18.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

18.2.1.1. **Action Step:** Encourage riparian restoration to regain riparian corridors damaged from livestock and other causes.

18.2.1.2. **Action Step:** To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes

18.2.1.3. **Action Step:** Where necessary, establish predetermined stream crossings when herding cattle between pastures.

18.2.1.4. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

18.2.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

18.2.2.1. **Action Step:** Aid landowners willing to fence off riparian areas with development of offstream alternative water sources

18.2.2.2. **Action Step:** Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.

18.2.3. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.2.3.1. **Action Step:** Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.

18.2.3.2. **Action Step:** Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.

18.2.3.3. **Action Step:** Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.

18.2.3.4. **Action Step:** Manage rotational grazing to aid in the reduction of noxious weeds.

19. Threat- Logging

19.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.1.1. **Recovery Action:** Prevent future impacts to habitat complexity

19.1.1.1. **Action Step:** Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations

19.1.1.2. **Action Step:** Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels

19.1.1.3. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.1.4. **Action Step:** Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).

19.1.1.5. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within high value habitat areas

19.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.2.1.1. **Action Step:** Develop a Transportation Plan and adequately upgrade necessary roads, and relocate and/or decommission riparian or unnecessary roads (see ROADS for specific actions/areas)

19.2.1.2. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes problem sites and outlines implementation and a timeline of necessary actions.

19.2.1.3. **Action Step:** Utilize BMP's to properly construct roads for stormproofing and Avoid the construction of roads in the riparian zone

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.1.1. **Recovery Action:** Prevent impairment to water quality

22.1.1.1. **Action Step:** Implement performance standards in Stormwater Management Plans.

22.1.1.2. **Action Step:** Disperse discharge from commercial and residential areas into a spatially distributed network rather than a few point discharges.

22.1.1.3. **Action Step:** Improve water quality where necessary by addressing residential and commercial pollutant sources.

22.1.2. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.1.2.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

22.1.2.2. **Action Step:** Enforce requirements of local regulations and riparian/setbacks

22.1.2.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.1.2.4. **Action Step:** Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating coho salmon.

22.1.2.5. **Action Step:** Address failing septic systems in rural areas

22.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.2.1.1. **Action Step:** Utilize native plants when landscaping and discourage the use of exotic invasives

22.2.1.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

22.2.1.3. **Action Step:** Explore the use of conservation easements to provide incentives for private landowners to preserve riparian corridors

22.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.2.1. **Action Step:** Encourage the use and provide incentives for rooftop water storage and other conservation devices

23. Threat- Roads/Railroads

23.1. **Objective:** Address the inadequacy of existing regulatory mechanism

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.1.1.2. **Action Step:** Implement DS level recommendations

23.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.2.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.2.1.2. **Action Step:** Assess roads in Nolan and Thurston Creeks to identify high priority and high sediment yield sources.

23.2.1.3. **Action Step:** Implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources.

23.2.1.4. **Action Step:** Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.2.1.5. **Action Step:** Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.2.1.6. **Action Step:** Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Work with CDFG, County of Sonoma, State Parks, municipalities, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.

24.1.1.2. **Action Step:** Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).

24.1.1.3. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

24.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.2.1. **Recovery Action:** Prevent impairment to hydrology

24.2.1.1. **Action Step:** Minimize water use and seek alternatives during droughts.

24.2.1.2. **Action Step:** Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.

24.2.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.2.2.1. **Action Step:** Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas (See WATER QUALITY for specific actions/areas

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).

25.1.1.2. **Action Step:** Promote the use of reclaimed water for agricultural or other uses.

25.1.1.3. **Action Step:** Promote water conservation by the public, water agencies, agriculture, private industry, and the citizenry.

25.1.2. **Recovery Action:** Prevent impairment to estuary

25.1.2.1. **Action Step:** Identify upstream pollution sources which contribute to poor water quality conditions in the estuary

25.1.3. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.3.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Table ~ Salmon Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-1.1	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat (see WQ parameters)										
SC-CCC-1.1.1.1	Action Step	Estuary	Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen) and the practice of artificial breaching	2	12	CDFG, NMFS, Sonoma County Water Agency, USACE	250.00	250.00	100.00			600	
SC-CCC-1.1.1.2	Action Step	Estuary	Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements	3	10	CA Coastal Commission, California Coastal Conservancy, CDFG						TBD	Costs associated with removal of structures will depend on the number and type of structures identified and cannot be accurately determined at this time.
SC-CCC-1.1.1.3	Action Step	Estuary	Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary	3	5	CDFG, RWQCB, Sonoma County, USACE							
SC-CCC-1.2	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SC-CCC-1.2.1	Recovery Action	Estuary	Increase the physical extent of estuarine habitat										
SC-CCC-1.2.1.1	Action Step	Estuary	Implement the SCC Salmon Creek Enhancement Plan by regaining as much of the historical capacity and area of the Salmon Creek Estuary as possible.	2	30	California Coastal Conservancy, CDFG, FishNet 4C, NMFS HCD, Private Landowners, RWQCB, Sonoma County, State Parks, USFWS						TBD	Costs and duration are dependent on the specific mechanisms chosen to accomplish the task.
SC-CCC-1.2.1.2	Action Step	Estuary	Restore estuarine wetlands and sloughs, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.	2	10	CA Coastal Commission, California Coastal Conservancy, CDFG, Private Landowners	415.00	415.00				830	Cost based on treating 5% of 61 acres of estuarine habitat at a rate of $272,120/acre for riparian planting and ELJ.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-1.2.1.3	Action Step	Estuary	Assess the need to dredge Salmon Creek Estuary to increase capacity of estuarine habitat.	2	10	California Coastal Conservancy, CDFG, NMFS HCD, USACE						TBD	Cost is difficult to ascertain at this time.
SC-CCC-1.2.2	Recovery Action	Estuary	Improve freshwater inflow										
SC-CCC-1.2.2.1	Action Step	Estuary	Restore estuary function by increasing in-stream flow in Salmon Creek and tributaries that will provide greater freshwater input into the estuary.	2	30	CDFG, Gold Ridge RCD, NMFS, Private Landowners						TBD	Increasing flow within Salmon Creek will likely entail purchasing water rights upstream. The cost of purchasing water rights is unknown at this time.
SC-CCC-1.2.2.2	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	2		California Coastal Conservancy, RWQCB, Sonoma County, Sonoma County Water Agency, SWRCB						TBD	
SC-CCC-1.2.3	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
SC-CCC-1.2.3.1	Action Step	Estuary	Restore estuary function by reducing fine sediment input from the upper watershed.	2	30	CDFG, Gold Ridge RCD, NMFS, Private Landowners, Sonoma County Water Agency						TBD	
SC-CCC-1.2.3.2	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).	2	60	Gold Ridge RCD, Sonoma County						TBD	Costs related to increase physical extent of estuary habitat.
SC-CCC-1.2.3.3	Action Step	Estuary	Monitor the habitat use of various life stages of coho salmon in the Salmon Creek estuary and associated wetlands.	2	30	CDFG, Gold Ridge RCD, NMFS						TBD	
SC-CCC-1.2.4	Recovery Action	Estuary	Increase and enhance habitat complexity features										
SC-CCC-1.2.4.1	Action Step	Estuary	Restore estuary function in Salmon Creek Estuary by improving complex habitat features and restoring historical flooding patterns where possible.	2	30	California Coastal Conservancy, CDFG, NMFS HCD, NOAA RC, Sonoma County, USACE, USFWS							Cost related to increasing physical extent of estuary habitat.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-1.2.4.2	Action Step	Estuary	Develop Estuary Enhancement Projects to improve rearing habitat for juveniles and smolts (e.g. habitat features such as LWD, vegetative cover, deeper habitat, etc.)	2	15	California Coastal Conservancy, CDFG, County Planning, NOAA RC, Private Consultants, Private Landowners, RCD, Sonoma County Water Agency							Cost related to increasing physical extent of estuary habitat.
SC-CCC-1.2.4.3	Action Step	Estuary	Monitor the effectiveness of LWD structures and other restoration projects in the estuary	2	30	CDFG, Gold Ridge RCD						TBD	
SC-CCC-1.2.5	Recovery Action	Estuary	Increase the rate of lagoon formation and/or freshwater conversion										
SC-CCC-1.2.5.1	Action Step	Estuary	Evaluate alterations to river mouth dynamics and implement changes to restore natural function	2	10	California Coastal Conservancy, CDFG, NMFS, Sonoma County, Sonoma County Water Agency, State Parks, USACE						TBD	Cost likely related to above action steps.
SC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
SC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	2	5	CDFG, Gold Ridge RCD, NOAA RC						tbd	
SC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Avoid new development within riparian zones and the 100 year floodprone zones.	2	30	CDFG, NMFS, Sonoma County						TBD	
SC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Encourage willing landowners to restore historical floodplains or offchannel habitats through conservation easements, etc.	3	10	County Planning, Land Trusts, Private Landowners, RCD						TBD	
SC-CCC-2.2	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
SC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches	2	10	Farm Bureau, NMFS HCD, Public Works, RCD	103.50	103.50				207	Cost for wetland monitoring estimated at $206,493/project.
SC-CCC-2.2.1.2	Action Step	Floodplain Connectivity	Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).	2	10	Private Consultants, Private Landowners, Sonoma County	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project.
SC-CCC-2.2.1.3	Action Step	Floodplain Connectivity	Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats in lower Salmon Creek.	2	10	California Coastal Conservancy, MMWD, NMFS HCD, RCD	90.00	90.00				180	Cost based on treating 5 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
SC-CCC-2.2.1.4	Action Step	Floodplain Connectivity	Support landowners and the Gold Ridge RCD in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).	3	60	Gold Ridge RCD, Private Landowners						tbd	
SC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve shelter rating										
SC-CCC-3.1.1.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	20	CDFG, MMWD, NMFS						In-Kind	Cost of initial dialog is expected to be minimal.
SC-CCC-3.1.1.2	Action Step	Habitat Complexity	Protect existing riparian areas to maintain LWD supply and canopy.	2	20	CDFG, Gold Ridge RCD						In-Kind	
SC-CCC-3.1.1.3	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	2	60	Gold Ridge RCD, Private Consultants, Private Landowners, Sonoma County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-3.2	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SC-CCC-3.2.1	Recovery Action	Habitat Complexity	Increase frequency of primary or staging pools.										
SC-CCC-3.2.1.1	Action Step	Habitat Complexity	Increase pool frequency across 60% of watershed to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in select reaches of Nolan, Tannery, Fay, and Thurston Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited	112.50	112.50				225	Cost based on treating 9 miles of stream at a rate of $25,000/mile for placement of LWD. If ELJ used for increasing pool frequency, cost would be $2,730,000 averaging 3 ELJ/mile.
SC-CCC-3.2.1.2	Action Step	Habitat Complexity	Where feasible, design and engineer pool enhancement structures to increase the number of pools (Gold Ridge Resource Conservation District and Prunuske Chatham, Inc., 2007; CDFG 2004).	2	60	CDFG, Gold Ridge RCD, NOAA RC						TBD	Cost accounted for to increase pool frequency across 60% in watershed.
SC-CCC-3.2.2	Recovery Action	Habitat Complexity	Increase large wood frequency (BFW 0-10 meters)										
SC-CCC-3.2.2.1	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in select reaches of Fay, Tannery, Finley, and Thurston Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited							Cost related to increase frequency of primary or staging pool habitat.
SC-CCC-3.2.2.2	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in Salmon Creek	2	5	CDFG, NOAA RC, Private Consultants, Private Landowners	275.00					275	Cost based on treating 11 miles at a rate of $25,000/mile.
SC-CCC-3.2.3	Recovery Action	Habitat Complexity	Improve shelter rating										
SC-CCC-3.2.3.1	Action Step	Habitat Complexity	Increase shelter ratings in 75% of watershed to optimal conditions (>80 pool shelter value) in select reaches of Fay, Tannery, Finley, Thurston and Salmon Creeks	2	10	CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited							Cost related to increase pool frequency and LWD placement activities.
SC-CCC-3.2.4	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-3.2.4.1	Action Step	Habitat Complexity	Increase riffle frequency in 50% of watershed to achieve optimal conditions (20% riffles) by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Coleman Valley, Fay and Finley Creeks	2	5	CDFG, NOAA RC, Private Consultants, Private Landowners	150.00					150	Cost based on treating 6 miles of stream at a rate of $25,000/mile
SC-CCC-3.3	**Objective**	**Habitat Complexity**	**Address other natural or manmade factors affecting the species' continued existence**										
SC-CCC-3.3.1	Recovery Action	Habitat Complexity	Improve habitat complexity										
SC-CCC-3.3.1.1	Action Step	Habitat Complexity	Investigate the feasibility of beaver re-location and re-introductions to promote channel complexity, improve baseflows and provide rearing habitat	2	10		5.00	5.00				10	Cost for beaver re-introduction estimated at $10,000/beaver family translocation.
SC-CCC-4.1	**Objective**	**Hydrology**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
SC-CCC-4.1.1.1	Action Step	Hydrology	Develop rearing habitat curves to identify optimal base flow conditions	2	20	CDFG, SWRCB						TBD	Cost accounted for in stream flow model.
SC-CCC-4.1.1.2	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	60	Gold Ridge RCD, Private Landowners						In-Kind	
SC-CCC-4.1.1.3	Action Step	Hydrology	Avoid and/or minimize the adverse effects of water diversion on coho salmon by establishing: a more natural hydrograph, by-pass flows, season of diversion, and off-stream storage (BM-HU-04 in CDFG 2004).	1	20	Gold Ridge RCD, Private Consultants, Private Landowners, Sonoma County							Stream flow model should identify flow levels necessary to maintain suitable habitat conditions for coho salmon.
SC-CCC-4.1.2	Recovery Action	Hydrology	Improve flow conditions (instantaneous conditions)										
SC-CCC-4.1.2.1	Action Step	Hydrology	Reduce the rate of frost protection and domestic drawdown in the spring	2	5	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, Private Consultants, Private Landowners, RCD, SWRCB, UC Extension						TBD	Cost difficult to determine based on willingness of landowners.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-4.2	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-4.2.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
SC-CCC-4.2.1.1	Action Step	Hydrology	Develop cooperative projects with private landowners to conserve summer flows	1	5	CDFG, NFWF, NMFS HCD, Private Consultants, Private Landowners, RCD						TBD	
SC-CCC-4.2.1.2	Action Step	Hydrology	Support the water conservation training conducted by the Occidental Arts and Ecology Center Water Institute, Gold Ridge RCD, and Salmon Creek Watershed Council.	2	20	Gold Ridge RCD, Private Consultants, Private Landowners, Sonoma County						In-Kind	
SC-CCC-4.2.2	Recovery Action	Hydrology	Minimize redd scour										
SC-CCC-4.2.2.1	Action Step	Hydrology	Develop floodplain enhancement and LWD projects in modified and incised channel areas of major tributaries	2	10	California Conservations Corps, CDFG, NOAA RC, Private Consultants, Private Landowners, Trout Unlimited						TBD	Cost accounted for in other action steps.
SC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-5.1.1	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										
SC-CCC-5.1.1.1	Action Step	Landscape Patterns	Utilize BMP's which prevent fracturing of landscapes and interruption of natural function in forested watersheds, riparian corridors, and stream systems	3	100							In-Kind	
SC-CCC-5.1.1.2	Action Step	Landscape Patterns	Avoid new development, or road construction within floodplains, riparian areas, unstable soils or other sensitive areas	3	100							In-Kind	
SC-CCC-5.1.1.3	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	3	100							In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-5.2	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-5.2.1	Recovery Action	Landscape Patterns	Conserve water resources										
SC-CCC-5.2.1.1	Action Step	Landscape Patterns	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	3	60	CDFG, City Planning, County Planning, MMWD, Private Consultants, Private Landowners, Public Works, SWRCB						In-Kind	
SC-CCC-5.2.1.2	Action Step	Landscape Patterns	Livestock and Ranch Managers should utilize Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California (MRCD, 2007), and Management Tips to Enhance Land & Water Quality for Small Acreage Properties (Sotoyome Resource Conservation District 2007a), and The Grazing Handbook (Sotoyome Resource Conservation District 2007b)	3	60	Farm Bureau, Private Consultants, Private Landowners, RCD						In-Kind	
SC-CCC-5.2.1.3	Action Step	Landscape Patterns	Agricultural users should utilize BMP's in Vineyard Frost Protection: A guide for Northern Coastal California (Sotoyome Resource Conservation District 2011)	3	60	CDFG, Farm Bureau, NRCS, Private Consultants, Private Landowners, SWRCB						In-Kind	
SC-CCC-5.2.2	Recovery Action	Landscape Patterns	Improve sediment transport within the watershed										
SC-CCC-5.2.2.1	Action Step	Landscape Patterns	Decommission and or re-locate riparian roads upslope to achieve desirable riparian road density criteria (<0.1 to 0.4 Miles/Square Mile)	2	10	Private Landowners, RCD	120.00	120.00				240	Cost based on decommissioning 20 miles of riparian road at a rate of $12,000/mile
SC-CCC-5.2.2.2	Action Step	Landscape Patterns	Upgrade roads (and skid trails on forestlands) to reduce surface and ditch erosion into adjacent watercourses, eliminate or upgrade ditch relief culverts, and upgrade stream crossing culverts to improve spawning gravel transport (CDFG 2004).	2	10	Private Landowners, Public Works, RCD	210.00	210.00				420	Cost based on upgrading 20 miles of road network at a rate of $21,000/mile.
SC-CCC-5.2.3	Recovery Action	Landscape Patterns	Prevent increased landscape disturbance										
SC-CCC-5.2.3.1	Action Step	Landscape Patterns	Implement DS level actions	3									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-8.1	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
SC-CCC-8.1.1.1	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	2	20	CDFG, Gold Ridge RCD, NMFS, NRCS, Private Consultants, Private Landowners, USFWS						TBD	Cost difficult to determine because of landowner participation and feasibility to implement conservation measures.
SC-CCC-8.2	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-8.2.1	Recovery Action	Riparian	Increase tree diameter within 25% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)										
SC-CCC-8.2.1.1	Action Step	Riparian	Plant native riparian species and native conifers/hardwoods in the riparian zone within the southern portion of the watershed (Salmon Creek mainstem) to increase overall tree diameter	2	20	CDFG, NOAA RC, Private Consultants, Private Landowners, RCD	402.50	402.50	402.50	402.50		1,610	Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre..
SC-CCC-8.2.1.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate throughout the watershed.	2	20	Board of Forestry, Private Consultants, Private Landowners	85.50	85.50	85.50	85.50		342	Cost based on treating 3 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,422/acre.
SC-CCC-8.2.1.3	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).	2	50	City Planning, Land Trusts, Sonoma County						In-Kind	
SC-CCC-8.2.2	Recovery Action	Riparian	Improve canopy cover in 25% of streams within the watershed										
SC-CCC-8.2.2.1	Action Step	Riparian	Increase the average stream canopy to a minimum of 80% within select reaches of Salmon, Nolan and Coleman Valley Creeks.	2	5	CDFG, NOAA RC, Private Landowners, RCD						TBD	Cost related to increase tree diameter in 25% of watershed in southern portion of Salmon Creek.
SC-CCC-8.2.2.2	Action Step	Riparian	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (CDFG 2004).	3	5	Gold Ridge RCD, Private Consultants, Private Landowners	72.00					72	Cost for riparian monitoring estimated at $71,436/project. Cost for enhancing riparian habitat accounted for in above action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-8.2.2.3	Action Step	Riparian	Encourage the cultivation and availability of locally indigenous riparian plants for use in restoration and bank stabilization (CDFG 2004)	2	60	CDFG, Gold Ridge RCD, NRCS, Private Consultants, Private Landowners						In-Kind	
SC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										
SC-CCC-9.1.1.1	Action Step	Sediment	Continue to implement erosion control projects that were assessed and inventoried in sediment assessment plans (CDFG 2004).	2	60	Gold Ridge RCD, Private Consultants, Private Landowners, Sonoma County						TBD	
SC-CCC-9.1.1.2	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	2	60	Gold Ridge RCD, NRCS, Private Consultants, Private Landowners, Sonoma County						TBD	
SC-CCC-9.1.1.3	Action Step	Sediment	Address sources from slides and gullies that deliver sediment and runoff to stream channels.	2	10	Gold Ridge RCD, NRCS, Private Consultants, Private Landowners, Sonoma County	34.00	34.00				68	Cost for erosion assessment (assume 25% of total watershed acres) estimated at $12/acre.
SC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
SC-CCC-10.1.1.1	Action Step	Viability	Continue the operation of the Captive Broodstock Program in Salmon Creek.	1								TBD	Estimating cost for continued operation of the Captive Broodstock Program is difficult to determine at this time. Cost estimate for hatchery production estimated at $387/fish. To make an estimate of cost for this action step, current and future production levels need to be identified.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-10.1.1.2	Action Step	Viability	Minimize departure from the genetic profile that historically existed in the population.	1	5	NOAA SWFSC						TBD	
SC-CCC-10.1.1.3	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, Gold Ridge RCD, NMFS, Trout Unlimited						In-Kind	Existing operations
SC-CCC-10.1.1.4	Action Step	Viability	Implement recovery actions where indicators rated poor or fair in high potential value areas.										
SC-CCC-10.1.1.5	Action Step	Viability	Monitor the effectiveness and maintenance of watershed restoration projects and augment inventories as needed (CDFG 2004).	2	20	CDFG, Gold Ridge RCD, NMFS	28.00	28.00	28.00	28.00		112	Cost for fish/habitat effectiveness monitoring estimated at $111,192/project.
SC-CCC-10.1.1.6	Action Step	Viability	Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions	3	10	NMFS						TBD	
SC-CCC-10.1.1.7	Action Step	Viability	Conduct habitat surveys to monitor change in key habitat variables. Specific locations to be monitored will be determined through implementation of the Coastal Salmonid Monitoring Plan	2		CDFG, NMFS						22,000	Cost for habitat surveys estimated at $333/IP km.
SC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
SC-CCC-10.1.2.1	Action Step	Viability	Fund monitoring actions in Salmon Creek to evaluate success of adult reintroductions towards salmon recovery.	2	20	CDFG	32.00	32.00	32.00	32.00		128	Cost for annual adult spawner ground surveys estimated at $64,040/year for Central Coast diversity stratum.
SC-CCC-10.1.2.2	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	2	20	CDFG, Gold Ridge RCD, NMFS							
SC-CCC-10.1.3	Recovery Action	Viability	Increase spatial structure and diversity										
SC-CCC-10.1.3.1	Action Step	Viability	Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed.	2	2	Gold Ridge RCD						In-Kind	
SC-CCC-10.1.3.2	Action Step	Viability	Use surplus broodstock to repopulate remaining extirpated streams within the watershed.	1	10	CDFG, NMFS						TBD	
SC-CCC-10.1.3.3	Action Step	Viability	Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock in Russian River, Walker and Salmon Creeks.	1	10	CDFG						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-10.1.3.4	Action Step	Viability	Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.	2	20	CDFG, Gold Ridge RCD, NMFS	50.00	50.00	50.00	50.00		200	Cost for smolt outmigrant trapping estimated at $50,030/year.
SC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
SC-CCC-11.1.1.1	Action Step	Water Quality	Increase the canopy by planting native species where shade canopy is not at acceptable levels within middle Salmon Creek, Nolan, and Coleman Valley Creeks.	2									Cost accounted for in other action steps.
SC-CCC-11.1.2	Recovery Action	Water Quality	Improve stream water quality conditions										
SC-CCC-11.1.2.1	Action Step	Water Quality	Install continuous water quality monitoring stations in lower Salmon Creek	3	5	NMFS, Private Landowners, RWQCB	15.00					15	Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume minimum of 3. Cost does not account for maintenance or data management.
SC-CCC-11.1.2.2	Action Step	Water Quality	Work with livestock and ranch owners to implement BMP's to control sediment and nitrates	3	30	NRCS, Private Landowners, RCD						In-Kind	
SC-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.
SC-CCC-11.1.3.1	Action Step	Water Quality	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100							TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-11.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10							In-Kind	
SC-CCC-11.1.3.3	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	3							In-Kind	
SC-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
SC-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent increased landscape disturbance										
SC-CCC-12.1.1.1	Action Step	Agricultural Practices	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	2	10	CDFG, Farm Bureau, NMFS, Private Landowners, RCD						TBD	Cost is TBD since the vagaries of the plan are unknown at this time.
SC-CCC-12.1.1.2	Action Step	Agricultural Practices	Streamline permit processing where landowners are conducting actions aligned with recovery priorities.	3	5	CDFG, NMFS, NRCS, RCD, SWRCB, USACE						In-Kind	Streamlining permit processing is not expected to cost much, and may save money through future efficiencies.
SC-CCC-12.1.1.3	Action Step	Agricultural Practices	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage increased involvement and support existing landowners who conduct operations in a manner compatible with salmon recovery priorities.	3	10	CDFG, Farm Bureau, NMFS, NRCS, Private Landowners, RCD						In-Kind	Soliciting cooperation not expected to cost much outside of already existing federal and state and local salaries.
SC-CCC-12.1.2	Recovery Action	Agricultural Practices	Prevent adverse alterations to riparian species composition and structure										
SC-CCC-12.1.2.1	Action Step	Agricultural Practices	Improve water temperature conditions for migrating smolts and summer rearing juvenile salmonids throughout 35% of watershed by increasing the canopy by planting native species where shade canopy is not at acceptable levels within middle Salmon Creek, Nolan, and Coleman Valley Creeks.	2	20	CDFG, NMFS, NOAA RC, NRCS, Private Landowners, RCD	2,025	2,025	2,025	2,025		8,100	Cost based on treating 5 miles of stream (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-12.1.2.2	Action Step	Agricultural Practices	Monitor instream water temperatures to determine baseline conditions and judge the efficacy of restoration actions. High priority streams include tributary and mainstem reaches within Salmon and Walker Creeks (CDFG stream survey reports).	2	5	CDFG, NMFS, NRCS, Private Landowners, RCD	5.00					5	Cost for stream temperature gauges estimated at $500/gauge. Assume a minimum of 10. Cost does not account for maintenance or data management.
SC-CCC-13.1	**Objective**	**Channel Modification**	**Address inadequacies of regulatory mechanisms**										
SC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity										
SC-CCC-13.1.1.1	Action Step	Channel Modification	All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.	2	30	NMFS PRD, Sonoma County, USACE						In-Kind	
SC-CCC-13.1.1.2	Action Step	Channel Modification	Channel modifying projects should be designed to ensure potential effects to salmonid habitat are fully minimized or mitigated, and where possible, existing poor conditions should be remediated.	2	50	NMFS PRD, USACE						In-Kind	
SC-CCC-13.1.1.3	Action Step	Channel Modification	Ensure that all future and existing channel designed for flood conveyance incorporate features that enhance salmonid migration under high and low flow conditions.	3	60	NMFS PRD, USACE						In-Kind	
SC-CCC-13.1.1.4	Action Step	Channel Modification	Modify city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones	3	50	City Planning, Sonoma County, USACE						In-Kind	
SC-CCC-13.1.1.5	Action Step	Channel Modification	Develop a mitigation policy that requires in-kind replacement of removed large woody debris at a 3:1 ratio.	3	10	CalTrans, Farm Bureau, FEMA, FishNet 4C, Gold Ridge RCD, NRCS, Private Consultants, Private Landowners, Public, Sonoma County						TBD	Costs may vary significantly depending on level of commitment from local government and private landowners. The majority of the costs would likely include local government and consultant staff time.
SC-CCC-13.2	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-13.2.1.1	Action Step	Channel Modification	Where feasible, remove obsolete bank stabilization structures from the channel which contribute to channel incision and reduced habitat complexity.	2	10	CalTrans, Farm Bureau, FEMA, FishNet 4C, Gold Ridge RCD, NRCS, Private Consultants, Private Landowners, Public, Sonoma County						TBD	Costs may vary significantly depending on level of commitment from local government and private landowners. The majority of the costs would likely include local government and consultant staff time.
SC-CCC-13.2.1.2	Action Step	Channel Modification	Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.	3		RCD, Sonoma County						TBD	Cost accounted for in other action steps.
SC-CCC-13.2.1.3	Action Step	Channel Modification	Conduct rehabilitation activities that restore channels, floodplains and meadows to extend the duration of the summer flow and provide refuge from high winter flows, (see FLOODPLAIN for specific actions).	2	30	CDFG, NOAA RC, NRCS, Private Landowners, Sonoma County, USACE						TBD	Cost accounted for in other action steps.
SC-CCC-13.2.1.4	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.	3	50	CDFG, NMFS PRD, USACE						In-Kind	
SC-CCC-18.1	**Objective**	**Livestock**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-18.1.1	Recovery Action	Livestock	Establish conservative residual dry matter (RDM) target per acre that ensures area is not overgrazed with 1000 lbs RDM (residual dry matter)/acre left at end of grazing season. Remove cattle from pasture before soils dry out.	3		NRCS, RCD						TBD	
SC-CCC-18.2	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-18.2.1	Recovery Action	Livestock	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SC-CCC-18.2.1.1	Action Step	Livestock	Encourage riparian restoration to regain riparian corridors damaged from livestock and other causes.	2	30	Farm Bureau, Gold Ridge RCD, NRCS, Private Landowners						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-18.2.1.2	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes	2	60	NRCS, RCD						TBD	
SC-CCC-18.2.1.3	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	60	NRCS, RCD						TBD	
SC-CCC-18.2.1.4	Action Step	Livestock	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.	2	20	Farm Bureau, Gold Ridge RCD, NRCS, Private Landowners						TBD	
SC-CCC-18.2.2	Recovery Action	Livestock	Prevent impairment to stream hydrology (impaired water flow)										
SC-CCC-18.2.2.1	Action Step	Livestock	Aid landowners willing to fence off riparian areas with development of offstream alternative water sources	2	30	NRCS, RCD						TBD	
SC-CCC-18.2.2.2	Action Step	Livestock	Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.	2	30	Farm Bureau, Gold Ridge RCD, NRCS, Private Landowners						TBD	
SC-CCC-18.2.3	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										
SC-CCC-18.2.3.1	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	60	NRCS, RCD						TBD	
SC-CCC-18.2.3.2	Action Step	Livestock	Encourage develop and fund riparian restoration projects to regain riparian corridors damaged from livestock and other causes.	3	30	NRCS, RCD						TBD	
SC-CCC-18.2.3.3	Action Step	Livestock	Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.	3	60	NRCS, RCD						TBD	
SC-CCC-18.2.3.4	Action Step	Livestock	Manage rotational grazing to aid in the reduction of noxious weeds.	3	60	NRCS, RCD						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-19.1	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-19.1.1	Recovery Action	Logging	Prevent future impacts to habitat complexity										
SC-CCC-19.1.1.1	Action Step	Logging	Acquire key large tracts of forestlands identified as a priority by Federal, State, local government, and non-governmental organizations	3	60	CDFG, NMFS, RCD, Sonoma County, State Parks						TBD	Impossible to anticipate where and how much land will come available for purchase in the future.
SC-CCC-19.1.1.2	Action Step	Logging	Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	2	60	Board of Forestry, NMFS, Private Landowners, Sonoma County, State Parks, US EPA						o	Recruitment of LWD to the stream is critical. This action is mainly a policy issue, with little or no direct costs.
SC-CCC-19.1.1.3	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	60	Board of Forestry, CDFG, NMFS, Sonoma County, State Parks, USEPA						TBD	Costs cannot be determined at this time, due to an unknown number of variables and research priorities.
SC-CCC-19.1.1.4	Action Step	Logging	Assign NMFS staff to conduct THP reviews of the highest priority areas using revised "Guidelines for NMFS Staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004).	3	2	CalFire, CDFG, NMFS						0	Cost is minimal because NMFS/DFG already participate in meetings the Board of Forestry.
SC-CCC-19.1.1.5	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within high value habitat areas	3	100	NMFS						In-Kind	This action would require funding of a 1/4 time NMFS position. The need for this action may change if the California Forest Practice Rules change and reach a no-take standard.
SC-CCC-19.2	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SC-CCC-19.2.1	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SC-CCC-19.2.1.1	Action Step	Logging	Develop a Transportation Plan and adequately upgrade necessary roads, and relocate and/or decommission riparian or unnecessary roads (see ROADS for specific actions/areas)	2	5							TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-19.2.1.2	Action Step	Logging	Develop a Road Sediment Reduction Plan that prioritizes problem sites and outlines implementation and a timeline of necessary actions.	2	5	Board of Forestry, CalFire, CDFG, Private Landowners, RCD						TBD	
SC-CCC-19.2.1.3	Action Step	Logging	Utilize BMP's to properly construct roads for stormproofing and Avoid the construction of roads in the riparian zone	2									
SC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality										
SC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Implement performance standards in Stormwater Management Plans.	3		RWQCB, Sonoma County							
SC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Disperse discharge from commercial and residential areas into a spatially distributed network rather than a few point discharges.	3		City Planning, Public Works, Water Agencies							
SC-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Improve water quality where necessary by addressing residential and commercial pollutant sources.	2	10	Private Landowners, Public Works, RCD, RWQCB						tbd	
SC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2		City Planning, Sonoma County						TBD	
SC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Enforce requirements of local regulations and riparian/setbacks	2		City Planning, Sonoma County							
SC-CCC-22.1.2.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	3		Board of Forestry, CalFire, CDFG, City Planning, Sonoma County							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-22.1.2.4	Action Step	Residential/Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating coho salmon.	3		Sonoma County, Sonoma County Water Agency							
SC-CCC-22.1.2.5	Action Step	Residential/Commercial Development	Address failing septic systems in rural areas	3	10	City Planning, County Planning, RWQCB						tbd	
SC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Utilize native plants when landscaping and discourage the use of exotic invasives	3		Private Landowners, UC Extension							
SC-CCC-22.2.1.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	2		Private Landowners, Sonoma County							
SC-CCC-22.2.1.3	Action Step	Residential/Commercial Development	Explore the use of conservation easements to provide incentives for private landowners to preserve riparian corridors	2		CDFG, Land Trusts, Private Consultants, Private Landowners						TBD	
SC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
SC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Encourage the use and provide incentives for rooftop water storage and other conservation devices	2		Private Consultants, Private Landowners, Sonoma County							
SC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										
SC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-23.1.1.1	Action Step	Roads/Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	3	20	Marin County, USACE						In-Kind	Existing authorities of permitting agencies facilitate implementation at minimal costs.
SC-CCC-23.1.1.2	Action Step	Roads/Railroads	Implement DS level recommendations	2									
SC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SC-CCC-23.2.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	10	CalTrans, Marin County						TBD	Costs associated with assessment and redesign cannot be determined at this time, however some assessment has already been conducted.
SC-CCC-23.2.1.2	Action Step	Roads/Railroads	Assess roads in Nolan and Thurston Creeks to identify high priority and high sediment yield sources.	2		Private Consultants, Private Landowners, Public Works, RCD							
SC-CCC-23.2.1.3	Action Step	Roads/Railroads	Implement results of existing sediment source surveys, and assess remaining watershed road networks to eliminate high priority and high sediment yield sources.	2		Private Consultants, Private Landowners, Public Works, RCD							
SC-CCC-23.2.1.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	2		Private Landowners, Public Works							
SC-CCC-23.2.1.5	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	2	20	Private Landowners, Sonoma County	25.75	25.75	25.75	25.75		103	This is the only road parameter that received a high or very high threat (density of roads in riparian zone). Cost based for decommissioning 8.6 miles of road network at a rate $12,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-23.2.1.6	Action Step	Roads/Railroads	Utilize best management practices for road construction (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3		Private Landowners, Public Works							
SC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
SC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
SC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Work with CDFG, County of Sonoma, State Parks, municipalities, and knowledgeable biologists to develop emergency rules and adopt implementation agreements.	3	20	Cities, Sonoma County, State Parks						TBD	
SC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Land use zoning should be appropriate to the site and be tolerant to anticipated conditions (e.g., tolerant to frequent flooding).	3	60	Bodega Land Trust, CalFire, Farm Bureau, FEMA, FishNet 4C, Gold Ridge RCD, NRCS, Private Landowners, RWQCB						TBD	Costs will vary significantly depending on site specific conditions and landowner willingness to have roads addressed.
SC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	3	10	CDFG, Cities, FEMA, Gold Ridge RCD, NMFS, Sonoma County, USACE						0	Outreach and education are ongoing, and additional costs are expected to be minimal.
SC-CCC-24.2	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SC-CCC-24.2.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
SC-CCC-24.2.1.1	Action Step	Severe Weather Patterns	Minimize water use and seek alternatives during droughts.	1	20	Cities, Private Landowners, Sonoma County						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-24.2.1.2	Action Step	Severe Weather Patterns	Work with land owners or public agencies to acquire water that would be utilized to minimize effects of droughts.	2	20	Gold Ridge RCD, Private Landowners, Sonoma County						TBD	
SC-CCC-24.2.2	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
SC-CCC-24.2.2.1	Action Step	Severe Weather Patterns	Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas (See WATER QUALITY for specific actions/areas	2		CDFG, NOAA RC, Private Landowners, RCD							
SC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
SC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	5	CDFG, Gold Ridge RCD, Private Landowners, RWQCB, Sonoma County						TBD	
SC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Promote the use of reclaimed water for agricultural or other uses.	2	10	Gold Ridge RCD, Private Landowners, RWQCB, Sonoma County, Sonoma County Water Agency						TBD	
SC-CCC-25.1.1.3	Action Step	Water Diversion/Impoundment	Promote water conservation by the public, water agencies, agriculture, private industry, and the citizenry.	2									
SC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to estuary	2	10	CDFG, NMFS HCD, SWRCB						TBD	
SC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Identify upstream pollution sources which contribute to poor water quality conditions in the estuary	2		County Planning, SWRCB, Water Agencies						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										
SC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2									

San Gregorio Creek

Location	•San Mateo County
Watershed Area	• 52.0 Square Miles
Potential Habitat	•36.7 Stream Miles
Vegetation	•32% Coniferous, 39% Shrubland, 23% Grassland
Erodability	•Moderate
Ownership Patterns	•98% Private; 2% Public
Dominant Land Uses	•Rural Residential, Recreation., Agricultural
Housing Density	•Low to Moderate
TMDL Pollutants	•Pathogens, Sediment

San Gregorio lagoon
Photo by Kristine Atkinson

San Gregorio Creek Coho Salmon: Nearly Extirpated

Recovery Goals

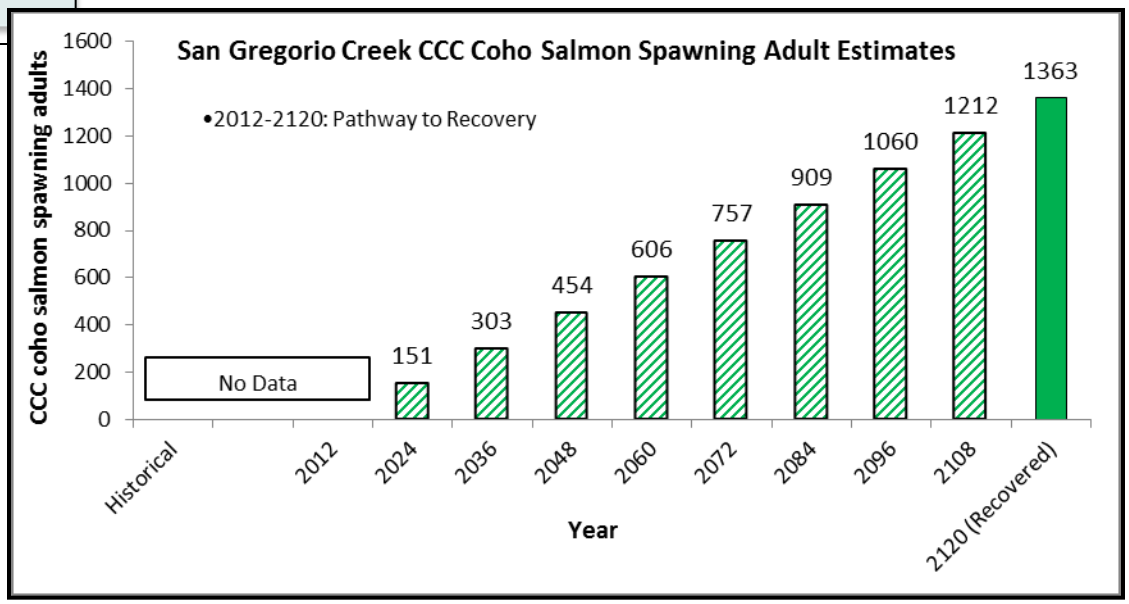
✓ Implement a monitoring program to evaluate the performance of recovery efforts

San Gregorio Creek Adult Spawner Targets

Downlisting to Threatened
682

Recovery
1,363

STEELHEAD: YES
CHINOOK SALMON: NO



San Gregorio Creek

Potential Habitat: 36.7 miles
Recovery Target: 1,363 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	POOR	FAIR	GOOD	POOR	FAIR	FAIR	POOR	POOR	VERY GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or other seasonal habitats
- Educate landowners, land managers, and County staff on the importance of LWD for coho salmon conservation and recovery
- Provide incentives to water rights holders willing to convert some or all of their water right to instream uses
- Continue to fund the maintenance and operation of the San Gregorio gauge
- Support SWRCB in regulating the use of streamside wells and groundwater. Request the SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters

Priority 2 & 3: Long-Term Restoration Actions

- Target habitat restoration and enhancement projects that will function between winter base flow and flood stage
- Decommission elevated road alignments through riparian zones or adjacent to stream channels
- Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth
- Promote off-channel storage to reduce impacts of water diversion
- Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds

Regional Open Space · Monterey Bay Sanctuary Citizen Watershed Monitoring Network · Trout Unlimited · California Department of Fish & Game

Recovery Partners
San Mateo RCD, CEMAR

Stillwater Sciences · Natural Heritage Institute · Coastal Watershed Council · SGERC

Photo Courtesy from left to right: Campbell Timberland, David Hines, NMFS, Campbell Timberland, City of Santa Rosa and Morgan Bond, SWFSC

San Gregorio Creek

Potential Habitat: 36.7 miles
Recovery Target: 1,363 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
HIGH	HIGH	MEDIUM	HIGH	MEDIUM	NA	MEDIUM	MEDIUM	NA	MEDIUM	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage forest-to-vineyard land or rural residential conversions
- Protect channel migration zones and their riparian areas by designing new roads and developments to allow streams to meander in historical patterns
- Conduct annual inspections of all roads prior to winter and correct conditions that are likely to deliver sediment to streams
- Ensure all water diversions in the watershed are in compliance with all applicable laws and policies
- Ensure current and future water diversions (surface and groundwater) do not further impair estuary water quality conditions

Priority 2 & 3: Long-Term Threat Abatement Actions

- New development should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.
- Maintain intact and properly functioning riparian buffers
- Encourage County to continue implementation of the San Mateo County Road Maintenance Manual
- Request the SWRCB consult with CDFG and NMFS on the issuance of water rights permits

Streambank erosion in San Gregorio Creek
Photo by Kristine Atkinson

Conservation Highlights

- Mid Peninsula Open Space District is performing sediment abatement programs
- Trout Unlimited and the Center for Ecosystem Management and Restoration (in cooperation with the California Coastal Conservancy) are operating multiple streamflow gauges in the watershed

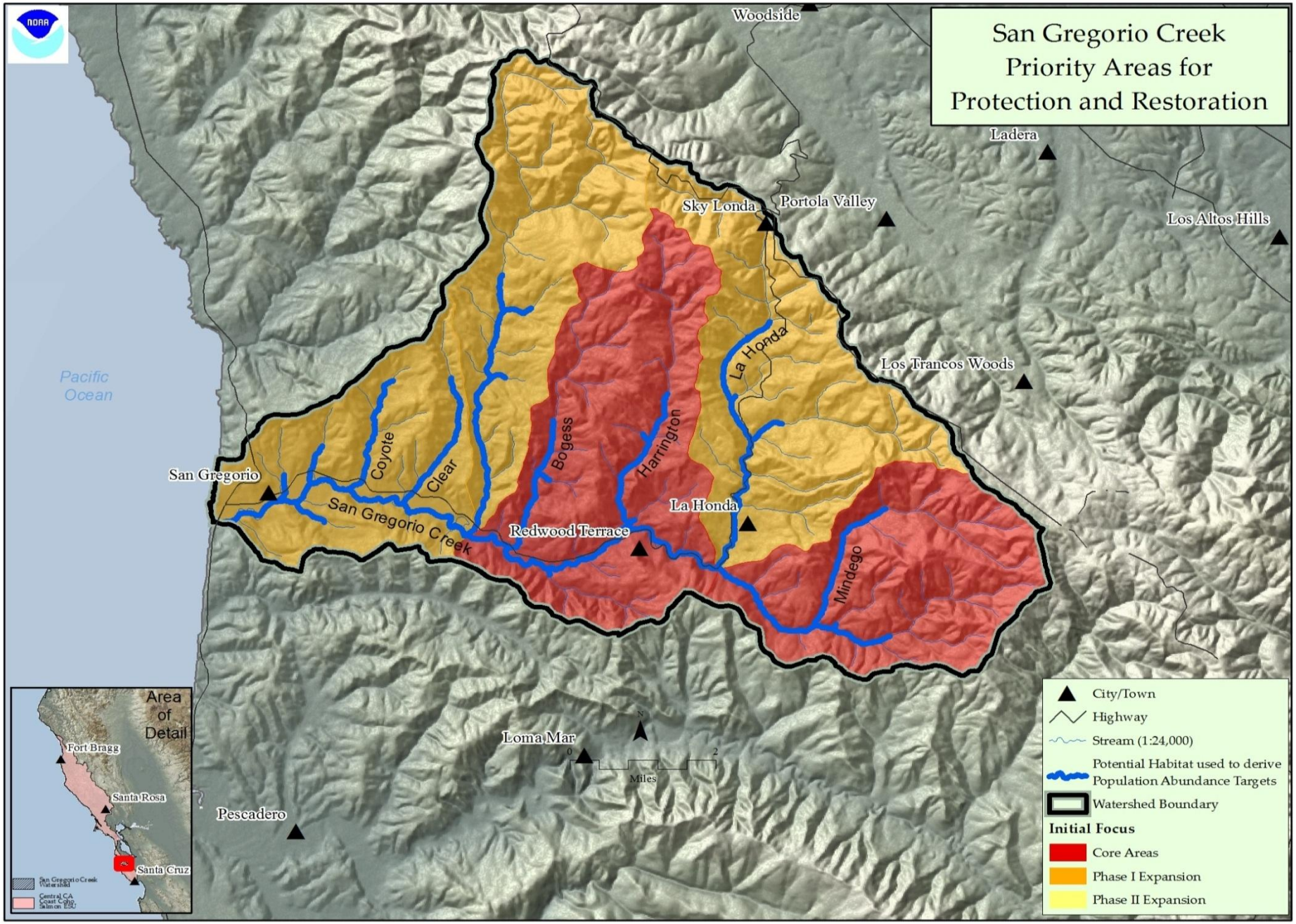


Figure 1: Map of San Gregorio Creek

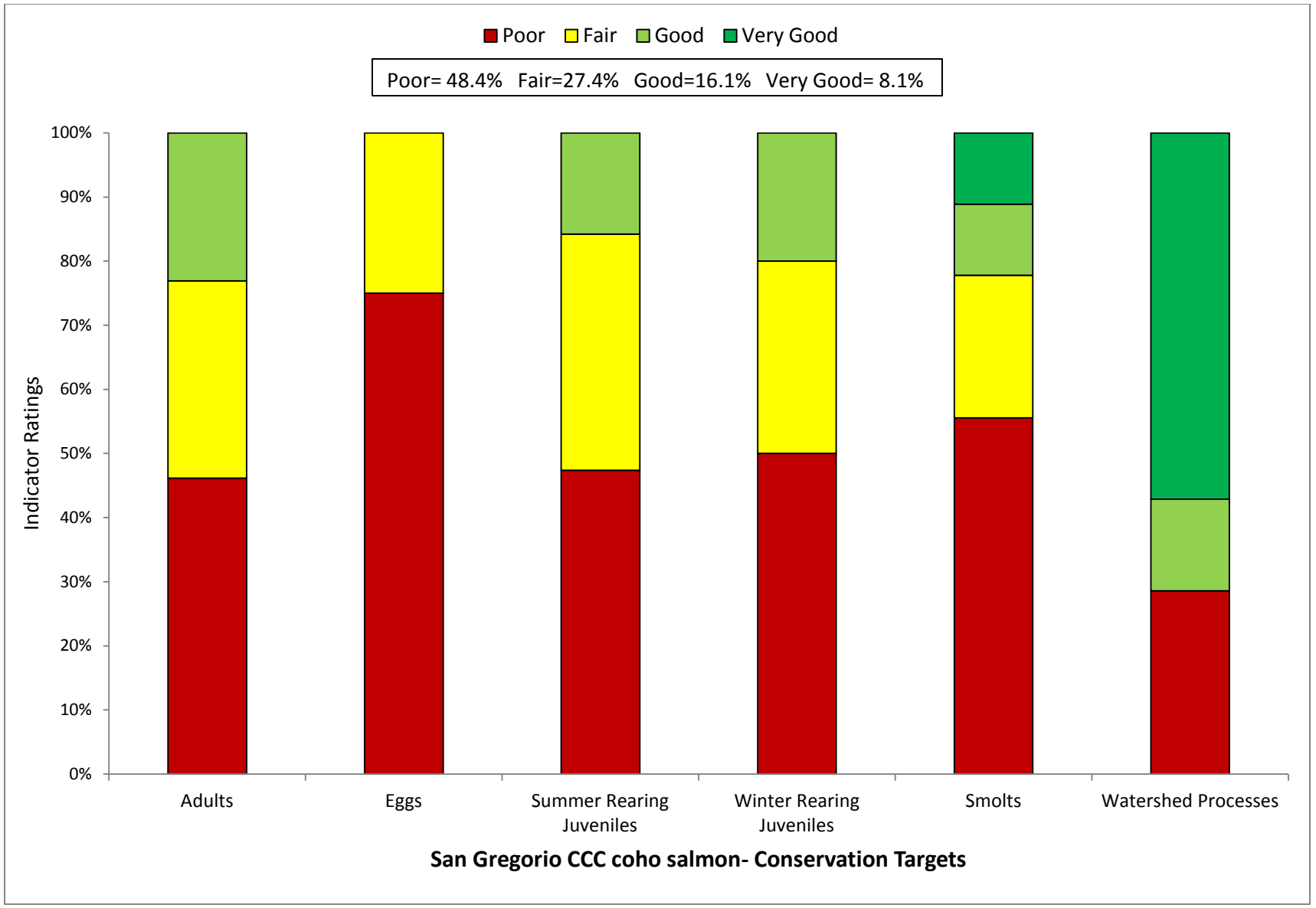


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ San Gregorio Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**1.35 Key Pieces/ 100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/ 100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**71% streams 82% IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =83**	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**78.9% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**0 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =83**	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**29% of streams 19% by IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**1.35 Key Pieces/ 100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**14% streams 42% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**71% streams 82% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score = >75**	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =51-75**	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**10.38 Diversions/10 IP-km**	Poor	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**77.5 of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**22% streams 11% IP with average canopy >85%**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**22% streams 23% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP-km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-Km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**0 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**1.35 Key Pieces/ 100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/ 100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**71% streams 82% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**77.5 of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**22% streams 23% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Properly Functioning Condition**	Good	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**10.38 Diversions/10 IP-km**	Poor	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =83**	Poor	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**>90% IP-km (>6 and <16 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundace leading to high risk spawner density =0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.28% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.71% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**<15% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**6% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**3 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**3.2 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Medium	High	High	Medium	Medium	High
2	Channel Modification	Medium	Medium	High	High	Medium	Medium	High
3	Disease, Predation and Competition	High	-	Medium	Medium	Medium	Medium	Medium
4	Fire, Fuel Management and Fire Suppression	High	Medium	High	High	Medium	Medium	High
5	Fishing and Collecting	Medium	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Medium	Low	Low	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	Medium	Medium	Medium	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Medium	Medium	Medium	Medium	Low	Medium	Medium
11	Residential and Commercial Development	High	High	Very High	Very High	High	Medium	Very High
12	Roads and Railroads	High	High	Very High	High	Medium	High	Very High
13	Severe Weather Patterns	High	Medium	Very High	High	Medium	Very High	Very High
14	Water Diversion and Impoundments	High	Medium	Very High	High	High	Very High	Very High
Threat Status for Targets and Project		Very High	High	Very High	Very High	High	Very High	Very High

Central CA Coast Coho Salmon ~ San Gregorio Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.1.1. **Action Step:** Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.

1.1.2. **Recovery Action:** Reduce frequency of artificial breaching events

1.1.2.1. **Action Step:** Encourage State Parks to develop alternative access points to San Gregorio Beach.

1.1.2.2. **Action Step:** Implement patrols by citizens groups, State Parks staff, and law enforcement to ensure the sandbar is not breached.

1.1.2.3. **Action Step:** Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the lagoon.

1.1.2.4. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.

2.1.1. **Recovery Action:** Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest.

2.1.1.1. **Action Step:** Delineate and protect reaches possessing both potential winter rearing habitat and floodplain areas.

2.1.1.2. **Action Step:** Target habitat restoration and enhancement that will function between winter base flow and flood stage.

2.1.1.3. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.4. **Action Step:** Encourage establishment of conservation easements on floodplain habitat in key stream reaches.

2.1.1.5. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Educate landowners, land managers, and County staff on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.

3.1.1.2. **Action Step:** Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.1.3. **Action Step:** Encourage retention and recruitment of large woody debris for all historical salmonid rearing habitats in the San Gregorio Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.1.4. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.1.5. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.1.6. **Action Step:** Encourage San Mateo County to initiate large instream wood structure tracking in key stream reaches where unauthorized large woody material is commonly modified or removed.

3.1.1.7. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.1.2. **Recovery Action:** Improve frequency of primary pools and shelter ratings.

3.1.2.1. **Action Step:** Promote growth of larger diameter trees where appropriate.

3.1.2.2. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions

4.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.1.1.2. **Action Step:** Promote conjunctive use of water for water projects whenever possible to maintain or restore coho salmon habitat.

4.1.1.3. **Action Step:** Promote irrigation efficiency projects for agricultural practices.

4.1.2. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.2.1. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.

4.1.2.2. **Action Step:** Continue to fund the maintenance and operation of the San Gregorio gauge.

4.1.2.3. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon and steelhead. Focus initial efforts in the middle reaches and lower reaches of San Gregorio Creek.

4.1.2.4. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

4.1.2.5. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

4.1.3. **Recovery Action:** Minimize redd scour

4.1.3.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Encourage San Mateo to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.

9.1.1.2. **Action Step:** Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Gregorio Creek.

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

9.1.2.2. **Action Step:** Establish and/or maintain continuous native riparian buffers.

9.1.2.3. **Action Step:** Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.

9.1.2.4. **Action Step:** Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

9.1.2.5. **Action Step:** Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC coho salmon recovery priorities.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Encourage a watershed-wide HCP for all or multiple landowners within a watershed to pool resources as a means to facilitate the long-term survival and recovery for coho salmon and their habitat.

10.2.2. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.2.2.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2.3. **Recovery Action:** Increase spawner density

10.2.3.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.3. **Objective:** Address other natural or manmade factors affecting the species' continued existence

10.3.1. **Recovery Action:** Increase spawner density

10.3.1.1. **Action Step:** Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

10.3.2. **Recovery Action:** Measure or estimate the condition of key attributes across the watershed.

10.3.2.1. **Action Step:** Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.

10.3.2.2. **Action Step:** Monitor population status for response to recovery actions.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Reduce toxicity and pollutants

11.1.1.1. **Action Step:** Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

11.1.2. **Recovery Action:** Evaluate point and non-point sources contributing to poor water quality, including sources contributing debris, pesticides, and sediment (turbidity); develop and implement a plan to address these sources.

11.1.2.1. **Action Step:** Evaluate water quality below likely sources of contamination.

11.1.2.2. **Action Step:** Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals into watercourses.

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

11.1.3.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

11.1.3.3. **Action Step:** Encourage San Mateo County to establish wider riparian buffers in residential and urban areas.

11.1.3.4. **Action Step:** Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

12.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity

12.1.1.1. **Action Step:** Maintain properly functioning conditions, and do not allow further degradation, of floodplain extent and connectivity.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

13.1.1.1. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.1.1.2. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.

13.1.1.3. **Action Step:** Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.

13.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity

13.1.2.1. **Action Step:** Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.

13.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

13.1.3.1. **Action Step:** Remove or modify structures impairing or reducing the historical feeding and salt water transition habit where feasible and benefits to rearing coho and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism with modification of culvert identified in Stillwater Sciences et al. (2010) upstream of the Highway 1 Bridge.

13.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

13.2.1.1. **Action Step:** Modify county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historical CCC coho salmon watersheds.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

14.1.1.1. **Action Step:** Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.

14.2. **Objective:** Address disease or predation

14.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.2.1.1. **Action Step:** Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.5. **Action Step:** Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the watershed (and all other watersheds in the County).

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.

15.1.2.2. **Action Step:** In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

15.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.3.1. **Action Step:** Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. **Threat- Livestock**

No species-specific actions were developed.

19. **Threat- Logging**

No species-specific actions were developed.

20. **Threat- Mining**

No species-specific actions were developed.

21. **Threat- Recreation**

No species-specific actions were developed.

22. **Threat- Residential/Commercial Development**

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.1.1. **Action Step:** New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.

22.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

22.1.2.1. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.

22.1.2.2. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.

22.1.2.3. **Action Step:** Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.

22.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

22.1.3.1. **Action Step:** Design new development to allow streams to meander in historical patterns.

22.1.3.2. **Action Step:** Encourage County planning departments to designate special assessment districts for properties with infrastructure located in high risk flood prone zones. Revenue generated should be used to raise or relocate infrastructure away from high risk flood zones.

22.1.3.3. **Action Step:** Evaluate watershed for infrastructure at high risk of flooding.

22.1.4. **Recovery Action:** Prevent increased landscape disturbance

22.1.4.1. **Action Step:** Promote infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.4.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.2.1.1. **Action Step:** Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.

22.2.2. **Recovery Action:** Prevent impairment to water quality

22.2.2.1. **Action Step:** Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.

22.2.2.2. **Action Step:** Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.

22.2.3. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.3.1. **Action Step:** Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.

22.2.4. **Recovery Action:** Prevent increased landscape disturbance

22.2.4.1. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.4.2. **Action Step:** Discourage San Mateo County from rezoning forestlands to rural residential.

22.2.4.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.2.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

22.2.5.1. **Action Step:** County should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.1.2. **Action Step:** Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.

23.1.1.3. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.2.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.2.3. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.2.4. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.

23.1.2.5. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.2.6. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.2.7. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.

23.1.2.8. **Action Step:** Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.

23.1.2.9. **Action Step:** Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. Seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.

23.1.2.10. **Action Step:** Encourage County to continue implementation of the San Mateo County Road Maintenance Manual.

23.1.3. **Recovery Action:** Prevent impairment to passage and migration

23.1.3.1. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.4.1. **Action Step:** Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.1.4.2. **Action Step:** Encourage adoption and implementation of a plan similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities. This plan was developed to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Encourage County of San Mateo to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.3.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.3.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.2.3.3. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

24.1.1.1. **Action Step:** Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).

24.1.1.2. **Action Step:** Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).

24.1.1.3. **Action Step:** Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for

habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.

24.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.2.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions during drought conditions.

24.1.2.2. **Action Step:** Ensure all diversions in the watershed are in compliance with all applicable laws and policies during drought periods.

24.1.2.3. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated through conservation programs.

24.1.3. **Recovery Action:** Prevent impairment to water quality

24.1.3.1. **Action Step:** Implement performance standards in Stormwater Management Plans.

24.1.3.2. **Action Step:** Ensure tolerable water temperatures are maintained during drought periods.

24.1.4. **Recovery Action:** Prevent impairment to passage and migration

24.1.4.1. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.

24.1.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.5.1. **Action Step:** Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.

24.1.5.2. **Action Step:** Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

24.1.5.3. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

24.1.5.4. **Action Step:** Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.

24.1.6. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.6.1. **Action Step:** Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in San Mateo County.

24.1.6.2. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.1.6.3. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater) do not further impair estuary water quality conditions for rearing juvenile salmonids.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).

25.1.2.3. **Action Step:** Enforce stream flow bypass requirements for all authorized diversions in San Gregorio Creek and its tributaries.

25.1.2.4. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in San Gregorio Creek.

25.1.3.2. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.4.1. **Action Step:** Ensure water diversions do not impair water temperatures in the San Gregorio Creek.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.2. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.3. **Action Step:** Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.

25.2.1.4. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ San Gregorio Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-1.1.1	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
SGC-CCC-1.1.1.1	Action Step	Estuary	Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.	3	15	CA Coastal Commission, California Coastal Conservancy, CDFG, IWRP, San Mateo RCD, State Parks	13.67	13.67	13.67			41	Improving quantity of structures should be targeted at providing improved residual depth during low tide in spring for smolt transition and feeding. Cost to treat 1 acre (assume 1 project/acre in 5% of total estuarine habitat) at a rate of $41,092/acre.
SGC-CCC-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
SGC-CCC-1.1.2.1	Action Step	Estuary	Encourage State Parks to develop alternative access points to San Gregorio Beach.	2	5	State Parks						In-Kind	In some years, beach goers cannot access the beach without entering the lagoon. This may encourage illegal breaching. An alternative access point may minimize motivation to breach the sandbar.
SGC-CCC-1.1.2.2	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff, and law enforcement to ensure the sandbar is not breached.	2	100	CDFG Law Enforcement, NMFS OLE, Public, State Parks						In-Kind	The majority of this responsibility should belong to State Park who manage San Gregorio beach and the associated parking lot. State Parks staff working at San Gregorio beach should be encouraged to monitor the lagoon throughout the summer and fall sandbar closure period on a regular basis. Other methods should also be evaluated such as installation of cameras that provide real time oversight to ensure the sandbar is closely monitored during periods when patrols are not occurring.
SGC-CCC-1.1.2.3	Action Step	Estuary	Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the lagoon.	2	100	CDFG Law Enforcement, NMFS OLE, State Parks						TBD	Financial rewards may act as a deterrent to those involved in unauthorized breaching of the lagoon. Breaching is believed to result in significant adverse impacts to salmonids and tidewater goby rearing in the lagoon.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-1.1.2.4	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	State Parks	1.50	1.50				3	Signs should convey messages in multiple languages and cite relevant regulations that prohibit breaching activities. Signs should be placed in multiple locations across the sandbar and not just in a kiosk. Signs should be placed on the sandbar within one day of closure and remain in place throughout the critical summer and fall periods. Signs should not be removed until the lagoon has breached on its own and will likely remain open for the duration of the winter period. Cost for signs vary widely depending on content and materials. Assume $1,000/sign for a minimum of 3 signs.
SGC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.**										
SGC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest.										
SGC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate and protect reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	California Coastal Conservancy, CDFG, Private Consultants, San Mateo County	117.50	117.50				235	Significant work has occurred in recent years in San Gregorio Creek and total costs could be reduced by leveraging existing information. Cost for wetland monitoring estimated at $235,402/project.
SGC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	100	California Coastal Conservancy, CDFG, IWRP, NMFS, Private Consultants, Private Landowners						TBD	Costs cannot be determined at this time. Implementation will depend on landowner participation.
SGC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	100	California Coastal Conservancy, CDFG, IWRP, NMFS, NOAA RC, San Mateo County, San Mateo RCD, USACE						TBD	Costs will vary depending on restoration action and total number of projects implemented.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-2.1.1.4	Action Step	Floodplain Connectivity	Encourage establishment of conservation easements on floodplain habitat in key stream reaches.	2	100	FEMA, MROSD, POST, Private Landowners, San Mateo County						TBD	A lack of available winter refuge habitat, due in part to lack of access to inundated floodplain or off-channel habitats, has been identified as a limiting factor for coho salmon in the watershed according to Stillwater Sciences et al. (2010). According to Stillwater Sciences et al. (2010), the lower mainstem San Gregorio Creek historically may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. Mainstem channel and low gradient tributary reaches should be assessed to target opportunities to restore floodplain connectivity. Cost are dependent upon market value and landowner participation.
SGC-CCC-2.1.1.5	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	2	5	CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County	140.00					140	Cost based on decommissioning 10 miles of riparian road network (assume 25% of riparian roads) at a rate of $13,680/mile.
SGC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SGC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
SGC-CCC-3.1.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County staff on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	50	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						In-Kind	Program should initially be directed at landowners along important stream reaches where large wood removal has been identified as an ongoing concern by the resource agencies and the County of San Mateo.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-3.1.1.2	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE	145.00	145.00				290	This is a high priority for the San Gregorio watershed. Overall costs may be reduced by assessing and leveraging past surveys and ongoing assessment in the watershed to prioritize key areas. However, due to the urbanized nature of the watershed (particularly adjacent to riparian areas) and flooding concerns, it is anticipated that most LWD structures will require engineering. Cost based on treating 10 miles of stream (assume 1 project/mile in 50% High IP) at a rate of $28,500/mile. If ELJ used instead, cost estimated to be $1,152,768.
SGC-CCC-3.1.1.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid rearing habitats in the San Gregorio Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						In-Kind	Manipulation of LWD should not occur until evaluated by the San Mateo County Planning staff and hydrologist and/or qualified biologist familiar with Central Coast streams. LWD target could likely be achieved in a relatively short time period of existing and newly recruited large wood was left intact by landowners. Cost savings would be significant. Currently a significant amount of large woody material was removed without proper authorization in the watershed.
						CDFG, Mid Peninsula Open Space District,							Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure. Winter habitat has been degraded for salmonids in part from a lack of LWD, which provides important slow-water refuge areas during high flow events (Stillwater Sciences et al. 2010). Coho salmon summer habitat has also been degraded by the lack of LWD, which helps to form pools where salmonids can over-summer, and provides cover and protection from predators. Winter habitat has been degraded for both coho salmon and steelhead and Winter habitat LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should be implemented and designed to provide cover, and facilitate scour

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-3.1.1.4	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	2	50	MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						In-Kind	during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated to threaten adjacent infrastructure.
SGC-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	100	CDFG, IWRP, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						In-Kind	Cost should be minimal. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. CDFG stream surveys indicate a lack of LWD within the San Gregorio Creek watershed where all but one stream ranked as "poor". Low LWD abundance within San Gregorio Creek is likely the result of past logging practices that removed trees from riparian areas and stream clearance efforts. The lack of LWD likely is the major contributor to the lower shelter values estimated in the watershed (an average rating of 0 out of a possible total of shelter rating of 300). Reduced large wood and shelter adversely affect the summer, winter, and smolt life stages in San Gregorio Creek.
SGC-CCC-3.1.1.6	Action Step	Habitat Complexity	Encourage San Mateo County to initiate large instream wood structure tracking in key stream reaches where unauthorized large woody material is commonly modified or removed.	2	10	San Mateo County	20.00	20.00				40	Tracking efforts will provide greater certainty to regulatory agencies and land owners in regard to potential threats and benefits posed by instream woody debris. Additional funding for staff will likely be necessary to implement this recommendation.
SGC-CCC-3.1.1.7	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE	3.85	3.85				8	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely or insignificant to downstream reaches. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost based on treating 5 miles (assume 80 acres/mile in 25% High IP) at a rate of$1,621.
SGC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools and shelter ratings.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-3.1.2.1	Action Step	Habitat Complexity	Promote growth of larger diameter trees where appropriate.	3	100								
SGC-CCC-3.1.2.2	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFG, Santa Cruz County, USACE						In-Kind	
SGC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions										
SGC-CCC-4.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFG, Farm Bureau, IWRP, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, San Mateo County, San Mateo RCD, SWRCB, Trout Unlimited						In-Kind	Promoting these type of projects will require a sustained effort to target willing landowners in critical stream reaches. Incentive programs could result in rapid acceptance of these types of water conservation programs. This recommendation (which will include transfer or modification of water rights in some circumstances) should be incorporated into all future regulatory reviews of water rights applications and 1600 Agreements in the San Gregorio watershed. Infrastructure will likely consist of off stream storage facilities that are used to store winter flows. These devices in over allocated watersheds, must be carefully evaluated before installation. Due to the significant amount of over allocation in the watershed, the impact of off channel storage must be evaluated against potential impacts to channel forming flow events and migration requirements of adult salmonids.
SGC-CCC-4.1.1.2	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore coho salmon habitat.	2	10	CDFG, Farm Bureau, IWRP, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, San Mateo County, San Mateo RCD, SWRCB, Trout Unlimited						TBD	Highlighting these issues will likely require the development of MOAs between water users. Conjunctive management of water resources, utilizing surface water and groundwater area could meet the current winter demand of the local diverters. The benefits of conjunctive use include providing a reliable supplemental supply, replenishment of depleted groundwater basins, and improvements to fisheries habitat. Cost will be dependent upon participation of stakeholders.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-4.1.1.3	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	3	30	Farm Bureau, IWRP, NRCS, San Mateo RCD, Trout Unlimited							
SGC-CCC-4.1.2	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
SGC-CCC-4.1.2.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	10	CDFG, Farm Bureau, IWRP, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, San Mateo County, SWRCB						TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Cost are estimated for first ten years assuming successful implementation of two projects per year. Costs are estimated at $70000 per landowner per year. Costs will vary depending on the size of the diversion and participation of diverters.
SGC-CCC-4.1.2.2	Action Step	Hydrology	Continue to fund the maintenance and operation of the San Gregorio gauge.	1	20	SWRCB, USACE, USGS	25.00	25.00	25.00	25.00		100	Cost are based on ongoing maintenance and operation expenses.
													Program can likely leverage off other assessment efforts in the San Gregorio watershed. Low instream flow in San Gregorio Creek has been identified as a factor limiting age 0+ and age 1+ steelhead abundance (and coho when present), and upstream migration of adult steelhead and coho salmon during dry years. This is not a desired condition for fish. CDFG stream surveys, other local literature, and a field survey by Stillwater Sciences et al. (2010) noted dry stream reaches in the late summer and fall in some years. Dry reaches restrict availability and access to riffle and deep-pool rearing habitats. By summer, particularly in dry years, flows in many portions of San Gregorio Creek are extremely low, decreasing access and contributing to loss of habitat during the rearing period. When low flows restrict the amount of area for rearing, competition for food

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-4.1.2.3	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon and steelhead. Focus initial efforts in the middle reaches and lower reaches of San Gregorio Creek.	2	10	CDFG, IWRP, Private Consultants, Private Landowners, San Mateo County, SWRCB, Trout Unlimited	36.00	36.00				72	and space is increased in the remaining habitat. Low flows can also decrease invertebrate production in riffles (Harvey et al., 2006). Therefore growth rates, in particular, could be reduced by low flow summer conditions (i.e., reduced food supply, increased density in pools), especially if water temperatures are increased as a result of decreased flows. Significant monitoring efforts are currently occurring in the San Gregorio watershed. Data from this monitoring effort should be evaluated and incorporated into the stream flow evaluation program as a means to reduce overall costs. However, due to the large amount of water diverted and the poor condition of the fishery it is likely an IFIM study will be needed that focuses on necessary instream flows in multiple streams and stream reaches in San Gregorio. Particular focus of this effort should be directed at stream reaches with high IP values and significant diversions. San Gregorio is most heavily over allocated streams in the San Cruz Mountains. Evaluation should also account for freshwater input into the lagoon. Cost based on stream flow model at a cost of $71,825.
SGC-CCC-4.1.2.4	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFG, NMFS, NMFS OLE, Public, SWRCB, Trout Unlimited						In-Kind	
SGC-CCC-4.1.2.5	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	1	100	CDFG, NMFS, Private Landowners, Public, SWRCB						In-Kind	Cost to promote SWRCB review existing diversions will likely vary between depending on the cooperation of the diverter.
SGC-CCC-4.1.3	Recovery Action	Hydrology	Minimize redd scour										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-4.1.3.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5		749					749	Redd scour is likely a limiting factor in some reaches of San Gregorio Creek, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of coho egg and alevin mortality. Cost based on $115,276/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $182,250 for treating 6.5 miles of high IP. Co-related to habitat complexity.
SGC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.
SGC-CCC-9.1.1.1	Action Step	Sediment	Encourage San Mateo to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	2	100	Private Landowners, San Mateo County						TBD	Cost are dependent on market value and property turnover.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-9.1.1.2	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Gregorio Creek.	3	100	CDFG, IWRP, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						TBD	Extent of bank failures are unknown. Repairs should be completed using bioengineering techniques and material, where appropriate. Habitat enhancement should be incorporated into the engineering design, where appropriate. The San Gregorio Creek Watershed Information Center includes six detailed and relatively recent inventories of bank erosion, landslide, and road-related fine sediment supply areas located primarily on Mid-peninsula Open Regional Open Space District and San Mateo County properties. In addition, the San Mateo County RCD is conducting additional assessments and geospatial analysis of roads in the watershed as part of its Rural Roads Program. Implementing the high priority recommendations for treatment in these inventories is a logical and cost-effective way to remediate known sources of fine sediment.
SGC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
SGC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalTrans, Mid Peninsula Open Space District, NRCS, POST, RWQCB, San Mateo County, State Parks						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain and remove potentially chronic fine sediment sources that impact primary stream channels. Sites should be located on smaller tributaries or first order streams.
SGC-CCC-9.1.2.2	Action Step	Sediment	Establish and/or maintain continuous native riparian buffers.	3	100	CalFire, CalTrans, Mid Peninsula Open Space District, NRCS, Pescadero Municipal Advisory Council, Private Landowners, RWQCB, San Mateo County, State Parks, USACE						TBD	In a study on the San Lorenzo River in Santa Cruz County, Balance Hydrologics found stream reaches with a total of 1.5 to 2 bankfull widths (on both banks) of healthy native riparian vegetation offer the best instream habitat and have the most stable banks (Balance Hydrologics 1998). These riparian width recommendations are also appropriate for San Gregorio and would facilitate return of watershed processes to properly functioning conditions.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-9.1.2.3	Action Step	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.	3	100	Farm Bureau, NRCS, RWQCB, San Mateo County, San Mateo RCD						In-Kind	Excessive sediment transport rates in the San Gregorio watershed have compromised spawning and rearing habitat. Pool filling appears to result from upslope erosion, and has been noted to reduce available habitat throughout the San Gregorio Creek watershed since the 1970s (Titus et al., 2010).
SGC-CCC-9.1.2.4	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFG, FEMA, NMFS PRD, NRCS, RWQCB, San Mateo County, USACE, USFWS						In-Kind	While costs are involved in this recommendation, inspections should be considered a standard business practice by all regulatory agencies and this action should not be considered as an additional cost.
SGC-CCC-9.1.2.5	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC coho salmon recovery priorities.	3	10	CDFG, Farm Bureau, NRCS, Private Landowners, San Mateo RCD						In-Kind	Evaluate and adopt programs such as the Fish Friendly Farming Program.
SGC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
SGC-CCC-10.1.1.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	CDFG, NOAA SWFSC, Private Consultants, Private Landowners, San Mateo RCD						In-Kind	
SGC-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.	2	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						TBD	Re-introduction should only occur in subwatersheds where instream habitat conditions are suitable for all coho salmon lifestages. Conditions evaluated should include summer flow conditions, cover, winter refugia, pools depths, instream temperature, and gravel quality.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
SGC-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
SGC-CCC-10.2.1.1	Action Step	Viability	Encourage a watershed-wide HCP for all or multiple landowners within a watershed to pool resources as a means to facilitate the long-term survival and recovery for coho salmon and their habitat.	3	10	CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, San Mateo RCD, State Parks	400.00	400.00				800	If existing information is adequate regarding watershed conditions for covered species, it is possible to reduce overall costs considerably. However, if HCP negotiations are contentious and protracted, costs could increase considerably.
SGC-CCC-10.2.2	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
SGC-CCC-10.2.2.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE	41.00	41.00				82	Cost based on riparian restoration at a cost of $81,437.
SGC-CCC-10.2.3	Recovery Action	Viability	Increase spawner density										
SGC-CCC-10.2.3.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20	CDFG, Mid Peninsula Open Space District, MROSD, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks	14.25	14.25	14.25	14.25		57	Standardized surveys should occur when a small sustained run of CCC coho salmon is re-established in the watershed. Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum and therefore, San Gregorio ranks lower in overall priority in the immediate future. Redd monitoring using (GTRS sampling design) may be less expensive than establishing life cycle station to count migrating adults and smolts. All assessments should use standardized methods. Methods should be consistent across the ESU, or at a minimum, the Santa Cruz Mountains Diversity Stratum. Cost based on annual ground survey cost for Santa Cruz Mtns.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-10.3	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**										
SGC-CCC-10.3.1	Recovery Action	Viability	Increase spawner density										
SGC-CCC-10.3.1.1	Action Step	Viability	Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	3	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE							Imprinting stations will increase the likelihood of adults returning and re-establish a run in targeted sub basins. A total of two to three imprinting station may be needed in various tributaries of San Gregorio Creek. Stations should continue until a run is verifiably re-established. Suitable locations should be carefully evaluated for their potential to support a viable run.
SGC-CCC-10.3.2	Recovery Action	Viability	Measure or estimate the condition of key attributes across the watershed.										
SGC-CCC-10.3.2.1	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	2	15	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						TBD	All assessments should use standardized methods. Methods should be consistent across the CCC DPS or at a minimum the Santa Cruz Mountains Diversity Stratum. Results from past assessments can be used in some circumstances to jump start restoration actions and need not necessarily wait upon completion of a standardized assessment protocol.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-10.3.2.2	Action Step	Viability	Monitor population status for response to recovery actions.	3	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE	63.50	63.50				127	Primary emphasis for monitoring should be placed on adult assessments. All efforts should be closely coordinated for survey efforts within the Santa Cruz Mountains to minimize duplication and ensure consistency of results. Priority ranking may change if San Gregorio is determined to be an optimal watershed in regional sampling. Priorities for sampling should be coordinated with coho sampling efforts. While San Gregorio is considered to be an Independent population only the San Lorenzo and Pescadero are considered to have Independent populations for CCC coho salmon in the Santa Cruz Mountains Diversity Stratum. Due to this ranking, it is likely Pescadero and San Lorenzo will carry greater importance in a regional sampling effort. Cost for fish/habitat restoration effectiveness monitoring estimated at $126,758/project.
SGC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-11.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants										
SGC-CCC-11.1.1.1	Action Step	Water Quality	Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	100	RWQCB, San Mateo County						In-Kind	
SGC-CCC-11.1.2	Recovery Action	Water Quality	Evaluate point and non-point sources contributing to poor water quality, including sources contributing debris, pesticides, and sediment (turbidity); develop and implement a plan to address these sources.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-11.1.2.1	Action Step	Water Quality	Evaluate water quality below likely sources of contamination.	2	10	RWQCB, San Mateo County, USEPA	12.50	12.50				25	Sources of input may include leaky septic systems, nursery effluent, wild or domestic animals, and/or poorly managed horse and livestock facilities. The San Gregorio Creek watershed is currently listed as impaired for bacteria and sediment under Section 303(d) of the Clean Water Act (SFBRWQCB, 2006). Water temperature was considered suboptimal; temperatures thresholds for juvenile coho salmon, which are lower than those for steelhead, were exceeded at some of the sampling locations according to information presented in the San Gregorio Creek Watershed Management Plan (NHI 2010). NMFS determined setting temperature thresholds based on the more narrow range of coho salmon thermal requirements was appropriate for watersheds with co-occurring populations of CCC coho salmon and CCC steelhead. Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume minimum 5 for San Gregorio Creek. Cost does not account for maintenance or data management.
SGC-CCC-11.1.2.2	Action Step	Water Quality	Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals into watercourses.	2	25	County DA, Law Enforcement, Public, Sheriff Department						TBD	
SGC-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-11.1.3.1	Action Step	Water Quality	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100	CalFire, CalTrans, Private Landowners, RWQCB, San Mateo County, USACE, USEPA						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant. Turbidity data (NHI, 2010) indicated elevated levels during the winter and spring following seasonal rainfall events. Elevated turbidity levels could injure gills, reduce feeding efficiency and adversely affect growth. Increased rates of turbidity and temperature are likely the result of land and water management practices in the watershed. Winter rearing juveniles are the primary life-stage affected by high turbidity levels.
SGC-CCC-11.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10	CalFire, Farm Bureau, NRCS, Private Landowners, RWQCB, San Mateo County, San Mateo RCD						In-Kind	
SGC-CCC-11.1.3.3	Action Step	Water Quality	Encourage San Mateo County to establish wider riparian buffers in residential and urban areas.	2	10	CDFG, NMFS, Private Landowners, RWQCB, San Mateo County, USEPA, USFWS						In-Kind	This will likely be a sensitive issue for many landowners with property located next to riparian areas. This recommendation should be applied to all new development projects.
SGC-CCC-11.1.3.4	Action Step	Water Quality	Implement Best Management Practices such as those in the Fish Friendly Farming program (California Land Stewardship Institute), or other cooperative conservation programs.	3	100	Farm Bureau, Private Landowners, San Mateo County, San Mateo RCD						In-Kind	Note that these programs and take minimization measures and are not a no take standard. The San Mateo Farm Bureau is working with landowners to voluntarily address sources of sediment contribution and the Sotoyome RCD program could be combined with this ongoing effort.
SGC-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SGC-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent impairment to floodplain connectivity										
SGC-CCC-12.1.1.1	Action Step	Agricultural Practices	Maintain properly functioning conditions, and do not allow further degradation, of floodplain extent and connectivity.	1	100	San Mateo County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SGC-CCC-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Geological Survey, CalTrans, CDFG, FEMA, RWQCB, San Mateo County						In- Kind	Eliminating gabion baskets will result in long-term cost savings due implementation of longer lasting and better engineered solutions.
SGC-CCC-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	100	California Geological Survey, CalTrans, CDFG, FEMA, RWQCB, San Mateo County						In-Kind	This recommendation should be adopted as a standard business practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation.
SGC-CCC-13.1.1.3	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	2	100	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Public, RWQCB, San Mateo County, San Mateo RCD						In-Kind	This should become a standard business practice for all agencies and consulting firms engaged in constructing and designing solutions to address channel stability.
SGC-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to instream habitat complexity										
SGC-CCC-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.	2	100	California Geological Survey, CalTrans, CDFG, FEMA, RWQCB, San Mateo County						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-13.1.3	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCC-13.1.3.1	Action Step	Channel Modification	Remove or modify structures impairing or reducing the historical feeding and salt water transition habit where feasible and benefits to rearing coho and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism with modification of culvert identified in Stillwater Sciences et al. (2010) upstream of the Highway 1 Bridge.	3	10	CA Coastal Commission, CalTrans, CDFG, IWRP, NMFS, San Mateo County, San Mateo RCD, State Parks, USACE, USFWS						TBD	Questions remain regarding the benefits of the action to improving conditions to the now-dewatered marsh as identified by Stillwater Sciences et al. (2010) and Smith (1987). Additional benefits may be accrued for tidewater goby and USFWS should be closely consulted. Benefits to coho may include additional winter high water refugia and additional sources of food production for salmonids rearing in the lagoon.
SGC-CCC-13.2	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms**										
SGC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCC-13.2.1.1	Action Step	Channel Modification	Modify county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historical CCC coho salmon watersheds.	2	100	San Mateo County						In-Kind	
SGC-CCC-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SGC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
SGC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.	3	20	Private Landowners, San Mateo RCD	79.00	79.00	79.00	79.00		316	Cost based on removing invasive exotic vegetation in 1 mile (assume 80 acres/mile in 5% High IP) at a rate of $39,574/acre.
SGC-CCC-14.2	**Objective**	**Disease/Predation/Competition**	**Address disease or predation**										
SGC-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.	3	20	CDFG, NOAA SWFSC	95.00	95.00	95.00	95.00		380	Cost based on life history/population size at a cost of $188,264.
SGC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SGC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire						in-Kind	This recommendation should be considered a standard practice.
SGC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
SGC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Some areas in the San Gregorio watershed have high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment in stream channels. Furthermore, if existing riparian areas were lost to fire, higher stream temperatures, which are already above optimal condition along the mainstem, would likely result.
SGC-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						In-Kind	Standard business practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the watershed (and all other watersheds in the County).	2	100	CalFire						In-Kind	
SGC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
SGC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Work with County planners to define future impacts of proposed urban and infrastructure development on fire suppression and fuel load buildup.	2	50	CalFire, San Mateo County, San Mateo RCD						In-Kind	Some areas in the San Gregorio watershed have a high fire hazard rating according to CalFire data. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures, which are already above optimal condition along the mainstem, would likely result.
SGC-CCC-15.1.2.2	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors contact the resource agencies for ESA consultation (or technical assistance) regarding the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire, San Mateo County, San Mateo RCD						In-Kind	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
SGC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										
SGC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire							Require all water truck/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
SGC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										
SGC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire						0	
SGC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SGC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
SGC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.	2	100	RWQCB, San Mateo County						TBD	Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SGC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SGC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.	2	100	FEMA, Private Landowners, San Mateo County						In-Kind	A shallow landslide model predicted about 4.4% of the watershed as chronic or high instability in the headwater regions of the El Corte de Madera, La Honda, and Mindego Creek sub-basins. Stringent review by permitting agencies is expected to reduce ancillary costs associated with poorly planned and poorly located developments. Priority areas that should be avoided include the estuary and geologies with steep mixed lithology and the sandstone geologies in the watershed.
SGC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	FEMA, Private Landowners, San Mateo County							Functional buffers provide multiple benefits to water processes. Buffers in residential areas frequently become compromised overtime due to encroachment issues.
SGC-CCC-22.1.2.3	Action Step	Residential/Commercial Development	Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100	FEMA, Private Landowners, San Mateo County						In-Kind	General recommendation that should be applied to all pre existing and future landuse activities in the watershed. This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Design new development to allow streams to meander in historical patterns.	1	100	FEMA, Private Landowners, San Mateo County						In-Kind	Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.
SGC-CCC-22.1.3.2	Action Step	Residential/Commercial Development	Encourage County planning departments to designate special assessment districts for properties with infrastructure located in high risk flood prone zones. Revenue generated should be used to raise or relocate infrastructure away from high risk flood zones.	3	20	FEMA, Private Landowners, San Mateo County						In-Kind	Protection of floodplains is critical for juvenile salmonids, particularly during the winter high flow period. Restoration of floodplains is typically very expensive when subject to development pressures.
SGC-CCC-22.1.3.3	Action Step	Residential/Commercial Development	Evaluate watershed for infrastructure at high risk of flooding.	2	10	FEMA, Private Landowners, San Mateo County	10.00	10.00				20	Most of these structures have likely been identified. Cost associated with ground truthing and site specific evaluation.
SGC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
SGC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Promote infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	RWQCB, San Mateo County						In-Kind	This action encourages implementation of many existing policies. The 2000 census estimated the population within San Gregorio Creek at 2,458 individuals; six percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009), with the majority of the development located in close proximity to the various watercourses. Although the population in the watershed in relatively low compared to many other watersheds in the ESU, the proximity of residences to stream channels places riparian areas and stream channels at greater risk for future alteration.
SGC-CCC-22.1.4.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	1	100	County of San Mateo, Mid Peninsula Open Space District, POST						TBD	
SGC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SGC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	3	5	Public, RWQCB, San Mateo County						In-Kind	San Mateo County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs. mainstem.
SGC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality										
SGC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	3	100	Public, RWQCB, San Mateo County						In-Kind	Costs should be minimal and are considered part of RWQCB existing authority and obligation.
SGC-CCC-22.2.2.2	Action Step	Residential/Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	3	100	RWQCB, San Mateo County, USEPA						In-Kind	
SGC-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
SGC-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.	3	10	CDFG, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC, State Parks, USACE						In-Kind	
SGC-CCC-22.2.4	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-22.2.4.1	Action Step	Residential/Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	100	San Mateo County						In-Kind	
SGC-CCC-22.2.4.2	Action Step	Residential/Commercial Development	Discourage San Mateo County from rezoning forestlands to rural residential.	1	100	San Mateo County						In-Kind	
SGC-CCC-22.2.4.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CDFG, Mid Peninsula Open Space District, MROSD, POST, RWQCB, San Mateo County, San Mateo RCD, SGERC						In-Kind	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality, increased rates of sedimentation, future consequences of flood fighting to riparian zones and bank hardening, etc. The adverse impacts of extensive rural residential development in the San Lorenzo River watershed is reflected in high rates of sedimentation and water diversion.
SGC-CCC-22.2.5	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCC-22.2.5.1	Action Step	Residential/Commercial Development	County should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	3	20	San Mateo County						TBD	Many residences and properties in the San Gregorio watershed are prone to flooding, and efforts to minimize the impacts of flooding will likely include removing instream habitat features such as wood debris (a practice that has occurred in the past). Residences located adjacent to stream channels are often at increased risk of bank erosion, and efforts to protect existing infrastructure will likely include bank stabilization efforts that could further degrade salmonid habitat.
SGC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, CalTrans, Private Landowners, San Mateo County						In-Kind	All new and replacement culverts should be sized to accommodate a 100 year flow event.
SGC-CCC-23.1.1.2	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	40.25	40.25	40.25	40.25		161	Cost based on inventorying 133 miles of road network at a rate of $1,056/mile and establishing a database.
SGC-CCC-23.1.1.3	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	3	20	CalFire, CalTrans, Private Landowners, San Mateo County	45.00	45.00	45.00	45.00		180	This recommendation will be difficult to implement due to the extensive development in the watershed and topographical confinement. Initial roads targeted will likely be unsurfaced seasonal roads where ongoing maintenance does not comport with modern standards. Targeted areas should include sub watersheds with high erosion potential. Many of the former logging roads in the upper portion of the watershed are now used as recreational trails by mountain bikers. These trails are often very steep and contribute substantial fine sediment to San Gregorio Creek due to inadequate maintenance practices and poor trail locations (Ambrose, pers. obs. 2002). A shallow landslide model predicted about 4.4% of the watershed as chronic or high instability in the headwater regions of the El Corte de Madera, La Honda, and Mindego Creek sub-basins. Repairing and decommissioning roads in areas predicted as chronically or highly unstable could reduce the likelihood of sediment input from areas predicted as chronically or highly unstable. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 13 miles of road network at a rate of $13,690/mile.
SGC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County						In-Kind	This recommendation should be considered standard practice.
SGC-CCC-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	CalFire, CalTrans, IWRP, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, San Mateo RCD							On many forest and ranch roads, located on both public and private lands, periodic maintenance falls short of addressing chronic, localized erosion problems. In these circumstances, grading of poorly drained roads and repair of failed fills and stream crossings can continue and even exacerbate the rate of fine sediment delivery to the stream channel. Additionally, paved and unpaved roads parallel many of the waterways within San Gregorio Creek, and may impinge channel migration. Cost accounted for in RESIDENTIAL/COMMERCIAL DEVELOPMENT.
SGC-CCC-23.1.2.3	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	20	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County	775	775	775	775		3,100	Costs associate with barrier modification must be carefully balanced against other restoration activities that are less popular socially, but may yield greater benefits to various lifestages. If bridges are not feasible, replacement culverts on fish bearing streams must have a natural bottom. Cost base on improving passage at 9 stream crossings (2 impassable, 7 temporary or partially impassable) at a rate of $744,882 for impassable and $254,278 for partially impassable.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-23.1.2.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	5	CalFire, CalTrans, RWQCB, San Mateo County, State Parks						TBD	Inadequate storage of sediment from road managment has been an ongoing issue in San Gregorio watershed. The paucity of locations for temporary storage of landslide material is a significant constraint. Sites should be identified within the duration specified and this action should be continued in perpetuity. A significant amount of sediment is removed from inside ditches and road surfaces during winter months due to general erosion and removal of landslides and is temporarily deposited in areas with hydraulic connectivity to watercourses. Future efforts may require incentives to increase landowner participation. Cost dependent on identifying spoil storage sites and feasibility of meeting targets.
SGC-CCC-23.1.2.5	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County						In-Kind	Roadside berms are common on many private and county roads in San Mateo County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails).
SGC-CCC-23.1.2.6	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, State Parks						TBD	Road inventory should identify the number and extent of energy dissipaters needed.
SGC-CCC-23.1.2.7	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, State Parks						In-Kind	This should be an ongoing program. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-23.1.2.8	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, CalTrans, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, State Parks						TBD	Costs will vary depending on number of culvert upgrades occur on a road network and the inefficiency of the current drainage system. Pretreatment systems should be installed as part of new projects or upgraded. A maintenance plan should be part of all pretreatment systems.
SGC-CCC-23.1.2.9	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. Seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalFire, CalTrans, FEMA, Mid Peninsula Open Space District, POST, Private Landowners, San Mateo County, State Parks						TBD	Costs are difficult to accurately determine but it may result in a long term cost savings. San Mateo County should seek amendments to FEMA policies to facilitate improvements that prevent erosion and failure, particularly for watersheds targeted in this and the CCC coho salmon recovery plan.
SGC-CCC-23.1.2.10	Action Step	Roads/Railroads	Encourage County to continue implementation of the San Mateo County Road Maintenance Manual.	2	100	San Mateo County							
SGC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
SGC-CCC-23.1.3.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, FEMA, IWRP, NRCS, San Mateo RCD, USACE							Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis. Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
SGC-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										
SGC-CCC-23.1.4.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	CalFire, CalTrans, FEMA, IWRP, NRCS, Private Landowners, San Mateo County, San Mateo RCD, USACE							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-23.1.4.2	Action Step	Roads/Railroads	Encourage adoption and implementation of a plan similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities. This plan was developed to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalFire, CalTrans, FEMA, IWRP, Mid Peninsula Open Space District, NRCS, POST, San Mateo County, San Mateo RCD, USACE							
SGC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
SGC-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
SGC-CCC-23.2.1.1	Action Step	Roads/Railroads	Encourage County of San Mateo to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	San Mateo County							The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within San Gregorio Creek and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening.
SGC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCC-23.2.2.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CDFG, FEMA, IWRP, NMFS, NRCS, Private Landowners, RPFs, RWQCB, San Mateo County, USACE, USFWS							Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
SGC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-23.2.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	100	CalFire, CalTrans, CDFG, Mid Peninsula Open Space District, NMFS, POST, Private Landowners, RPFs, RWQCB, San Mateo County							Standard business practice; however, implementation may be difficult in the watershed due to the large number of small landowners and varying degree of financial resources. County of San Mateo evaluated roads and trails and likely have a good idea of priority locations that should be addressed on an annual basis. Rural roads should receive the majority of the attention vs. mainline roads in the watershed.
SGC-CCC-23.2.3.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	CalFire, Mid Peninsula Open Space District, NRCS, POST, Private Landowners, RPFs, RWQCB, San Mateo County							This should be considered the minimum standard for dirt roads in the watershed.
SGC-CCC-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	CalTrans, Mid Peninsula Open Space District, MROSD, NRCS, POST, RWQCB, San Mateo County						In-Kind	Cost should be considered part of land owner road management plans. These standards should be adopted for all unsurfaced roads and trails in the San Gregorio watershed.
SGC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SGC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary (impaired quality and extent)										
SGC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	FEMA, State Parks, USACE							
SGC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	10	FEMA, State Parks, USACE	156.00	156.00				312	Cost for estuary monitoring are estimated at $311,467.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	FEMA, State Parks, USACE							
SGC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
SGC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions during drought conditions.	1	10	CDFG, Mid Peninsula Open Space District, NMFS, NMFS OLE, POST, Private Landowners, San Mateo RCD, SGERC, SWRCB	36.00	36.00				72	Due to the heavy overdraft of water resources from San Gregorio Creek, the impact of a severe drought could be devastating to all lifestages of coho salmon and steelhead in the watershed. Numerous diversions are located throughout the watershed in every major tributary. Although a water master is appointed, the required minimum bypass flows set by the Courts were not based on salmonid requirements. Severe drought, particularly if occurring over a period of two or more years, would likely adversely impact salmonid habitat throughout the watershed and reduce the overall carrying capacity of available habitat. Cost based on stream flow modeling at a cost of $71,825.
SGC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Ensure all diversions in the watershed are in compliance with all applicable laws and policies during drought periods.	1	5	CDFG, NMFS, NMFS OLE, Private Landowners, SWRCB						In-Kind	The SWRCB should conduct periodic sweeps of diversions in San Gregorio Creek to ensure they are in compliance with annual reporting requirements and that annual water usage is accurately reported.
SGC-CCC-24.1.2.3	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated through conservation programs.	2	20	CDFG, NMFS, NMFS OLE, Private Landowners, SWRCB							
SGC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.	3	30	CDFG, NMFS, NMFS OLE, Private Landowners, SWRCB						In-Kind	This recommendation should be considered standard practice.
SGC-CCC-24.1.3.2	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	2	5	CDFG, NMFS, NMFS OLE, Private Landowners, SGERC, SWRCB	10.00					10	Water temperatures during drought will be directly affected by ongoing surface water diversions in San Gregorio Creek and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures. Cost based on temperature monitoring at a cost of $10,000.
SGC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
SGC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	3	2	CDFG Law Enforcement, NMFS OLE						In-Kind	Costs are anticipated to be absorbed into ongoing activities.
SGC-CCC-24.1.5	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SGC-CCC-24.1.5.1	Action Step	Severe Weather Patterns	Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.	3	10	CDFG, NMFS HCD, San Mateo County						In-Kind	Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailor to general San Mateo County constraints. Costs may be higher if new guidelines are developed that do not rely on protocols from past studies.
SGC-CCC-24.1.5.2	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-24.1.5.3	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						TBD	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. A lack of available winter refuge habitat, due in part to lack of access to inundated floodplain or off-channel habitats, has been identified as a limiting factor for coho salmon in the watershed according to Stillwater Sciences et al. (2010). This limiting factor for coho salmon is likely also a limiting factor for steelhead in the watershed, but to a lesser degree. According to Stillwater Sciences et al. (2010), the lower mainstem San Gregorio Creek historically may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. Mainstem channel and low gradient tributary reaches should be assessed to target opportunities to restore floodplain connectivity.
SGC-CCC-24.1.5.4	Action Step	Severe Weather Patterns	Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.	1	100	CalTrans, FEMA, Public, San Mateo County, USACE						In-Kind	Not building flood control projects will not incur expenses. Particular attention should be directed at ensuring substantial future infrastructure is not placed within the historical tidal prism of the estuary.
SGC-CCC-24.1.6	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
SGC-CCC-24.1.6.1	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in San Mateo County.	2	5	CDFG, NMFS HCD, San Mateo County						In-Kind	Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailor to general San Mateo County constraints.
SGC-CCC-24.1.6.2	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalTrans, FEMA, Public, San Mateo County, USACE							Extreme flood events could result in major erosion within upslope locations. Much of the watershed is comprised of erodible geology that would likely impact spawning and rearing habitats when sediment enters the stream channel. Changes and improvements in land use practices will likely lower sediment yield rates following future flooding events. However, much of the watershed is considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions.

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SGC-CCC-24.1.6.3	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	3	10	CalTrans, FEMA, Public, San Mateo County, USACE						In-Kind	Outreach and education are ongoing, and additional costs are expected to be minimal.
SGC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SGC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										
SGC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair estuary water quality conditions for rearing juvenile salmonids.	1	100	CDFG, NMFS, San Mateo County, SWRCB						In-Kind	Aquatic conditions in San Gregorio Creek are likely adversely affected by water diversions -- the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board. Water diversions adversely impact the summer lifestage by reducing flows and available habitat for rearing and feeding in the riverine areas as well as the estuary. Water diversions also extend the duration necessary for conversion to a freshwater lagoon during the summer.
SGC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
													The San Gregorio watershed is adjudicated and a minimum bypass requirement of 2 cfs was established for new diversions. However, this requirement does not apply to existing water diversions, and flows are often less than 2 cfs in summer and fall (Stillwater Sciences et al. 2010). In addition, the CDFG Coho Recovery

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	100	CDFG, NMFS, San Mateo County, SWRCB						In-Kind	Plan (CDFG 2004) states that the prescribed bypass flows are too low to assure viable coho salmon populations. NMFS believes the concerns for coho salmon are applicable to steelhead as well, and that a minimum bypass flow of five cfs be applied to all water diversions, including existing and new wells, riparian pumping, and stream side wells. To reduce the amount of water diverted from the stream and pumped from the alluvial groundwater basin, and potentially maintain summer and fall instream flows, domestic, agricultural, and recreational water conservation strategies should be implemented (Stillwater Sciences et al.2010). Efforts to address the adverse impacts of water diversions could include increased oversight by the SWRCB (and County of San Mateo for ongoing monitoring groundwater wells) for permitted diversions, and enforcement of applicable laws for unpermitted diversions.
SGC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).	2	10	CDFG, Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD, SWRCB							Water diversions reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions. Water diversions are distributed throughout the watersheds many tributaries as well as the mainstem of San Gregorio Creek. These diversions, coupled with poor instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. Notable flow fluctuations are occasionally measured at the USGS San Gregorio stream gauge during low flow periods. For example, flows will drop from approximately one cfs to near zero over a period of a few hours and then return to one cfs several hours later. The cause of these fluctuations is unknown, and although specific effects on instream conditions have not been determined, they are suspected to be detrimental to fish and their habitat. The magnitude of this effect is not currently known, but during below-normal water years the available water supply can be insufficient to meet all the water rights allocated in the watershed and provide instream flows for aquatic species.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Enforce stream flow bypass requirements for all authorized diversions in San Gregorio Creek and its tributaries.	1	100	CDFG, NMFS, SWRCB						In-Kind	A water master has been appointed in the San Gregorio watershed. In time, bypass requirements may change due to findings from instream flow studies.
SGC-CCC-25.1.2.4	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	100	CDFG, Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD, SWRCB						In-Kind	
SGC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
SGC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in San Gregorio Creek.	3	100	CDFG, NMFS, Private Landowners, San Mateo County, SWRCB							
SGC-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	100	CDFG, NMFS, Private Landowners, SWRCB						TBD	An assessment of the number of unscreened or improperly screened diversions needs to occur first.
SGC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
SGC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure water diversions do not impair water temperatures in the San Gregorio Creek.	2	100	CDFG, Farm Bureau, NMFS, Private Landowners, San Mateo County, San Mateo RCD, SWRCB						In-Kind	As part of future 1600 agreement, CDFG should require installation of temperature thermographs upstream and downstream of the diversion. These results should be reviewed on a yearly basis by the SWRCB and CDFG.
SGC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**										
SGC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

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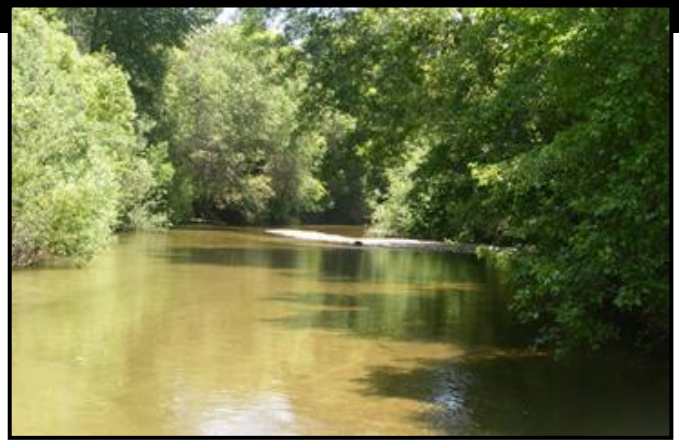
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	2	5	CDFG, SWRCB						In-Kind	Evaluate rates of compliance and overall impact of currently permitted diversion to coho salmon and steelhead survival and recovery. This should be adopted as a standard practice by CDFG. However, full implementation may be limited due to a lack of staffing. In this circumstance, other alternatives should be evaluated.
SGC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	100	SWRCB						In-Kind	Aquatic conditions in San Gregorio Creek are adversely affected by water diversions -- the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board. Water management operations adversely impact almost all coho salmon (and steelhead) life-stages, particularly during drought conditions. Additionally, water diversions reduce freshwater inflow to the estuary and extend the duration necessary for conversion to a freshwater lagoon during the summer. Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in the San Gregorio lagoon by improving water quality. Costs are considered minor due to appointment of a water master per the adjudication. Diversions in San Gregorio Creek and its tributaries, coupled with degraded instream habitat conditions, likely contribute to significant degradation of juvenile rearing opportunities during the summer period. To reduce the amount of water diverted from the stream and pumped from the alluvial groundwater basin, and potentially maintain summer and fall instream flows, domestic, agricultural, and recreational water conservation strategies should be implemented (Stillwater Sciences et al. 2010). Efforts to address the adverse impacts of water diversions could include increased oversight by the SWRCB (and County of San Mateo ongoing monitoring for groundwater wells) for permitted diversions, and enforcement of applicable laws for unpermitted diversions.
SGC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFG, NMFS, SWRCB						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SGC-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Support SWRCB in regulating the use of streamside wells and groundwater.	2	100	CDFG, NMFS, San Mateo County, State Parks, SWRCB, USFWS						0	The number of individual landowners in the watershed who maintain groundwater wells for residential and irrigation water supply is not known. The total number of wells in the watershed between 2006 and 2008, as contained within San Mateo County Environmental Health Division (EHD) records, was estimated at 311 (Table 2-6). The majority of these (79%) are situated in the eastern half of the watershed, which primarily acts as an area of groundwater recharge to the basin aquifer in the valley.

San Lorenzo River

Location	•Santa Cruz County
Watershed Area	•139.0 Square Miles
Potential Habitat	•117.5 Stream Miles
Vegetation	•62% Coniferous forest, 22% Grassland or Shrubland, 16% Urban
Erodability	•Moderate to High
Ownership Patterns	•90% Private; 10% Public
Dominant Land Uses	•Rural Residential, Timber, Agricultural
Housing Density	•High
TMDL Pollutants	•Nutrients, Pesticides, Pathogens, PCBs, Sediment



San Lorenzo River
Photo © USGS

San Lorenzo River Coho Salmon: Nearly Extirpated

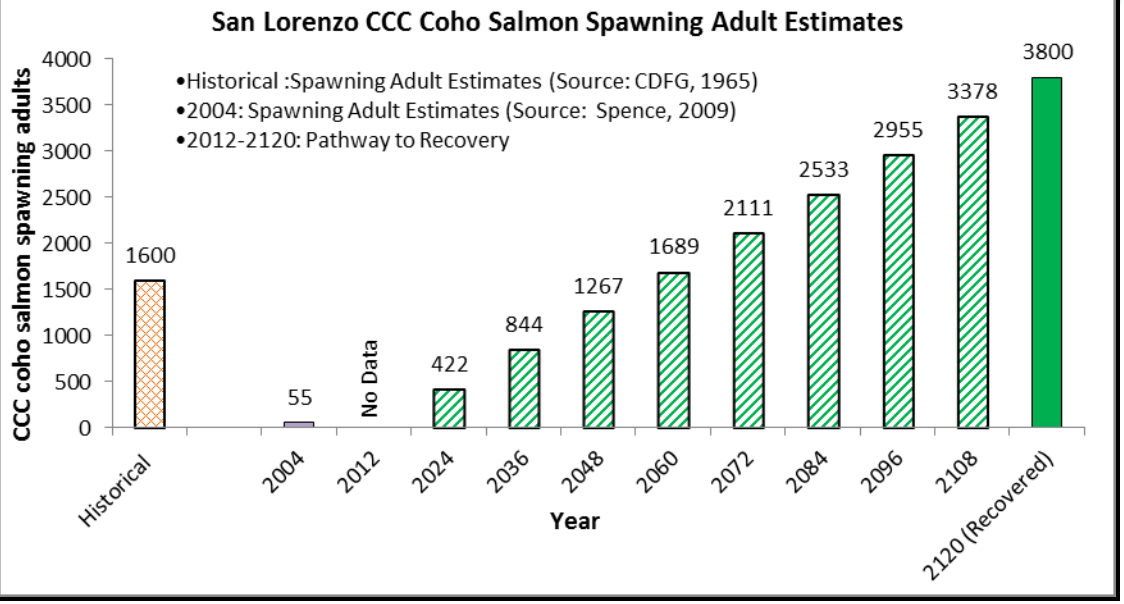
Recovery Goals

- ✓ Implement a monitoring program to evaluate presence and the performance of recovery efforts
- ✓ Continue ongoing monitoring of juveniles

San Lorenzo River Adult Spawner Targets

Downlisting to Threatened
1,900

Recovery
3,800



STEELHEAD: YES
CHINOOK SALMON: NO

San Lorenzo River

Potential Habitat: 117.5 miles
Recovery Target: 3,800 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	POOR	GOOD	GOOD	POOR	POOR	FAIR	POOR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Regulate streamside wells and groundwater
- Re-introduce coho salmon into areas when habitat becomes suitable
- Retain, recruit and actively input large wood into stream
- Restore and protect summer flows
- Hydrologically disconnect and winterize roads

Priority 2 & 3: Long-Term Restoration Actions

- Post interpretive signs to discourage breeching of the lagoon
- Promote off channel storage
- Reduce sediment input
- Develop a plan for water storage and conservation

Recovery Partners

RWQCB

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, KRIS Information System, City of Santa Rosa and Morgan Bond, SWFSC

San Lorenzo River

Potential Habitat: 117.5 miles
Recovery Target: 3,800 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	VERY HIGH	HIGH	HIGH	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM	HIGH	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Ensure all diversions are properly permitted
- Set back future development from streams and floodplains
- Locate new roads away from wetlands and floodplains
- Ensure new construction occurs outside flood prone areas
- Enhance retention and recruitment of LWD

Priority 2 & 3: Long-Term Threat Abatement Actions

- Monitor the river mouth until natural breeching occurs
- Increase stream buffers and improve roads for timber harvest
- Monitor passage at summer dams
- Encourage the use of native plants in landscaping
- Eliminate use of gabion baskets and undersized rock in channels
- Conduct education and outreach

Passage impediment on San Lorenzo River
Photo by D.W. ALLEY & Associates

Conservation Highlights

- The San Lorenzo Valley Water Agency and the County of Santa Cruz are funding annual juvenile abundance surveys
- The Santa Cruz RCD and the California Coastal Conservancy are involved in numerous barrier removal/modification and sediment remediation projects
- The City of Santa Cruz is developing a HCP

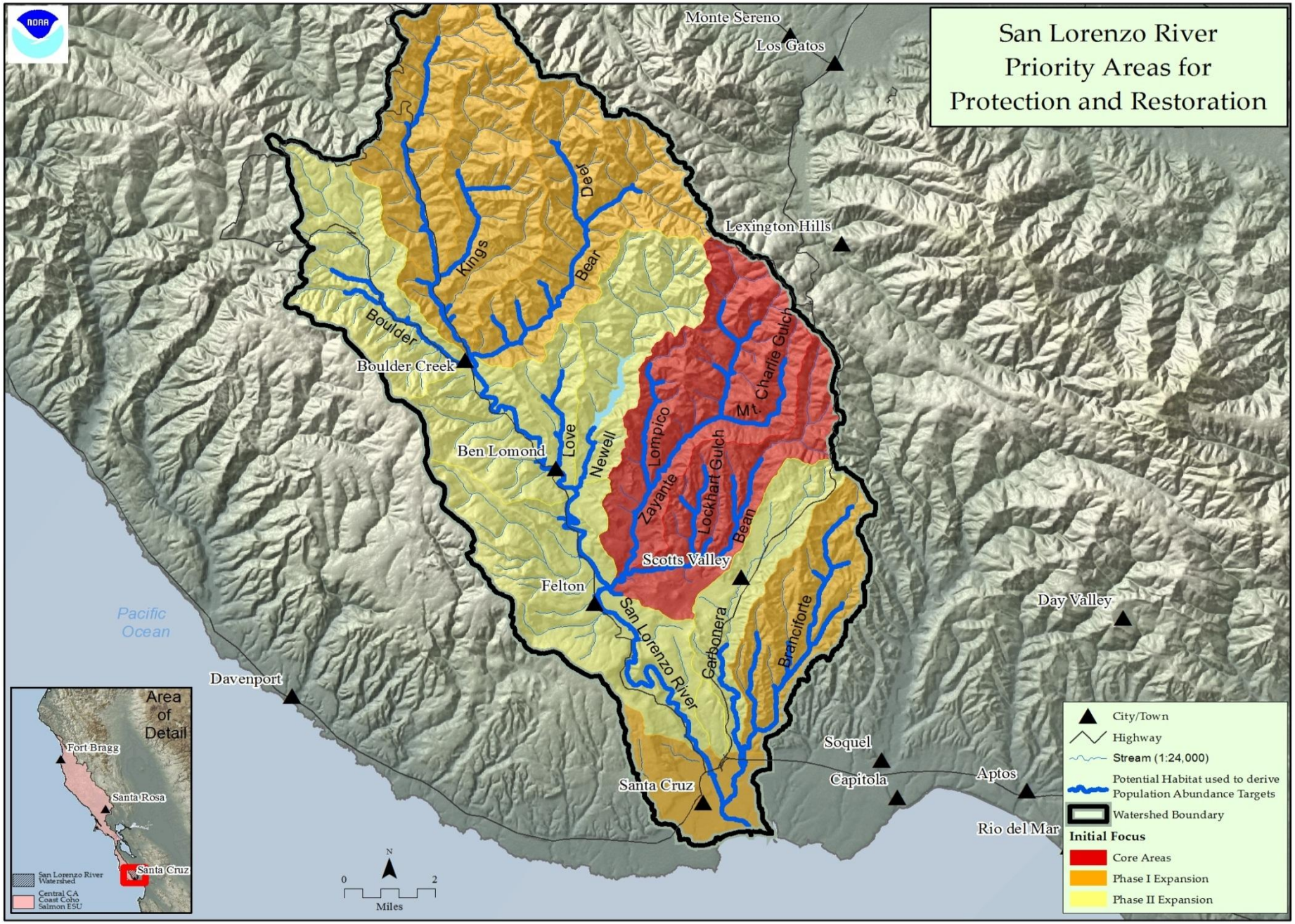


Figure 1: Map of San Lorenzo River

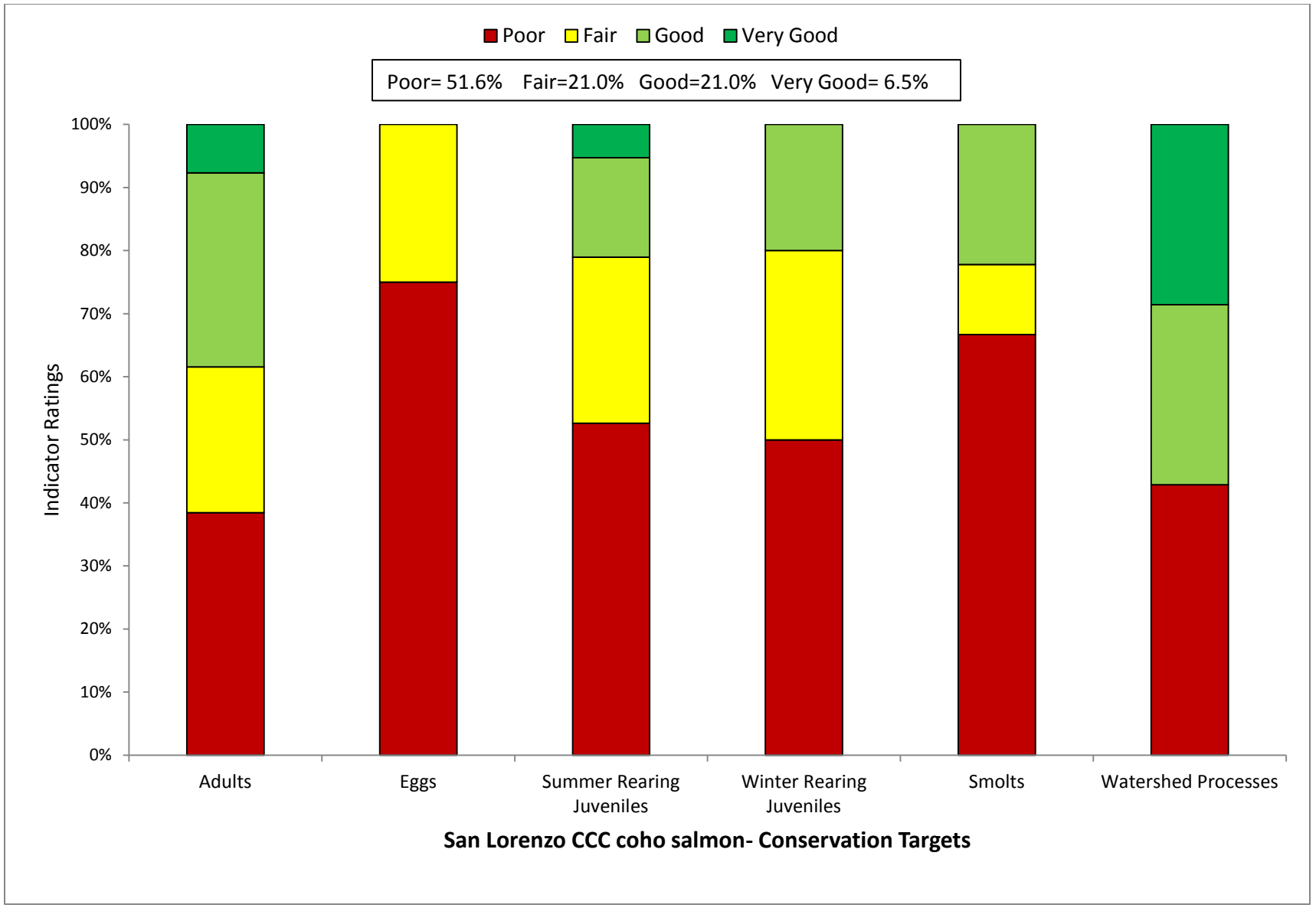


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ San Lorenzo River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**36% streams 52% IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**7% streams 2% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score = 42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**83% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = 58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score = 83**	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**14% streams 5% IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired and not functioning**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**36% streams 68% IP-km (>49% of pools are primary pools)**	Fair	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**36% streams 52% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**7% streams 2% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score >75**	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = 51-75**	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**6.8 Diversions/10 IP-km**	Poor	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**83% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**93% of streams/IP-km with average canopy >85%**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**14% streams 5% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**<50% IP-km (<16 C MWMT)**	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**36% streams 52% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**7% streams 2% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**83% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**14% streams 5% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired and not functioning**	Poor	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**7% streams 2% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**6.8 Diversions/10 IP-km**	Poor	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score >75**	Poor	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**5.69% of Watershed in Impervious Surfaces**	Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.25% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**6% of Watershed in Timber Harvest (in last 13 years)**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**>74% of watershed >1 unit/20 acres**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51 -74%> Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**5.3 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**6.2 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ San Lorenzo River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Medium	Medium
2	Channel Modification	High	Medium	Very High	High	High	Medium	Very High
3	Disease, Predation and Competition	High	-	Medium	Medium	High	Medium	High
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	High	High	Medium	High	High
5	Fishing and Collecting	High	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	Medium	-	Medium	Low	Medium	-	Medium
7	Livestock Farming and Ranching	Low	Low	Medium	Medium	Low	Medium	Medium
8	Logging and Wood Harvesting	Medium	Medium	Medium	High	Medium	Medium	High
9	Mining	Medium	Medium	Medium	Medium	Low	Medium	Medium
10	Recreational Areas and Activities	Medium	Low	Very High	Medium	High	High	High
11	Residential and Commercial Development	Very High	Medium	Very High	Very High	High	High	Very High
12	Roads and Railroads	Very High	High	Very High	Very High	High	Very High	Very High
13	Severe Weather Patterns	High	High	Very High	High	High	Very High	Very High
14	Water Diversion and Impoundments	Medium	Medium	Very High	High	High	Very High	Very High
Threat Status for Targets and Project		Very High	High	Very High	Very High	Very High	Very High	Very High

Central CA Coast Coho ~ San Lorenzo River

ACTIONS FOR RESTORING HABITATS

1. Restoration- Estuary

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).

1.1.1.2. **Action Step:** Remove structures impairing or reducing the historical feeding and salt water transition habitat where feasible and benefits to coho salmon and/or the estuarine environment are predicted.

1.1.1.3. **Action Step:** Remove structures impairing or reducing the historical feeding and salt water transition habit where feasible and benefits to rearing steelhead and/or the estuarine environment are predicted. Evaluate benefits to lagoon tidal prism from modification and/or reduction in the size of the San Lorenzo Park in the City of Santa Cruz.

1.1.2. **Recovery Action:** Reduce frequency of artificial breaching events

1.1.2.1. **Action Step:** Seek State legislation to address liability issues regarding lagoon management.

1.1.2.2. **Action Step:** Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the SLR lagoon.

1.1.2.3. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

1.1.2.4. **Action Step:** Install educational signage along key areas of the estuary to educate the public regarding the importance of estuaries and lagoons for fish and wildlife.

1.1.3. **Recovery Action:** Improve the quality of each estuarine habitat zone

1.1.3.1. **Action Step:** Enhance streambed aquatic cover and substrate in estuarine and transitional reaches of the SLR.

1.1.3.2. **Action Step:** Enhance riverbank shoreline habitat in transitional and estuarine reaches.

1.1.3.3. **Action Step:** Install structures designed to enhance scour, increase residual pool depth and shelter for smolt transition and feeding during the spring.

1.1.4. **Recovery Action:** Increase the rate of lagoon formation and/or freshwater conversion

1.1.4.1. **Action Step:** Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.

1.1.5. **Recovery Action:** Reduce toxicity and pollutants

1.1.5.1. **Action Step:** Continue implementation of sanitary sewer upgrades, sewer maintenance and storm drain maintenance practices.

1.1.5.2. **Action Step:** Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewers systems and storm drains.

1.1.5.3. **Action Step:** Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.

1.1.5.4. **Action Step:** Develop and implement a strategy to eliminate likely water quality impacts from camping and loitering in floodplain areas.

1.1.5.5. **Action Step:** Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.

1.1.5.6. **Action Step:** Consider requiring evaluation and repair of private sewer laterals, particularly in areas prone to high groundwater conditions.

1.1.5.7. **Action Step:** Implement dry weather diversion of storm drain discharge to the sanitary sewer system where other control measures are unsuccessful at reducing bacteria levels.

1.1.5.8. **Action Step:** Regularly clean storm drains and removal of accumulations of silt and organic material, particularly before the first storm of the season.

1.1.5.9. **Action Step:** Encourage Seaside Company to develop and implement a litter abatement program to discourage trash and other debris from entering the River from their parking lot area.

1.1.6. **Recovery Action:** Increase freshwater lagoon elevation during seasonal closures

1.1.6.1. **Action Step:** Evaluate and implement possible structural improvements to maintain water surface elevations during the summer through the late fall in the lagoon.

2. Restoration- Floodplain Connectivity

No species-specific actions were developed.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.

3.1.1.2. **Action Step:** Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.1.3. **Action Step:** Encourage retention and recruitment of large woody debris for all historical salmonid rearing habitats in the San Lorenzo River. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.1.4. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.1.5. **Action Step:** Encourage the County of Santa Cruz to expand large instream wood structure tracking.

3.1.1.6. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.1.2. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.1.2.1. **Action Step:** Target restoration actions in the mainstem reach between the upper Rincon Bend and the Tait Street diversion.

3.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

3.2.1. **Recovery Action:** Improve frequency of primary pools, LWD, and shelter ratings.

3.2.1.1. **Action Step:** Fund a watershed coordinator position.

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions

4.1.1.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.1.1.2. **Action Step:** Promote conjunctive use of water for water projects whenever possible to maintain or restore coho salmon habitat.

4.1.1.3. **Action Step:** Implement a comprehensive stream flow evaluation program to determine instream flow needs for salmonids. Focus initial efforts in the middle reaches of the mainstem San Lorenzo River.

4.1.1.4. **Action Step:** Investigate the potential for expansion of the Scott Valley water reclamation system.

4.1.1.5. **Action Step:** Investigate water recharge possibilities in Scotts Valley quarries.

4.1.1.6. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

4.1.1.7. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

4.1.1.8. **Action Step:** Adopt policies and practices for redevelopment/reconstruction projects to reduce storm water runoff.

4.1.1.9. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.

4.1.1.10. **Action Step:** Promote irrigation efficiency projects for agricultural practices.

4.1.2. **Recovery Action:** Minimize redd scour

4.1.2.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

4.1.3. **Recovery Action:** Reduce the number, conditions, and/or magnitude of diversions

4.1.3.1. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.

4.1.3.2. **Action Step:** Support SWRCB in regulating the use of streamside wells and groundwater.

4.1.3.3. **Action Step:** Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

5.1.1.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Improve access of spawning adults and juveniles

6.1.1.1. **Action Step:** Remediate passage barriers on mainstem San Lorenzo River.

6.1.1.2. **Action Step:** Remediate passage barriers in San Lorenzo River tributaries.

7. Restoration- Pool Habitat

No species-specific actions were developed.

8. Restoration- Riparian

8.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

8.1.1. **Recovery Action:** Protect existing riparian areas

8.1.1.1. **Action Step:** Work with PG&E to ensure practices do not impair riparian areas.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.

9.1.1.2. **Action Step:** Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Lorenzo River.

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Conduct road surveys beginning with inner gorge roads in sandy soils followed by roads in other settings.

9.1.2.2. **Action Step:** Implement sediment reduction efforts on tributaries that deliver sediment directly to the Middle River and on Zayante and Branciforte Creeks.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat determined appropriate by NMFS and CDFG.

10.1.1.2. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

10.2.2. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.2.2.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2.2.2. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.2.3. **Recovery Action:** Increase spawner density

10.2.3.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.2.3.2. **Action Step:** Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery.

10.3. **Objective:** Address other natural or manmade factors affecting the species' continued existence

10.3.1. **Recovery Action:** Increase spawner density

10.3.1.1. **Action Step:** Supplement existing populations where appropriate, while minimizing departure from the populations historical genetic profile. Evaluate feasibility and benefits of constructing and operating a conservation hatchery for the propagation of CCC coho salmon. Construct and operate the facility is determined to be feasible and beneficial.

10.3.1.2. **Action Step:** Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve instream temperature conditions

11.1.1.1. **Action Step:** Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.

11.1.2. **Recovery Action:** Reduce toxicity and pollutants.

11.1.2.1. **Action Step:** Implement improved wastewater disposal management though the San Lorenzo Wastewater Management Plan.

11.1.2.2. **Action Step:** Work with stable owners to reduce nitrate discharge by at least 50%

11.1.2.3. **Action Step:** Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

11.1.3.2. **Action Step:** Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

13.1.1.1. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.1.1.2. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.

13.1.1.3. **Action Step:** Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.

13.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity

13.1.2.1. **Action Step:** Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.

13.1.2.2. **Action Step:** Encourage the City of Santa Cruz to provide adult and smolt passage through the Lower San Lorenzo River and the flood control channel on Branciforte Creek according to recommendations in the Lower San Lorenzo River and Lagoon Management Plan.

13.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.2.1. **Recovery Action:** Prevent impairment to habitat complexity

13.2.1.1. **Action Step:** Encourage the Corps of Engineers to review and modify maintenance requirements on the lower San Lorenzo River in the light of designated Critical Habitat obligations.

13.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

13.2.2.1. **Action Step:** Modify county regulatory and planning processes to eliminate provisions allowing reconstruction, expansion, or (in some situations) channel stabilization within the 100-year flood prone zones.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

14.1.1.1. **Action Step:** Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.

14.1.1.2. **Action Step:** Prevent spread of the New Zealand mudsnail from the San Lorenzo River to other adjacent watersheds.

14.2. **Objective:** Address disease or predation

14.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.2.1.1. **Action Step:** Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.

14.2.1.2. **Action Step:** Evaluate possible impacts of annual planting of Chinook salmon from Central Valley hatcheries into Monterey Bay to coho salmon survival and abundance.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.5. **Action Step:** Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the San Lorenzo River watershed (and all other watersheds in the County).

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy or existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.

16.1.1.2. **Action Step:** Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.

16.1.1.3. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for the San Lorenzo River.

16.1.1.4. **Action Step:** Install/construct permanent signs at all major public access points along the San Lorenzo River that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).

16.1.1.5. **Action Step:** Increase oversight on anglers fishing in the San Lorenzo River Gorge to ensure compliance with fishing regulations.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to habitat complexity

19.1.2.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

19.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.3.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.3.2. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.3.3. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.4.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.4.2. **Action Step:** Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.

19.1.5. **Recovery Action:** Prevent increased landscape disturbance

19.1.5.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc).

19.1.6. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, etc.)

19.1.6.1. **Action Step:** All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, by hydrologically disconnected to prevent sediment runoff and delivery to streams.

19.1.6.2. **Action Step:** Avoid road construction in riparian zones

19.1.6.3. **Action Step:** All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

19.2.1.1. **Action Step:** Increase buffer widths on Class II streams.

19.2.2. **Recovery Action:** Prevent increased landscape disturbance

19.2.2.1. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.

19.2.2.2. **Action Step:** Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of coho salmon

19.2.2.3. **Action Step:** Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).

19.2.2.4. **Action Step:** Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.

19.2.2.5. **Action Step:** Erosion control measures and road maintenance should be maintained during the entire period between re-entrys.

19.2.2.6. **Action Step:** Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

21.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

21.1.1. **Recovery Action:** Prevent impairment to passage and migration

21.1.1.1. **Action Step:** Remove all existing summer dams that create a passage impediment to migrating adults or juveniles.

21.1.1.2. **Action Step:** Require monitoring of adult/juvenile passage at summer dam passage facilities.

21.1.1.3. **Action Step:** Implement the most recent NMFS' Guidelines for Summer Dams for all new summer dams seeking 1600 Agreement or Corps 404 permit.

21.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

21.1.2.1. **Action Step:** Develop a Road Sediment Reduction Plan for parklands. Plan should prioritize sites and outline implementation and timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.

21.1.2.2. **Action Step:** Educate users (including mountain bikers, hikers, ORV users, etc) to help prevent or control erosion and sediment problems along the stream.

21.1.2.3. **Action Step:** Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

21.2. **Objective:** Address inadequacies of regulatory mechanisms

21.2.1. **Recovery Action:** Prevent impairment to water quality

21.2.1.1. **Action Step:** Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.1.1. **Action Step:** New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.

22.1.1.2. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

22.1.1.3. **Action Step:** Provide incentives for water storage and water retention programs and other conservation devices

22.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

22.1.2.1. **Action Step:** Encourage Santa Cruz County to assess the effectiveness of Sensitive Habitat Ordinance and implement improved performance measures as necessary.

22.1.2.2. **Action Step:** Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.

22.1.2.3. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.

22.1.2.4. **Action Step:** Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.

22.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

22.1.3.1. **Action Step:** Design new development to allow streams to meander in historical patterns.

22.1.3.2. **Action Step:** Encourage Santa Cruz County to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.

22.1.3.3. **Action Step:** Evaluate watershed infrastructure at high risk of flooding.

22.1.3.4. **Action Step:** Encourage establishment of conservation easements on floodplain habitat in key stream reaches.

22.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.1.4.1. **Action Step:** Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

22.1.5. **Recovery Action:** Prevent increased landscape disturbance

22.1.5.1. **Action Step:** Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.5.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.2.1.1. **Action Step:** Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.

22.2.2. **Recovery Action:** Prevent impairment to water quality

22.2.2.1. **Action Step:** Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.

22.2.2.2. **Action Step:** Continue efforts to address failing septic systems in rural areas and other water quality impairments

22.2.2.3. **Action Step:** Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo River Watershed.

22.2.2.4. **Action Step:** Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.

22.2.3. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.3.1. **Action Step:** Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.

22.2.3.2. **Action Step:** As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.

22.2.3.3. **Action Step:** Support the development and implementation of regulations for activities that adversely impact groundwater recharge.

22.2.4. **Recovery Action:** Prevent increased landscape disturbance

22.2.4.1. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.4.2. **Action Step:** Discourage Counties from rezoning forestlands to rural residential.

22.2.4.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.2.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

22.2.5.1. **Action Step:** Santa Cruz County and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

22.2.5.2. **Action Step:** Minimize redevelopment within the 100 year floodplain.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

23.1.1.1. **Action Step:** Assess and redesign transportation network to minimize road density and maximize transportation efficiency.

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.2.2. **Action Step:** Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.

23.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.3.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.3.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.3.3. **Action Step:** Reduce erosion from mainline timber harvest roads.

23.1.3.4. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.3.5. **Action Step:** Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.

23.1.3.6. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.3.7. **Action Step:** Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.1.3.8. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.3.9. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.3.10. **Action Step:** Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.

23.1.3.11. **Action Step:** Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.

23.1.3.12. **Action Step:** Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.

23.1.3.13. **Action Step:** Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.

23.1.3.14. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.4. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.4.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.1.5. **Recovery Action:** Prevent impairment to passage and migration

23.1.5.1. **Action Step:** Target low flow crossings in Branciforte Creek for removal.

23.1.5.2. **Action Step:** All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.

23.1.5.3. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.6. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.6.1. **Action Step:** Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.1.6.2. **Action Step:** Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.

23.2.1.2. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

23.2.2. **Recovery Action:** Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.

23.2.2.1. **Action Step:** Educate road associations and informal road maintenance collectives to the benefit of integrating into the Santa Cruz County Service Area process.

23.2.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.3.1. **Action Step:** Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.

23.2.3.2. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.

23.2.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.4.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.4.2. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.2.4.3. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

23.2.4.4. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

24.1.1.1. **Action Step:** Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).

24.1.1.2. **Action Step:** Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).

24.1.1.3. **Action Step:** Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.

24.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.2.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions.

24.1.2.2. **Action Step:** Ensure all water diversions in the watershed are in compliance with all applicable laws and policies during dry and critically dry water years.

24.1.2.3. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.

24.1.2.4. **Action Step:** Prohibit filling of all recreational instream summer dams during drought periods.

24.1.3. **Recovery Action:** Implement performance standards in Stormwater Management Plans.

24.1.3.1. **Action Step:** Ensure tolerable water temperatures are maintained during drought periods.

24.1.4. **Recovery Action:** Prevent impairment to passage and migration

24.1.4.1. **Action Step:** Manage Loch Lomond reservoir to maintain suitable rearing conditions in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).

24.1.4.2. **Action Step:** Evaluate City of Santa Cruz's water right for Loch Lomond Reservoir to determine whether dam re-operation could result in benefits to salmonids in the watershed.

24.1.4.3. **Action Step:** Work with CDFG, County of Santa Cruz, municipalities (including all water districts in the San Lorenzo watershed), and knowledgeable biologists to develop emergency rules and adopt implementation agreements that will allow operations to continue and protect critical coho lifestages.

24.1.4.4. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.

24.1.4.5. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.

24.1.4.6. **Action Step:** Evaluate performance of all existing fish ladders on the San Lorenzo River to pass migrating fish during drought and high flow conditions.

24.1.5. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.5.1. **Action Step:** Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.

24.1.5.2. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

24.1.5.3. **Action Step:** Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.

24.1.6. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.6.1. **Action Step:** Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in Santa Cruz County.

24.1.6.2. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

24.1.6.3. **Action Step:** Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.6.4. **Action Step:** Continue implementation of the County of Santa Cruz's Grading and Erosion Control Ordinances.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater, legal and illegal) do not further impair estuary water quality conditions for rearing juvenile salmonids.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).

25.1.2.3. **Action Step:** Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).

25.1.2.4. **Action Step:** Investigate feasibility of desalination to prevent stream dewatering and ensure a more stable source of water overtime.

25.1.2.5. **Action Step:** Encourage programs and entrepreneurial efforts by private organizations to purchase easements on water rights for maintenance of adequate surface flows via petition change of use and Section 1707.

25.1.2.6. **Action Step:** Investigate the potential for expansion of the Scott Valley water reclamation system.

25.1.2.7. **Action Step:** Investigate water recharge possibilities in Scotts Valley quarries as a water conservation strategy.

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in the San Lorenzo River.

25.1.3.2. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.4.1. **Action Step:** Ensure water diversions do not impair water temperatures in the San Lorenzo River.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Develop and enforce stream flow bypass requirements for diversions in the San Lorenzo River and its tributaries Zayante, Fall, Bear, Boulder, and Branciforte creeks (CDFG 2004).

25.2.1.2. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).

25.2.1.3. **Action Step:** Petition the SWRCB to declare the Santa Margarita aquifer fully appropriated.

25.2.1.4. **Action Step:** Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.

25.2.1.5. **Action Step:** Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.

25.2.1.6. **Action Step:** Prohibit new or increased summer diversions.

25.2.1.7. **Action Step:** Work with the City of Santa Cruz (and other major diverters) to minimize impacts of their diversions.

25.2.1.8. **Action Step:** Work with the San Lorenzo Valley Water Agency to evaluate potential impacts to stream flow resulting from surface water diversions and timing of diversions. Encourage the San Lorenzo Valley Water Agency to adopt conservative protocols regarding yearly transition from surface water diversions to groundwater pumping.

25.2.1.9. **Action Step:** Encourage Lompico Water District to come into compliance with CDFG streambed alteration requirements.

25.2.1.10. **Action Step:** Identify source of dewatering in Carbonera Creek near the City of Scotts Valley.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ San Lorenzo River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
SLR-CCC-1.1.1.1	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).	3	30	CalTrans, CDFG, City of Santa Cruz, Santa Cruz RCD	518	518	518	518	518	3,110	Lower priority for coho salmon than steelhead but will benefit smolt transition and adult upmigration. The San Lorenzo estuary was reduced in size following urban development and flood control efforts (by approximately 80% of its historical size), which led to degraded rearing conditions for juvenile salmonids. Urban development from the late 1800s to 1955 filled in the historical tidal prism, which narrowed the river bed (Swanson Hydrology & Geomorphology et al., 2002). Following predictable high flow events that led to flooding in the City of Santa Cruz in 1955, the lower San Lorenzo River was leveed, straightened, and deepened. All the riparian vegetation was removed and the stream banks were hardened with rip rap (Mount 1995). The lagoon and estuary were narrowed considerably by the levee project, and a large island was eliminated (Swanson Hydrology & Geomorphology et al., 2002). These alterations reduced the quantity and quality of available estuarine habitat important for juvenile rearing. Cost based on increasing 10 acres of estuary habitat at a rate of $310,216/acre. Costs of implementation will likely be significant. A new parking area may need to be constructed. This action will result in direct benefits for year-round rearing for federally listed CCC steelhead and tidewater goby, smolt transition for CCC coho salmon and benefit overall water quality in the lagoon. Benefits to CCC coho will be directed at smolt outmigration in preparation for ocean entry. Benefits are anticipated to be achieved by increasing the size of the historical tidal prism which will increase the total quantity of available rearing habitat. Recommendation and cost estimate developed from the Lower San Lorenzo Urban River Plan (City of Santa Cruz 2003). Evaluate benefits to lagoon tidal prism from modification and/or reduction in the size of Santa Cruz Boardwalk Amusement Park's parking lot. Costs will be significant because the parking lot is protected by a levee which would also need to be deconstructed and relocated in order to provide protection for other adjacent residences and businesses. New levees would need be

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-1.1.1.2	Action Step	Estuary	Remove structures impairing or reducing the historical feeding and salt water transition habitat where feasible and benefits to coho salmon and/or the estuarine environment are predicted.	3	30	CA Coastal Commission, CDFG, City of Santa Cruz, Private Landowners, USACE, USFWS						TBD	constructed. It is likely that the San Lorenzo estuary could be restored to a semblance of its biological potential through a focused and comprehensive effort, particularly if actions are focused on enhancing the estuarine reach as defined in the Lower San Lorenzo River & Lagoon Management Plan (Swanson Hydrology & Geomorphology et al., 2002). Partial cost accounted for in restore estuarine habitat. Cost to acquire park cannot be determined and will be based on current market value. Partial cost accounted for in estuarine habitat. Cost of acquiring the parking cannot be determined.
SLR-CCC-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
SLR-CCC-1.1.2.1	Action Step	Estuary	Seek State legislation to address liability issues regarding lagoon management.	3	10	City of Santa Cruz, Public						0	Recommendation from the Lower San Lorenzo River and Lagoon Management Plan (2002).
SLR-CCC-1.1.2.2	Action Step	Estuary	Post and provide financial rewards to individuals who identify persons who illegally breach the sandbar to the SLR lagoon.	2	100	CDFG Law Enforcement, City of Santa Cruz, County DA, NMFS OLE						TBD	Financial rewards may act as a deterrent to those involved in the unauthorized breaching of the lagoon. The lagoon has a long history of illegal breaches and to date no one has been successfully prosecuted for this activity. Breaching is believed to result in significant adverse impacts to salmonids rearing in the lagoon. Successful prosecution would likely act as a major deterrent to future individuals who may attempt to breach the sandbar.
SLR-CCC-1.1.2.3	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	5	CDFG, City of Santa Cruz	3.00					3	When the sandbar to the San Lorenzo River estuary closes during the summer and water backs behind the sandbar to form a lagoon, conditions are set for the creation of optimal salmonid rearing habitat. Even though, for reasons listed above, current conditions are compromised from historical conditions, the lagoon still provides some important opportunities for juvenile rearing. However, unauthorized and illegal breaching of the sandbar is a frequent occurrence that can drain most of the lagoon and flush salmonids into the ocean prematurely, which likely results in death of an unknown percentage of the population. Artificial sandbar breaching has often occurred multiple times since at least 2000 during the late-summer/early-fall. Cost for signs varies depending on materials and content. Cost for signs estimated at $1,000/sign. Assume a minimum of 3 for lagoon.
SLR-CCC-1.1.2.4	Action Step	Estuary	Install educational signage along key areas of the estuary to educate the public regarding the importance of estuaries and lagoons for fish and wildlife.	2	5	City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, USACE						5	Signage should consist of a series of signs in areas with high public use. Signs should explain the importance of estuaries to water quality and endangered species.
SLR-CCC-1.1.3	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-1.1.3.1	Action Step	Estuary	Enhance streambed aquatic cover and substrate in estuarine and transitional reaches of the SLR.	3	15	CDFG, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, USACE	207.00	207.00	207.00			621	Recommendation from the Lower San Lorenzo River and Lagoon Management Plan (Stillwater Sciences et al. 2002). This recommendation includes installations of two types of structures: (1) log/boulder structures and (2) cobble and cattail bulrush structures. Cost based on treating 2 acres of estuarine habitat (assume 5% of current estuary extent) at a rate of $310,216/acre.
SLR-CCC-1.1.3.2	Action Step	Estuary	Enhance riverbank shoreline habitat in transitional and estuarine reaches.	2	10	CDFG, City of Santa Cruz, Santa Cruz RCD, USACE							Shoreline conditions are degraded in aforementioned reaches due to a lack of vegetation and rooted soil mass in the banks and straight rock rip rap slopes, particularly below Riverside Ave. Recommendations were proposed in the Lower San Lorenzo River and Lagoon Management Plan (Stillwater Sciences et al. 2002): Cost accounted for in enhance streambed aquatic cover.
SLR-CCC-1.1.3.3	Action Step	Estuary	Install structures designed to enhance scour, increase residual pool depth and shelter for smolt transition and feeding during the spring.	3	20	CDFG, City of Santa Cruz, IWRP, Santa Cruz RCD, USACE						TBD	Costs may vary depending on the total number of structures and necessary engineering. Permitting costs are anticipated to be negligible to likely use of programmatic permits. Cost likely accounted for in above action steps.
SLR-CCC-1.1.4	Recovery Action	Estuary	Increase the rate of lagoon formation and/or freshwater conversion										
SLR-CCC-1.1.4.1	Action Step	Estuary	Work with SWRCB to ensure all permitted diversions are in compliance with water diversion permit obligations and all other applicable laws.	2	5	CDFG, City of Santa Cruz, NMFS, SWRCB						In-Kind	Work would entail SWRCB reviewing all existing water diversions; contacting and educating diverters who are not in compliance with existing permits and licenses. It is likely that some diverters will require more time and interaction on the part of the SWRCB to bring into compliance which is reflected in the tentative cost estimate.
SLR-CCC-1.1.5	Recovery Action	Estuary	Reduce toxicity and pollutants										
SLR-CCC-1.1.5.1	Action Step	Estuary	Continue implementation of sanitary sewer upgrades, sewer maintenance and storm drain maintenance practices.	3	100	City of Santa Cruz						In-Kind	Maintain a high level of oversight and maintenance for sewer lines which have a higher probability of overflow or leakage. Currently, the City of Santa Cruz has a good sewer line maintenance program, with prompt response to spills, documentation of chronic problem areas, and scheduling of preventative cleaning and maintenance for problem areas.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-1.1.5.2	Action Step	Estuary	Conduct follow-up monitoring of bacteria levels in storm drains and investigate sewer and storm drain conditions in locations where storm drains have high bacteria levels. Investigate and correct infiltration and illicit connections between sanitary sewers systems and storm drains.	3	5	City of Santa Cruz	15.00					15	Follow up monitoring of storm drain outlets and wet wells should be conducted to verify whether the same storm drains still have high levels and whether there may be other sources of contamination, particularly during dry weather conditions. Monitoring of water level, sand bar condition, tidal affect, flow, temperature, salinity and dissolved oxygen should be done to better characterize overall lagoon water quality. Measurement at various depths in the water column should be done to assess the occurrence of water stratification. Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume a minimum of 3 for estuary habitat. Additional water quality monitoring parameters could increase the cost of this recommendation. Cost does not account for maintenance or data management.
SLR-CCC-1.1.5.3	Action Step	Estuary	Reduce other sources of bacterial contamination through education, ordinance, and agency practices for proper management of pet waste, garbage, storm drain inlets, and food facilities.	3	30	City of Santa Cruz						TBD	Maintain ongoing programs for prompt cleanup of sewage spills and correction of problems with private sewer laterals that cause chronic spills. Water quality data collected in the lagoon reveal degraded water quality parameters that likely adversely affect juvenile steelhead. Swanson Hydrology & Geomorphology et al., (2002) reported very low dissolved oxygen levels and water temperatures in the ranges lethal to steelhead. The Santa Cruz County Environmental Health Department has collected monthly water quality samples in coastal estuaries throughout the county. These data indicate the San Lorenzo lagoon has significantly elevated levels of nitrogen compared to Aptos and Soquel lagoons (CWC and SHG 2003). Elevated nutrient input (from upstream anthropogenic landuse practices), contributes to eutrophication and anoxic events, combined with reduced freshwater inflow (due to upstream diversions) and compromised water circulation patterns due to reduced tidal prism, act synergistically to create very poor water quality conditions for rearing juvenile salmonids.
SLR-CCC-1.1.5.4	Action Step	Estuary	Develop and implement a strategy to eliminate likely water quality impacts from camping and loitering in floodplain areas.	3	50	City of Santa Cruz						In-Kind	This is a complicated effort that will need to involve community leaders, law enforcement, and homeless services providers.
SLR-CCC-1.1.5.5	Action Step	Estuary	Implement a comprehensive urban runoff management program to reduce dry weather and wet weather pathogen levels in urban and suburban areas.	3	100	City of Santa Cruz							Implementation of this practice would include measures such as maintenance of stenciled storm drain warnings, maintaining sweeping programs, encouraging residents and businesses to prevent discharge of anything but storm water into the storm drain system, encouraging pet owners to collect and properly dispose of pet waste, and reduction of non-native waterfowl, such as domestic geese could improve water quality.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-1.1.5.6	Action Step	Estuary	Consider requiring evaluation and repair of private sewer laterals, particularly in areas prone to high groundwater conditions.	3	100	City of Santa Cruz, Santa Cruz County						TBD	Consider providing for testing of private laterals and correction at time of sale and/or in areas subject to contamination by subsurface sewage leakage. Although the City of Santa Cruz has upgraded most of its sewer mains, the potential remains for leakage from private laterals in poor condition. Some jurisdictions have implemented programs for inspection or testing and upgrade at time of property transfer. This would reduce dry weather leakage and wet weather infiltration.
SLR-CCC-1.1.5.7	Action Step	Estuary	Implement dry weather diversion of storm drain discharge to the sanitary sewer system where other control measures are unsuccessful at reducing bacteria levels.	3	10	City of Santa Cruz							Control of sewer leaks and other sources of bacterial contamination requires considerable effort and expense. Even with the best control efforts, storm drains may continue to have elevated bacteria levels. In many cases a simple solution is to divert the dry weather and first flush discharge to the sanitary sewer system. The sewer system and treatment plant will always have substantial excess capacity during the summer and early winter before the wet weather infiltration increases. In some cases flow can be diverted with a weir that allows peak storm flows to continue to discharge to the River. In other cases, the storm drain may need to be physically blocked, with a pump system installed to periodically pump the contents of the backed up storm drain to the sanitary system. The City already does this with the discharge from Neary Lagoon, and has done it several times on a temporary basis in the lower River area. This should again be considered for dealing with storm drains with very high bacteria levels, particularly if efforts are pursued to maintain the freshwater in the lagoon at an elevated level.
SLR-CCC-1.1.5.8	Action Step	Estuary	Regularly clean storm drains and removal of accumulations of silt and organic material, particularly before the first storm of the season.	3	100	City of Santa Cruz						0	The City of Santa Cruz has implemented a program of wet well and catch basin cleaning in recent years using their sewer vacuum trucks. Tremendous volumes of material have been removed and transported to the sewage treatment plant and landfill for disposal. Improvement in water quality in discharge water has been reported.
SLR-CCC-1.1.5.9	Action Step	Estuary	Encourage Seaside Company to develop and implement a litter abatement program to discourage trash and other debris from entering the River from their parking lot area.	3	100	City of Santa Cruz, Private Landowners						In-Kind	This recommendation originated from the San Lorenzo Urban River Plan (City of Santa Cruz 2003).
SLR-CCC-1.1.6	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-1.1.6.1	Action Step	Estuary	Evaluate and implement possible structural improvements to maintain water surface elevations during the summer through the late fall in the lagoon.	2	10	CA Coastal Commission, City of Santa Cruz, IWRP, USACE	100.00	100.00				200	Evaluation should include an analysis regarding the feasibility of installing a flume at the mouth of the SLR similar to the nearby flume at the mouth of Soquel Creek and maintained on a yearly basis by the City of Capitola. Cost estimate is for evaluation only, implementation costs cannot be estimated at this time but may exceed $200,000 or more depending on availability of information and concerns from the public and adjacent landowners. Yearly cost of operation by the City of Capitola for Soquel ranges between 70-80K/year. The 1989 San Lorenzo River Enhancement Plan indicated a flume was designed and this existing design may suffice. Cost estimate is based on review of potential new information and regulatory review for the flume. Permitting complication may arise due to concerns regarding newly listed species and issues pertaining to the Corps levees.
SLR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
SLR-CCC-3.1.1.1	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	10	CDFG, City of Santa Cruz, IWRP, NOAA RC, NRCS, Santa Cruz County, Santa Cruz RCD						In-Kind	According to NHI (2010) California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. This is particularly true in the streams in the Santa Cruz Mountains which contain little of the low-gradient, wide-valley streams that provide productive rearing habitat for salmonids. Thus, the role of large wood in these steeper streams was, in all likelihood, absolutely essential for providing refuge habitat during high flow events in winter, because there were fewer opportunities for off-channel habitat refuges (Moyle et al., 2008). An education program should initially be directed at landowners along important stream reaches where large wood removal has been identified as an ongoing concern by the resource agencies and the County of Santa Cruz. . The recommendation is based on ongoing efforts throughout the ten year period. Education effort would include workshops, mailings, fliers, signage, and focused presentations. Costs could be somewhat minimized through the use of existing materials already created by the RCD and County.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-3.1.1.2	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	2	10	CalFire, CalTrans, CDFG, IWRP, NRCS, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, State Parks, USACE	315.00	315.00				630	Data on LWD quantity are lacking for the San Lorenzo but the lack of functional instream wood was noted as the primary limiting factor in regard to escape cover for rearing juveniles in the watershed (Alley et al., 2004). Rearing habitat quality in most tributaries is limited by the paucity of deep pools with adequate cover. Low abundances of LWD in the San Lorenzo River is likely the result of removal by adjacent landowners and the County of Santa Cruz. Cost based on treating 22 miles (assume 1 project/mile in 50% High IP) at a rate of $28,500/mile. SLR has136 miles of IP habitat but it is assumed that many reaches will not be treated due to (often erroneous) concerns over impacts to existing infrastructure and flood capacity issues. Costs will be higher if engineered large wood placement approaches are used. Cost to implement ELJ for 22 miles of stream is $2,536,089. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody debris should be targeted to reach density and volume outlined in the Viability table in this document. Additional and very significant cost savings would be realized if natural recruitment into the SLR was allowed to stay in place.
SLR-CCC-3.1.1.3	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical salmonid rearing habitats in the San Lorenzo River. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CDFG, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	Cost savings would be significant. Currently a significant amount of large woody material is removed without proper authorization in the San Lorenzo River.
SLR-CCC-3.1.1.4	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	2	100	CDFG, City of Santa Cruz, Santa Cruz County, Santa Cruz RCD, State Parks						In-Kind	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure.
SLR-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage the County of Santa Cruz to expand large instream wood structure tracking.	2	10	Santa Cruz County						In-Kind	Additional tracking efforts will provide greater certainty to regulatory agencies and land owners in regard to potential threats and benefits posed by instream woody debris.
SLR-CCC-3.1.1.6	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	20	CalFire, Private Landowners, State Parks	214.00	214.00	214.00	214.00		856	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely or insignificant to downstream reaches. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost for treating 6.6 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,621/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
SLR-CCC-3.1.2.1	Action Step	Habitat Complexity	Target restoration actions in the mainstem reach between the upper Rincon Bend and the Tait Street diversion.	2	10	CDFG, City of Santa Cruz, RWQCB, Santa Cruz County, State Parks	50.00	50.00				100	This area is low gradient and accessible to adult coho salmon during drier water years. Growth potential may be good (although temperatures may be high), is relatively unconfined with deep pools where coho juveniles have been detected in the past. Enhancement opportunities are high at the heads of some of the deeper pools.
SLR-CCC-3.2	**Objective**	**Habitat Complexity**	**Address other natural or manmade factors affecting the species' continued existence**										
SLR-CCC-3.2.1	Recovery Action	Habitat Complexity	Improve frequency of primary pools, LWD, and shelter ratings.										
SLR-CCC-3.2.1.1	Action Step	Habitat Complexity	Fund a watershed coordinator position.	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, CalTrans, CDFG, City of Santa Cruz, City of Scotts Valley, IWRP, Lompico Water District, NMFS, NOAA RC, Private Landowners, Red Tree, Redwood Empire, Roaring Camp Railroad, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks, USFWS	350.00	350.00				700	A watershed coordinator is necessary in the San Lorenzo River watershed due to 1) the large number of small landowners adjacent to important watercourses and 2) multiple water agencies, and governmental jurisdictions that often work in a limited and uncoordinated fashion in regard to restoration activities. A coordinator should be able to work with various stakeholders to facilitate rapid implementation of high priority restoration and habitat enhancement projects. A watershed coordinator should have a thorough understanding of social and environmental constraints and opportunities in the San Lorenzo River. A qualified coordinator will be well versed in various State, County, and Federal permitting requirements and local issues and concerns with the various constituencies.
SLR-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-4.1.1.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	20	CDFG, Lompico Water District, NOAA RC, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, SWRCB, Trout Unlimited							Promoting these type of projects will require a sustained effort to target willing landowners in critical stream reaches. Incentive programs devised by the numerous water agencies in the San Lorenzo River for individual rate payers could result in rapid acceptance of these types of water conservation programs.
SLR-CCC-4.1.1.2	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore coho salmon habitat.	2	10	CDFG, City of Santa Cruz, City of Scotts Valley, IWRP, NRCS, Private Landowners, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, Trout Unlimited							Highlighting these issues will likely require the development of MOAs between water users. Conjunctive management of water resources, utilizing surface water and groundwater, in the Scotts Valley/Santa Cruz/Soquel area could meet the current winter demand of the local water purveyors and provide enough surplus water to slowly reverse the overdraft conditions in the major groundwater basins. The benefits of conjunctive use include providing a reliable supplemental supply, replenishment of depleted groundwater basins, and improvements to fisheries habitat. In the long term, if groundwater basins recover sufficiently, additional groundwater could be provided to local residents to provide supplemental supply during dry water years.
SLR-CCC-4.1.1.3	Action Step	Hydrology	Implement a comprehensive stream flow evaluation program to determine instream flow needs for salmonids. Focus initial efforts in the middle reaches of the mainstem San Lorenzo River.	2	10	CDFG, City of Santa Cruz, IWRP, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB, Trout Unlimited							Program can likely leverage off other assessment efforts in the San Lorenzo River watershed. Due to the heavy extraction of water from the river, site specific studies should be conducted to ensure adequate instream flow targets are established for all life stages. Studies should include determining critical flow levels for stream reaches impacted by diversions, both future and current diversions. Critical flow values would include minimum bypass flow requirements for upstream adult migration during winter months and rearing habitat conditions in the summer and fall months. Additionally, exceedence probability curves to predict late summer flow conditions according to parameters established by (Alley et al., 2004) would also be needed.
SLR-CCC-4.1.1.4	Action Step	Hydrology	Investigate the potential for expansion of the Scott Valley water reclamation system.	3	20	City of Scotts Valley, Santa Cruz County						In-Kind	This investigation is occurring as part of the County of Santa Cruz conjunctive use evaluation efforts. Scotts Valley is located above the anadromous portions of the San Lorenzo River watershed. Water savings in Scott Valley should result in increased flow into San Lorenzo River tributaries.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-4.1.1.5	Action Step	Hydrology	Investigate water recharge possibilities in Scotts Valley quarries.	3	20	NMFS, Santa Cruz County, SWRCB, USFWS						In-Kind	Aquifer recharge through the quarries should have the stated goal of replenishing overdrawn aquifers and be contingent on not facilitating additional development in the watershed. Careful coordination will be necessary with the USFWS to ensure eventual implementation of this strategy does not conflict with other ESA listed species under their jurisdiction.
SLR-CCC-4.1.1.6	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFG, NMFS, Public, Santa Cruz County, SWRCB						In-Kind	
SLR-CCC-4.1.1.7	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	1	100	Private Landowners, Public, SWRCB						In-Kind	Cost to promote SWRCB review of existing diversions will likely vary between depending on the cooperation of the diverter.
SLR-CCC-4.1.1.8	Action Step	Hydrology	Adopt policies and practices for redevelopment/reconstruction projects to reduce storm water runoff.	2	100	City of Santa Cruz, City of Scotts Valley, NRCS, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD							Encourage watershed-friendly practices, such as managing storm water with low-impact features like bioswales and rain gardens, use of previous asphalt and concrete, and rain water harvesting.
SLR-CCC-4.1.1.9	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	20	CDFG, IWRP, SWRCB							Costs will vary widely depending on quantity of water converted to instream use. Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed.
SLR-CCC-4.1.1.10	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD							
SLR-CCC-4.1.2	Recovery Action	Hydrology	Minimize redd scour										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-4.1.2.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5		749					749	Redd scour is likely a limiting factor in some reaches, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of coho egg and alevin mortality. Cost based on $115,276/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $182,250 for treating 6.5 miles of high IP. Co-related to habitat complexity.
SLR-CCC-4.1.3	Recovery Action	Hydrology	Reduce the number, conditions, and/or magnitude of diversions										
SLR-CCC-4.1.3.1	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	10							TBD	Significant oversight by regulatory agencies may be required to ensure successful program implementation. Implementation and outreach is anticipated to occur over the entire 100 year recovery horizon due to the large number of diversions in the watershed. Costs will vary depending on the size of the diversion and participation of diverters.
SLR-CCC-4.1.3.2	Action Step	Hydrology	Support SWRCB in regulating the use of streamside wells and groundwater.	1	100	CDFG, NMFS, NMFS OLE, Public, SWRCB, Trout Unlimited						In-Kind	
SLR-CCC-4.1.3.3	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (CDFG 2004).	1	100	CDFG, NMFS, Private Landowners, Public, SWRCB						In-Kind	Cost to promote SWRCB review existing diversions will likely vary between depending on the cooperation of the diverter.
SLR-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with urbanization										
SLR-CCC-5.1.1.1	Action Step	Landscape Patterns	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-6.1.1	Recovery Action	Passage	Improve access of spawning adults and juveniles										
SLR-CCC-6.1.1.1	Action Step	Passage	Remediate passage barriers on mainstem San Lorenzo River.	2	20		60,250	60,250	60,250	60,250		241,000	In general, migration barriers are not the most significant limiting factor to coho salmon in the San Lorenzo River. However, during drought years (in combination with ongoing water diversions) barriers could significantly reduce habitat accessibility in the watershed. Problematic barriers include: Rincon riffle, Four Rock, the wide natural bedrock chute above Ben Lomond, the bridge abutment below Alba Creek confluence, the bedrock step in Brookdale below Larkspur Bridge, the flashboard dam abutment (especially if wood is jammed in it) below the upper Irwin Way Bridge in the town of Boulder Creek, the flashboard dam abutment above the Kings Creek confluence (if jammed with wood), the apron and the box culvert at the Highway 9 bridge at Waterman Gap. Cost estimates will vary significantly and all impediments should be closely evaluated. Passage barriers (particularly natural barriers) should not necessarily be modified if the ultimate cause of the impairment is due to excessive water diversions. The impacts of water diversions should be carefully assessed prior to address any natural barrier.
SLR-CCC-6.1.1.2	Action Step	Passage	Remediate passage barriers in San Lorenzo River tributaries.	2	20	CDFG, City of Santa Cruz, IWRP, NMFS HCD, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						TBD	During drought, known passage impediments in tributaries include: the concrete flood control channel in lower Branciforte, the bedrock chute in Zayante Creek, the residential diversion dam downstream of the second bridge on Newell Creek, high gradient riffles in the Bracken Brae reach and upstream in Boulder Creek, the flashboard dam apron in lower Kings Creek, and several bedrock chutes below the Boy Scout Camp on Kings Creek. Cost estimates will vary significantly and all impediments should be closely evaluated. Passage barriers (particularly natural barriers) should not necessarily be modified if the ultimate cause of the impairment is due to excessive water diversions. The impacts of water diversions should be carefully assessed prior to address any natural barrier.
SLR-CCC-8.1	**Objective**	**Riparian**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-8.1.1	Recovery Action	Riparian	Protect existing riparian areas										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-8.1.1.1	Action Step	Riparian	Work with PG&E to ensure practices do not impair riparian areas.	2	10	CDFG, NMFS, PG&E, Private Landowners, RWQCB, Santa Cruz County							PG&E trims and removes trees along power line right-of-ways, which may contribute to increased sediment input, temperature increases, and reduced wood input into streams.
SLR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
SLR-CCC-9.1.1.1	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	2	100	CalFire, IWRP, NRCS, Private Landowners, RWQCB, Santa Cruz County, State Parks							Initial focus should be directed at the middle river and adjacent subwatersheds.
SLR-CCC-9.1.1.2	Action Step	Sediment	Identify and repair bank failures or landslide toes that are a significant source of chronic fine sediment loads into the San Lorenzo River.	3	50	California Geological Survey, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD							Ultimate reasons for bank failure should be identified and addressed. Bank and landslide stabilization should evaluate a full range of options to address instability such as setting back or removing problematic infrastructure (roads, etc.). Bioengineering should be the first stabilization method assessed. Bank hardening is not a preferred alternative. Focus initial efforts in Core areas.
SLR-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
SLR-CCC-9.1.2.1	Action Step	Sediment	Conduct road surveys beginning with inner gorge roads in sandy soils followed by roads in other settings.	3	20	CalFire, California Geological Survey, IWRP, Santa Cruz County, Santa Cruz RCD							Initial focus should be directed at the lower reaches of Bean, Zayante, Love, and Newell Creeks.
SLR-CCC-9.1.2.2	Action Step	Sediment	Implement sediment reduction efforts on tributaries that deliver sediment directly to the Middle River and on Zayante and Branciforte Creeks.	3	20	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD							
SLR-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SLR-CCC-10.1.1	Recovery Action	Viability	Increase abundance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-10.1.1.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat determined appropriate by NMFS and CDFG.	3	100	CDFG, City of Santa Cruz, NMFS, NOAA SWFSC, Private Consultants						TBD	Standardized monitoring methods should be used to evaluate long-term effectiveness of restoration efforts. Monitoring should likely occur in a few select and representative watersheds. This action is rated a lower priority due to the very low population of coho salmon in the watershed.
SLR-CCC-10.1.1.2	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds. Prioritize Core and Phase 1 watersheds.	1	10								Re-introduction should only occur in subwatersheds where instream habitat conditions are suitable for all coho salmon lifestages. Conditions evaluated should include: summer flow conditions, cover, winter refugia, pools depths, instream temperature, and gravel quality.
SLR-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
SLR-CCC-10.2.1.1	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	2	10	Private Consultants, San Lorenzo Valley Water Agency, Santa Cruz County	94.50	94.50				189	Cost for annual juvenile sampling estimated at $18,823/year for the Santa Cruz Diversity Stratum.
SLR-CCC-10.2.2	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
SLR-CCC-10.2.2.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	2	15	CDFG, NOAA RC, Private Consultants, San Lorenzo Valley Water Agency, Santa Cruz County	42.33	42.33	42.33			127	Cost for fish/habitat restoration effectiveness monitoring estimated at $126,758/project.
SLR-CCC-10.2.2.2	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	100	CDFG, NOAA RC, Public, SWRCB						TBD	
SLR-CCC-10.2.3	Recovery Action	Viability	Increase spawner density										
SLR-CCC-10.2.3.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	10		423.50	423.50				847	Standardized surveys should not occur until a small sustained run of CCC coho salmon is re-established in the watershed. Cost for annual spawner ground surveys estimated at $56,470/year in the Santa Cruz Diversity Stratum.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-10.2.3.2	Action Step	Viability	Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery.	2	10	CDFG, Monterey Bay Salmon and Trout Project, NMFS	202.50	202.50				405	Cost for adult escapement monitoring estimated at
SLR-CCC-10.3	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**										
SLR-CCC-10.3.1	Recovery Action	Viability	Increase spawner density										
SLR-CCC-10.3.1.1	Action Step	Viability	Supplement existing populations where appropriate, while minimizing departure from the populations historical genetic profile. Evaluate feasibility and benefits of constructing and operating a conservation hatchery for the propagation of CCC coho salmon. Construct and operate the facility is determined to be feasible and beneficial.	1	15	CDFG, NMFS, Public						TBD	The Monterey Bay Salmon and Trout Project operate a coho salmon broodstock program nearby in Scott Creek. The Scott Creek facility is constrained due to its location and cannot easily expand due to financial, physical, and hydrologic constraints, and is not suitable for longterm reintroduction efforts in the San Lorenzo River. A larger facility, located on the San Lorenzo River could serve as a regional conservation hatchery for multiple streams in the Santa Cruz Mountains Diversity Stratum. Possible locations could include Newell Creek below Loch Lomond where a reliable water supply is potentially available. The San Lorenzo River offers numerous potential locations and water quality and quantity should be closely evaluated. As with all such facilities, strict genetic management protocols should be followed. The facility should only be operated for broodstock purposes and not as a production facility.
SLR-CCC-10.3.1.2	Action Step	Viability	Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	2	10	CDFG, Monterey Bay Salmon and Trout Project, NMFS, NOAA SWFSC, Private Landowners						TBD	Imprinting stations will increase the likelihood of adults returning and re-establish a run in targeted sub basins. Approximately five imprinting station may be needed in various tributaries of the San Lorenzo River. Stations should continue until a run is re-established. Suitable locations should be carefully evaluated for their potential to support a viable run.
SLR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-11.1.1	Recovery Action	Water Quality	Improve instream temperature conditions										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-11.1.1.1	Action Step	Water Quality	Monitor instream summer water temperatures to determine baseline conditions and judge the efficacy of restoration actions.	2	5	City of Santa Cruz, City of Scotts Valley, Private Landowners, Public, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD	5.00					5	Temperature monitoring is relatively inexpensive. A thermograph should be installed in each tributary and in mainstem locations above and below each major confluence. Results should be compiled in one document and submitted to all participants and appropriate regulatory agencies on a yearly basis. Standard presentations should be used. Cost for stream temperature gauge estimated $500/gauge. Assume a minimum of 10. Cost does not account for maintenance or data management.
SLR-CCC-11.1.2	Recovery Action	Water Quality	Reduce toxicity and pollutants.										
SLR-CCC-11.1.2.1	Action Step	Water Quality	Implement improved wastewater disposal management though the San Lorenzo Wastewater Management Plan.	3	10	RWQCB, Santa Cruz County						In-Kind	
SLR-CCC-11.1.2.2	Action Step	Water Quality	Work with stable owners to reduce nitrate discharge by at least 50%	3	20	RWQCB, Santa Cruz County, Santa Cruz RCD							
SLR-CCC-11.1.2.3	Action Step	Water Quality	Native vegetation and xeric landscaping should be considered in all locations to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	50	RWQCB, San Mateo RCD, Santa Cruz County						In-Kind	This recommendation should be considered standard practice.
SLR-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										Water quality is impaired from land use practices in the watershed. Many landuse practices degrade water quality and coho salmon survival, principally through the input of fine sediment which results in increased turbidity, which smothers spawning gravels, reduces food production, and fills in rearing habitats. Sources of sediment input include roads and road maintenance, agriculture, residential development, and logging.
SLR-CCC-11.1.3.1	Action Step	Water Quality	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	2	100							TBD	
SLR-CCC-11.1.3.2	Action Step	Water Quality	Implement education programs and modify policies and procedures to improve riparian corridor protection, maintain channel integrity, implement alternatives to hard bank protection, and retain large woody debris.	3	10							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-13.1.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						In-Kind	Eliminating gabion baskets will result in long-term cost savings due to implementation of longer lasting and better engineered solutions.
SLR-CCC-13.1.1.2	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	100	California Geological Survey, CalTrans, CDFG, City of Santa Cruz, FEMA, NRCS, Private Landowners, RWQCB, Santa Cruz County, Santa Cruz RCD						In-Kind	Modification has also resulted as a consequence of the proximity of the large road network in the watershed and its adjacency to the mainstem San Lorenzo and many of its tributaries. In areas where houses are close to the bankfull channel, bank hardening often occurs to prevent or minimize streambank erosion which may threaten infrastructure. In the San Lorenzo River, these activities have simplified instream habitat complexity and disconnected some stream channels from their floodplains, primarily through streambank stabilization and channelization measures. These activities are anticipated to continue in the future. This recommendation should be adopted as a standard business practice for all agencies and consulting firms involved in actions that address stream stability. Many important high IP value reaches have already been subjected to bank hardening. These areas are frequently urbanized. Future proposals in these areas should be carefully evaluated and implemented only if necessary and with compensatory mitigation.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-13.1.1.3	Action Step	Channel Modification	Thoroughly investigate the ultimate cause of channel instability prior to engaging in site specific channel modifications and maintenance. Identify and target remediation of watershed process disruption as an overall priority.	2	100	California Geological Survey, CalTrans, FEMA, NRCS, Private Landowners, RWQCB, Santa Cruz County, Santa Cruz RCD						In-Kind	Channelization is one of the largest impacts of urbanization (Mount 1995). Most aspects of channelization disrupt the equilibrium of a river; where a stream is straightened, the stream power will increase, often leading to channel and bank scouring as the stream attempts to reestablish meandering or braided patterns (Mount 1995). The ecological consequences of channelization include: loss, reduction, or alteration of habitat complexity, streamside or bank cover, and pool habitat; and elimination of spawning, rearing, and feeding areas for fish (Brookes 1988). The removal of riparian vegetation associated with channelization directly affects both aquatic and terrestrial communities through increased water temperatures and loss of a local source of energy input (Mount 1995). Channel modification was determined to be a high threat in large part due to the extensive modifications to the tidal prism of the San Lorenzo River estuary and impacts to the watercourse due residential areas in the upper watershed. These modifications require constant maintenance which prevents the modified stream reaches from ever fully recovering and achieving properly functioning conditions. Areas of significant modification include the estuary, Branciforte, and Carbonera Creeks. Channel maintenance is expected to continue into the future and may actually increase if new policies established by the Corps (post hurricane Katrina) are implemented by the City of Santa Cruz.
SLR-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to instream habitat complexity										
SLR-CCC-13.1.2.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other methodologies to minimize habitat alteration effects.	2	100	CalFire, California Geological Survey, CalTrans, CDFG, City of Santa Cruz, FEMA, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks, USACE						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-13.1.2.2	Action Step	Channel Modification	Encourage the City of Santa Cruz to provide adult and smolt passage through the Lower San Lorenzo River and the flood control channel on Branciforte Creek according to recommendations in the Lower San Lorenzo River and Lagoon Management Plan.	2	10	CDFG, City of Santa Cruz, NMFS, NOAA RC, USACE	10.00	10.00				20	The City should immediately install baffles into existing slots in the Branciforte flood control channel as an interim measure. Other, more effective solutions should be evaluated and implemented if they do not significantly impair flood conveyance through the channel.
SLR-CCC-13.2	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to habitat complexity										
SLR-CCC-13.2.1.1	Action Step	Channel Modification	Encourage the Corps of Engineers to review and modify maintenance requirements on the lower San Lorenzo River in the light of designated Critical Habitat obligations.	2	5	City of Santa Cruz, NMFS, USACE						In-Kind	Increasing shade on the lower San Lorenzo River and upper estuarine reach could cool instream temperatures and provide more suitable rearing habitat conditions in the estuary. The Corps should be encouraged to allow important habitat forming features to remain in place where appropriate and where flood capacity will not be impaired beyond channel capacity.
SLR-CCC-13.2.2	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-13.2.2.1	Action Step	Channel Modification	Modify county regulatory and planning processes to eliminate provisions allowing reconstruction, expansion, or (in some situations) channel stabilization within the 100-year flood prone zones.	2	100	City of Scotts Valley, FEMA, Santa Cruz County, USACE						In-Kind	Santa Cruz County has many policies that, if effectively and consistently implemented, would be effective at protecting watershed processes. Modification of existing policies and/or creation of new policies will likely be controversial and implementation costs may be high. Available information indicates the County lack adequate funding to effectively enforce their current policies.
SLR-CCC-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SLR-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
SLR-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Improve conditions for salmonids by decreasing the adverse effects of exotic vegetation within the stream and riparian corridor.	3	100	Private Landowners, Santa Cruz County						100	This will primarily occur through educational and outreach programs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-14.1.1.2	Action Step	Disease/Predation/Competition	Prevent spread of the New Zealand mudsnail from the San Lorenzo River to other adjacent watersheds.	3	10	CDFG, City of Santa Cruz, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County	15.00	15.00				30	This will primarily occur through educational programs.
SLR-CCC-14.2	**Objective**	**Disease/Predation/Competition**	**Address disease or predation**										
SLR-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
SLR-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in coastal estuaries to juvenile and smolting salmonids and implement abatement strategies where appropriate.	3	10	CDFG, NOAA SWFSC	65.00	65.00				130	Cost for abundance/distribution estimate at $129,391/project.
SLR-CCC-14.2.1.2	Action Step	Disease/Predation/Competition	Evaluate possible impacts of annual planting of Chinook salmon from Central Valley hatcheries into Monterey Bay to coho salmon survival and abundance.	2	10	CDFG, NMFS, NOAA SWFSC						TBD	Evaluation should include an analysis of potential increases in predator populations (striped bass, sea birds, pinipeds) resulting from annual planting and consequences to coho salmon survival. cost accounted for in above action step.
SLR-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire						In-Kind	This recommendation should be considered a standard practice.
SLR-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Santa Cruz County						In-Kind	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
SLR-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire						In-Kind	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						In-Kind	Standard business practice.
SLR-CCC-15.1.1.5	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the San Lorenzo River watershed (and all other watersheds in the County).	2	100	CalFire, Santa Cruz County						In-Kind	Cost of providing the plan is minimal.
SLR-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
SLR-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire							Require all water truck/tenders be fitted with DFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
SLR-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										
SLR-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
SLR-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire							
SLR-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy or existing regulatory mechanisms**										
SLR-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
SLR-CCC-16.1.1.1	Action Step	Fishing/Collecting	Work with CDFG to monitor the river mouth until river flows naturally breach the sandbar.	2	100	CDFG						In-Kind	If river mouth has been artificially breached without appropriate authorization, prohibitions on offshore fishing should continue until appropriate flows occur.
SLR-CCC-16.1.1.2	Action Step	Fishing/Collecting	Prohibit offshore fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	3	10	CDFG, City of Santa Cruz, NMFS						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-16.1.1.3	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for the San Lorenzo River.	2	5	CDFG, NMFS, Public						In-Kind	Low flow closures are needed for the San Lorenzo River and should be based on flow gage information from a local watershed. The gauge at Big Trees is likely the most appropriate measurement location. Additionally, due to the late runs of CCC coho in the streams south of the Golden Gate, the date of opening season should be pushed back to later in the fishing season (currently fishing season starts on December 15) to at least January 15. Consideration should be given to pushing the entire fishing season back so that the total number of fishing days is not reduced significantly.
SLR-CCC-16.1.1.4	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along the San Lorenzo River that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	2	10	CDFG, Private Landowners, Santa Cruz County, State Parks							Cost accounted for in ESTUARY.
SLR-CCC-16.1.1.5	Action Step	Fishing/Collecting	Increase oversight on anglers fishing in the San Lorenzo River Gorge to ensure compliance with fishing regulations.	1	100	CDFG, CDFG Law Enforcement, NMFS OLE, Public, State Parks						In-Kind	
SLR-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	2	100	CDFG, IWRP, Santa Cruz County, SWRCB						In-Kind	
SLR-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to habitat complexity										
SLR-CCC-19.1.2.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, CDFG, RPFs, Santa Cruz County							The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
SLR-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, CDFG, RPFs, Santa Cruz County						In-Kind	
SLR-CCC-19.1.3.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Santa Cruz County						In-Kind	Cost is expected to be minimal
SLR-CCC-19.1.3.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, CDFG, RPFs, Santa Cruz County							This action should be considered a high priority within areas composed of Santa Margarita sandstone.
SLR-CCC-19.1.4	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
SLR-CCC-19.1.4.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFG, RPFs, Santa Cruz County							
SLR-CCC-19.1.4.2	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, CDFG, RPFs, Santa Cruz County							
SLR-CCC-19.1.5	Recovery Action	Logging	Prevent increased landscape disturbance										
SLR-CCC-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, CDFG, RPFs, Santa Cruz County							
SLR-CCC-19.1.6	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, etc.)										
SLR-CCC-19.1.6.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, by hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100								
SLR-CCC-19.1.6.2	Action Step	Logging	Avoid road construction in riparian zones	2	100	CalFire, CDFG, RPFs, Santa Cruz County							Old roads should not be reopened unless for proper decommissioning purposes.
SLR-CCC-19.1.6.3	Action Step	Logging	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	2	100	CalFire, CDFG, RPFs, Santa Cruz County							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-19.2.1	Recovery Action	Logging	Prevent impairment to water quality (impaired instream temperature)										
SLR-CCC-19.2.1.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, CDFG, NMFS, RWQCB, Santa Cruz County							Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC ESU) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for coho salmon rearing.
SLR-CCC-19.2.2	Recovery Action	Logging	Prevent increased landscape disturbance										
SLR-CCC-19.2.2.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.	2	20	CalFire, CDFG, Private Landowners, RWQCB						In-Kind	
SLR-CCC-19.2.2.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of coho salmon	3	20	Big Creek Lumber Co., Private Landowners, Red Tree, Redwood Empire							A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Timber harvest remains a threat to salmonid habitat in the San Lorenzo River, but at diminished levels compared to historical practices. In the Santa Cruz Mountains, even aged management was replaced long ago by selective harvest. Nonetheless, timber harvest was rated as one of the major sources of sediment contribution in the Zayante Area Sediment Source Study (Swanson Hydrology & Geomorphology 2001). Even with application of new California Forest Practice Rules these threats are anticipated to continue.
SLR-CCC-19.2.2.3	Action Step	Logging	Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3	10	NMFS							The need for this action may change if the California Forest Practice Rules change and reach a no-take standard or the state receives incidental take authorization through the HCP process.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-19.2.2.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.	2	100	CalFire, CDFG, Private Landowners, Santa Cruz County							Installing large woody material into streams deficient in large wood should be considered a top restoration priority, particularly in Core and Priority 1 subwatersheds. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
SLR-CCC-19.2.2.5	Action Step	Logging	Erosion control measures and road maintenance should be maintained during the entire period between re-entrys.	2	100	Big Creek Lumber Co., CalFire, CDFG, Private Landowners, Red Tree, Redwood Empire, RPFs, RWQCB							
SLR-CCC-19.2.2.6	Action Step	Logging	Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County							
SLR-CCC-21.1	**Objective**	**Recreation**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-21.1.1	Recovery Action	Recreation	Prevent impairment to passage and migration										
SLR-CCC-21.1.1.1	Action Step	Recreation	Remove all existing summer dams that create a passage impediment to migrating adults or juveniles.	3	30	CDFG, NMFS PRD, NOAA RC, Private Landowners, Public, Santa Cruz County, USACE	359.17	359.17	359.17	359.17	359.17	2,155	Costs may be high due to sediment deposition behind some dams and subsequent analysis of downstream impacts resulting from dam removal/sediment removal. The total cost is unknown due to the uncertainties regarding the extent of the problems and landowner willingness. Some summer dams on the San Lorenzo River have been permitted by the Corps and DFG. All future Corps section 7 consultations should consider impacts to IP-km and the consequence of the action to coho viability and recovery. Approximately 15 dams and dam abutments are believed to impede salmonid passage under some flow conditions in the San Lorenzo River watershed. Cost based on treating 15 barriers at a rate of $143,640/unit.
SLR-CCC-21.1.1.2	Action Step	Recreation	Require monitoring of adult/juvenile passage at summer dam passage facilities.	2	100	CDFG, NMFS, Private Landowners						In-Kind	The cost of monitoring adult/juvenile passage should be incorporated into each summer dam passage facility.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-21.1.1.3	Action Step	Recreation	Implement the most recent NMFS' Guidelines for Summer Dams for all new summer dams seeking 1600 Agreement or Corps 404 permit.	3	100	CDFG, NMFS, NMFS OLE, Private Landowners						In-Kind	Cost should be minimal to use existing guidelines when evaluating summer dams.
SLR-CCC-21.1.2	Recovery Action	Recreation	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-21.1.2.1	Action Step	Recreation	Develop a Road Sediment Reduction Plan for parklands. Plan should prioritize sites and outline implementation and timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	3	20	Santa Cruz County, Santa Cruz RCD, State Parks							Cost could be combined with other road assessment priorities in the watershed.
SLR-CCC-21.1.2.2	Action Step	Recreation	Educate users (including mountain bikers, hikers, ORV users, etc.) to help prevent or control erosion and sediment problems along the stream.	3	10	CDFG, City of Santa Cruz, NMFS, NOAA RC, Santa Cruz County, Santa Cruz RCD, State Parks						0	Cost could be offset with other education programs in the County.
SLR-CCC-21.1.2.3	Action Step	Recreation	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	20	California Geological Survey, City of Santa Cruz, Private Landowners, Public, RWQCB, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks						TBD	Costs cannot be determined until appropriate assessments have been conducted. Costs may vary significantly depending on type of road related problems and whether roads are closed or decommissioned.
SLR-CCC-21.2	**Objective**	**Recreation**	**Address inadequacies of regulatory mechanisms**										
SLR-CCC-21.2.1	Recovery Action	Recreation	Prevent impairment to water quality										
SLR-CCC-21.2.1.1	Action Step	Recreation	Ensure roads, hiking trails, and biking paths are properly winterized prior to winter rains according to California Forest Practice Rules standards under section 916.5.	3	10	CalFire, Santa Cruz County, Santa Cruz County Land Trust, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
SLR-CCC-22.1.1.1	Action Step	Residential/Commercial Development	New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.	2	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County, SWRCB						In-Kind	In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis. Encourage watershed-friendly practices, such as managing storm water with low-impact design features like bioswales and rain gardens (to remove pesticides, petrochemicals, and heavy metals from runoff).
SLR-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	3	100	City of Santa Cruz, City of Scotts Valley, RWQCB, Santa Cruz County						In-Kind	This recommendation should be considered as a higher priority in subbasins with highly erodible soils (e.g., Santa Margarita sandstone).
SLR-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Provide incentives for water storage and water retention programs and other conservation devices	2	100	IWRP, NRCS, Santa Cruz County, Santa Cruz RCD						In-Kind	
SLR-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Encourage Santa Cruz County to assess the effectiveness of Sensitive Habitat Ordinance and implement improved performance measures as necessary.	3	5	Santa Cruz County						In-Kind	According to Balance Hydrologics, Inc. (1998), the strength of the existing County environmental protection ordinances is their ability to guide new permitted development. However, their weaknesses have been in enforcement of violations from unpermitted activities and effecting remedial action to address erosion sources. The cumulative impact of this lack of effective enforcement is a backlog of known violations far exceeding the County's resources to resolve them (Balance Hydrologics, Inc. 1998).
SLR-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Design new developments to avoid unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites that occur adjacent to a CCC coho salmon watercourse.	2	100	Private Landowners, Santa Cruz County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-22.1.2.3	Action Step	Residential/Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County						In-Kind	Functional buffers provide multiple benefits to water processes. Buffers in residential areas frequently become compromised overtime due to encroachment issues.
SLR-CCC-22.1.2.4	Action Step	Residential/Commercial Development	Rate of sediment input from existing and future commercial development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100								General recommendation that should be applied to all pre-existing and future landuse activities in the watershed.
SLR-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Design new development to allow streams to meander in historical patterns.	1	100	City of Santa Cruz, City of Scotts Valley, RWQCB, Santa Cruz County						0	Protecting riparian zones and their floodplains or channel migration zones averts the need for bank protection in most situations.
SLR-CCC-22.1.3.2	Action Step	Residential/Commercial Development	Encourage Santa Cruz County to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	2	100	FEMA, Private Landowners, Santa Cruz County							This recommendation should not be interpreted as a procedure to ignore erosion, but as a long term strategy to address chronic and episodic sediment by ensuring new infrastructure is not placed in high risk areas.
SLR-CCC-22.1.3.3	Action Step	Residential/Commercial Development	Evaluate watershed infrastructure at high risk of flooding.	3	10	City of Santa Cruz, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks							Most of these structures have likely been identified. Cost associated with ground truthing and site specific evaluation.
SLR-CCC-22.1.3.4	Action Step	Residential/Commercial Development	Encourage establishment of conservation easements on floodplain habitat in key stream reaches.	2	100	Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks						0	
SLR-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SLR-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	2	10	City of Santa Cruz, City of Scotts Valley, San Lorenzo Valley Water Agency, Santa Cruz County						0	Outreach to landowners already occurs from many of the municipalities and water districts in the watershed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-22.1.5	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										Landscape patterns are highly impacted by urbanization which extends along much of the mainstem and throughout numerous tributaries in the watershed. Impacts include: increased disturbance through sediment and pathogen input, dumping of trash, yard waste, and toxic substances such as oil and garden chemicals in watercourses, increased levels of pharmaceuticals in the water column, conversion of native riparian vegetation and replacement with detrimental and invasive exotic vegetation, and altered hydrology due to impervious surfaces.
SLR-CCC-22.1.5.1	Action Step	Residential/Commercial Development	Continue County policy of promoting infill and high density developments over dispersal of low density rural residential in undeveloped areas.	1	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County						0	The 2000 census estimated the population within the San Lorenzo River watershed at 84,586 individuals; 74 percent of the watershed has a housing density higher than 1 unit per 20 acres (NMFS GIS 2009) with significant development located in the riparian zones of the mainstem San Lorenzo and many of its tributaries. The population in the watershed is relatively high compared to many other watersheds in the Santa Cruz Mountain's diversity stratum and the proximity of residences to stream channels and estuary likely place riparian areas and stream channel at greater risk for future alterations despite numerous policies and regulations from the County of Santa Cruz and City of Santa Cruz designed to protect water quality . This action encourages implementation of many existing policies.
SLR-CCC-22.1.5.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	1	100	FEMA, Santa Cruz County, Santa Cruz County Land Trust						0	Important areas include forest lands, and areas with high erosive geology.
SLR-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Encourage County and local municipalities to expand riparian buffer widths for existing development and enforce existing regulations.	2	5	City of Santa Cruz, City of Scotts Valley, PG&E, Santa Cruz County						0	The weakness of the County of Santa Cruz's existing riparian ordinance stems from exemptions allowed for pre-existing development. The current Riparian Corridor Ordinance requires a buffer width of 50 feet. County should develop incentives for landowners to facilitate an effective riparian zone of vegetation adjacent to stream banks to become established. Initial efforts should be directed at key tributaries vs. mainstem. Most of the riparian encroachment in the San Lorenzo watershed occurs in the tributaries. Incentives should be investigated to encourage landowners in key areas to allow establishment of a riparian buffer.
SLR-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to water quality										
SLR-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Avoid, or at a minimum regulate, the use of commercial and industrial products (e.g. pesticides) with high potential for contamination of local waterways.	3	100	Public, RWQCB, Santa Cruz County, USACE						0	Costs should be minimal and are considered part of RWQCB existing authority and obligation.
SLR-CCC-22.2.2.2	Action Step	Residential/Commercial Development	Continue efforts to address failing septic systems in rural areas and other water quality impairments	3	100	RWQCB, Santa Cruz County, USACE							The County of Santa Cruz has a ongoing program that should be expanded to address high nitrate levels in the San Lorenzo River watershed. The County of Santa Cruz (2001) rated the interrelationship of various water quality parameters to sources of impairment. The County determined that urban development and associated runoff from urban areas had a high relationship to various pathogens detected in the watershed. The County also determined septic systems and leaky sewers had a high relationship to both elevated pathogen levels and nitrate levels in the watershed. The San Lorenzo Nitrate Management Plan (County of Santa Cruz 1995) determined that an estimated 84% of the current nitrate load in the River results from human activities in the watershed. Of that human influenced nitrate load, 57% was associated septic systems in sandy and non-sandy soils. Impairment of water quality, the aquatic environment and associated riparian areas are anticipated to continue into the future.
SLR-CCC-22.2.2.3	Action Step	Residential/Commercial Development	Maintain the existing requirement of a one acre minimum parcel size for new development served by septic systems in the San Lorenzo River Watershed.	2	100	RWQCB, Santa Cruz County							This recommendation should be careful balanced against expansion of rural residential development over a wider landscape.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-22.2.2.4	Action Step	Residential/Commercial Development	Encourage increased oversight by appropriate regulatory agencies of activities that use hazardous commercial and industrial products in the watershed.	2	100	RWQCB, Santa Cruz County, USEPA							
SLR-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
SLR-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Implement ordinances and policies such that new developments meet a zero net increase in storm water runoff, changes in duration, or magnitude of peak flow.	2	10	City of Santa Cruz, City of Scotts Valley, Santa Cruz County							Increasing residential development and road construction increases the impervious surface in the watershed increasing the amount of runoff. This, in combination with reduced instream complexity (LWD formed habitats such as scour pools), increases the likelihood of redd scour during high flow events (Alley et al. 2004). Alley et al. (2004) noted that much of the streambed of the San Lorenzo is prone to scour, particularly along the lower mainstem and Zayante, Bean, and Branciforte tributaries. It was not known if scour is widespread or whether it is a significant cause of steelhead egg and alevin mortality.
SLR-CCC-22.2.3.2	Action Step	Residential/Commercial Development	As mitigation for hydrograph consequences, municipalities and counties should investigate funding of larger detention devices in key watersheds with ongoing channel degradation or in sub-watersheds where impervious surface area > 10 percent.	3	15	City of Santa Cruz, City of Scotts Valley, Santa Cruz County							Implementation of this recommendation will help reduce rates of channel incision, increase aquifer recharge, and reduce the likelihood of redd scour.
SLR-CCC-22.2.3.3	Action Step	Residential/Commercial Development	Support the development and implementation of regulations for activities that adversely impact groundwater recharge.	2	10	CDFG, City of Santa Cruz, City of Scotts Valley, RWQCB, San Lorenzo Valley Water Agency, Santa Cruz County							
SLR-CCC-22.2.4	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
SLR-CCC-22.2.4.1	Action Step	Residential/Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	100	City of Santa Cruz, City of Scotts Valley, HUD						0	
SLR-CCC-22.2.4.2	Action Step	Residential/Commercial Development	Discourage Counties from rezoning forestlands to rural residential.	1	100	Santa Cruz County							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-22.2.4.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	City of Santa Cruz, City of Scotts Valley, Santa Cruz County						0	Housing in forestlands typically leads to chronic stream degradation due to impacts to water quality, increased rates of sedimentation, future consequences of flood fighting to riparian zones and bank hardening, etc. The adverse impacts of extensive rural residential development in the San Lorenzo River watershed is reflected in high rates of sedimentation, illegal water diversions, and cannabis cultivation.
SLR-CCC-22.2.5	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-22.2.5.1	Action Step	Residential/Commercial Development	Santa Cruz County and municipalities should adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	3	20	Santa Cruz County						TBD	Many residences and some communities (parts of Felton) in the watershed are at risk for flooding and efforts to minimize the impacts of flooding will likely include removal of instream habitat features such as wood debris (this is a practice that still occurs, usually illegally). Additionally, residences located adjacent to stream channels are often at increased risk of bank erosion and efforts to protect existing infrastructure will likely include bank stabilization efforts which would further degrade salmonid habitat. The County has begun to address this issue by raising some infrastructure subject to frequent flooding in the Felton Grove area.
SLR-CCC-22.2.5.2	Action Step	Residential/Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	Santa Cruz County							The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection.
SLR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to stream hydrology (impaired water flow)										
SLR-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess and redesign transportation network to minimize road density and maximize transportation efficiency.	3	20	CalTrans, City of Scotts Valley, Santa Cruz County							Cost of implementation will likely be high due to the large amount of existing infrastructure. This recommendation should be initially targeted at seasonal and unsurfaced roads in areas with erodible geology and/or near high risk landslides. Cost cannot be determined without an assessment of road network and site feasibility.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
SLR-CCC-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalTrans, City of Santa Cruz, City of Scotts Valley, NRCS, RWQCB, Santa Cruz County, State Parks, USACE							All new and replacement culverts should be sized to accommodate a 100 year flow event.
SLR-CCC-23.1.2.2	Action Step	Roads/Railroads	Develop a private road database using standardized methods. The methods should document all road features, apply erosion rates, and compile information into a GIS database.	3	10	CalFire, CDFG, City of Santa Cruz, City of Scotts Valley, NOAA RC, Santa Cruz County, Santa Cruz RCD						TBD	Cost to develop a database could vary widely.
SLR-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-23.1.3.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	100	CalFire, CalTrans, City of Scotts Valley, NRCS, Private Landowners, RPFs, Santa Cruz County, Santa Cruz RCD							Road densities are high throughout the watershed and are estimated at 5.3 miles of road per square mile of watershed area, and at 6.2 miles per square mile of riparian area. Many of these roads are poorly situated, constructed, and improperly maintained. Road were determined as the primary sediment source in the watershed, including private, public, and timber harvest roads (County of Santa Cruz 2001). The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column.
SLR-CCC-23.1.3.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	3	10	CalFire, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD, State Parks	365.00	365.00				730	Some road assessment have already been conducted in the watershed. Initial assessment efforts should target Core and Priority 1 sub watersheds. Existing assessments should be used when possible. Cost for road inventory estimated at $927/mile (assume 75% of road network) and for erosion assessment estimated at $12/acre (assume 25% of total watershed acres).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-23.1.3.3	Action Step	Roads/Railroads	Reduce erosion from mainline timber harvest roads.	2	20	CalFire, CDFG, RWQCB, Santa Cruz County						TBD	The Zayante Area Sediment Study and San Lorenzo River Sediment TMDL both identify timber harvest roads as a major contributor of fine-grained sediment to stream channels. Review and implement additional recommendations in San Lorenzo River Salmonid Enhancement Plan (Alley et al. 2004). Areas of greatest sediment contribution were identified in the SLR sediment TMDL are the Kings, Boulder, Zayante and Bear Creek basins. Erosion control measures should be maintained during the entire period between re-entries.
SLR-CCC-23.1.3.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	30	CalFire, CalTrans, City of Santa Cruz, City of Scotts Valley, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD	114.00	114.00	114.00	114.00	114.00	684	Initial efforts should focus on roads in Branciforte, Bean, Zayante, Bear, and Kings Creek. Roads in urbanized areas will be very difficult to decommission; roads in more remote areas, particularly those used for timber harvest will likely be much easier to target for decommissioning. Decommission of entire riparian road network in the San Lorenzo River Watershed is infeasible, particularly in urban areas. Cost based on treating a portion of the riparian road network in rural areas, assuming 40% of riparian road network is in rural land. Cost based on decommission 50 miles of riparian road at a rate of $13,680/mile. If roads are upgraded, cost would be $1,197,000.
SLR-CCC-23.1.3.5	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	20	Private Landowners, Santa Cruz County, Santa Cruz RCD						0	Many road associations are inadequately funded. A road improvement fund for the San Lorenzo River could address sources of chronic and episodic sediment input by improving drainage features and reducing hydrologic connectivity.
SLR-CCC-23.1.3.6	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County, Santa Cruz RCD	1,600	1,600	1,600	1,600		6,400	Cost based on treating 25 stream crossings (10% of 258 total) at a rate of $254,278/unit.
SLR-CCC-23.1.3.7	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Private Landowners, RWQCB, Santa Cruz County							Santa Cruz Public Works has been largely unsuccessful at finding spoils sites. A recent effort to locate potential sites in each major watershed failed to identify locations with willing landowners. Future efforts may require incentives to increase landowner participation.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-23.1.3.8	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, CalTrans, Private Landowners, Santa Cruz County	192.50	192.50	192.50	192.50		770	Roadside berms are common on many private and county roads in Santa Cruz County and result in concentrated water and sediment runoff. These features are often created to serve as a quasi safety device (in lieu of crash barriers or guard rails). Cost based on upgrading 32 miles (5% of 641 miles of local, neighborhood, and rural road, city street, unseparated) at a rate of $23,940/mile.
SLR-CCC-23.1.3.9	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County						0	In-kind
SLR-CCC-23.1.3.10	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, CalTrans, Private Landowners, Santa Cruz County						TBD	Costs will vary depending on number of culvert upgrades on a road network and the inefficiency of the current drainage system. Pretreatment systems should be installed as part of new projects or upgraded. A maintenance plan should be part of all pretreatment systems.
SLR-CCC-23.1.3.11	Action Step	Roads/Railroads	Develop a road upgrade fund to supplement FEMA emergency repair funding so problem roads could be upgraded to reduce sediment loading and improve road reliability. The Counties should seek amendment of FEMA policies to allow improvements that prevent erosion and failure, particularly in watersheds with endangered salmonid habitat.	3	20	CalFire, CalTrans, City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County, State Parks						TBD	Cost difficult to determine but may result in a long term cost savings. Current economic conditions will likely delay implementation of this recommendation, if adopted.
SLR-CCC-23.1.3.12	Action Step	Roads/Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.	2	100	CalFire, FEMA, IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks							This should be an ongoing program. Existing outreach material can likely be used and tailored to private landowners and agencies with road maintenance staff.
SLR-CCC-23.1.3.13	Action Step	Roads/Railroads	Encourage all permanent and year-round access roads beyond the THP parcel be surfaced after harvest completion with base rock and road gravel, asphalt, or chipseal, as appropriate.	3	40	CalFire, RPFs, Santa Cruz County							

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-23.1.3.14	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	3	20	CalFire, CalTrans, City of Santa Cruz, City of Scotts Valley, RWQCB, Santa Cruz County, State Parks	220.00	220.00	220.00	220.00		880	This recommendation will be difficult to implement due to extensive development in the San Lorenzo River watershed. Initial roads targeted will likely be unsurfaced seasonal roads, rather than major paved roads, where ongoing maintenance does not comport with modern standards. Targeted areas should include sub watersheds with high erosion potential (e.g., Santa Margarita sandstone). Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost base on decommissioning 64 miles of road network at a rate of
SLR-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-23.1.4.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, CalTrans, NRCS, State Parks							
SLR-CCC-23.1.5	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
SLR-CCC-23.1.5.1	Action Step	Roads/Railroads	Target low flow crossings in Branciforte Creek for removal.	3	10	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD	275.00	275.00				550	Railcar bridges may result in large cost savings as compared to a seismically engineered bridge structure. Cost based on treating 4 barriers at a rate of $136,073/crossing.
SLR-CCC-23.1.5.2	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	2	100	CalFire, CalTrans, FEMA, IWRP, NRCS, Santa Cruz County, USACE							Adopt NMFS Guidelines for Salmonid Passage at Stream Crossings (NMFS 2001).
SLR-CCC-23.1.5.3	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	2	100	CalFire, CalTrans, Santa Cruz County, USACE						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SLR-CCC-23.1.6	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-23.1.6.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	CalFire, Private Landowners, Santa Cruz County, State Parks							
SLR-CCC-23.1.6.2	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	CalTrans, Santa Cruz County							
SLR-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
SLR-CCC-23.2.1.1	Action Step	Roads/Railroads	Encourage County of Santa Cruz to increase enforcement of existing County regulations regarding grading, riparian and building violations, and sediment release from county roads.	2	5	Santa Cruz County	350.00					350	The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the San Lorenzo River and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degraded streambed conditions in the watershed.
SLR-CCC-23.2.1.2	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, Santa Cruz County							
SLR-CCC-23.2.2	Recovery Action	Roads/Railroads	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.										
SLR-CCC-23.2.2.1	Action Step	Roads/Railroads	Educate road associations and informal road maintenance collectives to the benefit of integrating into the Santa Cruz County Service Area process.	2	10	IWRP, NRCS, Santa Cruz County, Santa Cruz RCD							

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SLR-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-23.2.3.1	Action Step	Roads/Railroads	Protect channel migration zones and their riparian areas by designing new roads to allow streams to meander in historical patterns.	1	100	CalFire, CalTrans, FEMA, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks, USACE							Preservation of remaining migration zones are a high priority due to their importance for various salmonid lifestages. Protection of these areas will potentially help facilitate future restoration actions.
SLR-CCC-23.2.3.2	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	3	20	CalFire, CalTrans, City of Scotts Valley, Santa Cruz County							A well designed road management plan should result in overall cost savings due to lower maintenance costs.
SLR-CCC-23.2.4	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SLR-CCC-23.2.4.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	100	CalFire, CalTrans, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks							The periodic grading and leveling of unsurfaced roads continuously exposes erodible material both on the road surface and along the road shoulders. This loose, unconsolidated material is frequently mobilized during winter storms where it enters the water column. Additionally, paved and unpaved roads parallel many of the waterways within the San Lorenzo River and impinge on channel migration. Many of these roads have areas that fail recurrently at the same unstable locations which contribute to ongoing sedimentation as well as bank hardening. Roads located in areas dominated by sandy soils are some of the largest contributors to degraded streambed conditions in the watershed (Balance Hydrologics, Inc. 1998).
SLR-CCC-23.2.4.2	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	Private Landowners, Santa Cruz County, State Parks							

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SLR-CCC-23.2.4.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, City of Santa Cruz, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, State Parks						0	Cost should be considered part of land owner road management plans.
SLR-CCC-23.2.4.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, CalTrans, RWQCB, Santa Cruz County							
SLR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SLR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary (impaired quality and extent)										
SLR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion (California State Coastal Conservancy et al. 2010).	3	100	City of Santa Cruz, FEMA, USACE						0	In-Kind
SLR-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	100	City of Santa Cruz, FEMA, USACE							
SLR-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Evaluate living shoreline and associated techniques as a way to benefit habitats while providing desired shoreline stabilization needs for future shoreline restoration or shoreline protection structures (California State Coastal Conservancy et al. 2010). Implement where feasible. See California State Coastal Conservancy et al. (2010) for habitat types to consider for inclusion, recommended monitoring, and potentially suitable locations for implementation.	3	100	CA Coastal Commission, City of Santa Cruz, FEMA, USACE							Improvements will likely be necessary to ensure the persistence of the Santa Cruz Boardwalk. Structural improvement should be designed in order to eliminate manipulation of flow patterns of the river.
SLR-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										

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SLR-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions.	2	10	CDFG, City of Santa Cruz, Lompico Water District, NMFS, NMFS OLE, Private Landowners, San Lorenzo Valley Water Agency, SWRCB							Many stream reaches in the San Lorenzo River have water diversions and it is likely that a large number of the downstream reaches experience impacts during the summer months. Due to the heavy overdraft of water resources in the watershed, the impacts of a severe drought in conjunction with ongoing overdraft of surface flows and the aquifer could be devastating to multiple lifestages of salmon in the watershed. Although the watershed is listed as fully appropriated in the summer, the listing is not adequately enforced for permitted surface water diversions. Additionally, even less oversight exists for ground water pumping in the watershed which has a significant impact to baseflow. Current demand for water exceeds the safe yield of local aquifers and a severe drought, particularly if occurring over a period of two or more years, would likely result in significantly reduced flows throughout the watershed reducing overall salmonid abundance. Critical flow values should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.
SLR-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Ensure all water diversions in the watershed are in compliance with all applicable laws and policies during dry and critically dry water years.	1	5	CDFG, City of Santa Cruz, NMFS PRD, Private Landowners, RWQCB, Santa Cruz County, SWRCB, USACE						0	The SWRCB should conduct periodic sweeps of diversions in the San Lorenzo River to ensure they are in compliance with annual reporting requirements and that annual water usage is accurately reported.
SLR-CCC-24.1.2.3	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	1	20	CDFG, City of Santa Cruz, Lompico Water District, NMFS, NMFS OLE, NRCS, Private Landowners, Public, San Lorenzo Valley Water Agency, Santa Cruz RCD, SWRCB, USFWS							Costs may be significant and cannot be predicted at this time. Initial focus should include the "Rincon" and "Four Rock" areas in the lower San Lorenzo River. These areas should be evaluated in light of all permitted and unpermitted diversions in the upper and middle reaches of the San Lorenzo River.
SLR-CCC-24.1.2.4	Action Step	Severe Weather Patterns	Prohibit filling of all recreational instream summer dams during drought periods.	3	100	CDFG, NMFS OLE							Few recreational dams on the San Lorenzo River are permitted. It is anticipated unpermitted dams may be installed on the River or its tributaries.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Implement performance standards in Stormwater Management Plans.										
SLR-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Ensure tolerable water temperatures are maintained during drought periods.	1	100	CDFG, City of Santa Cruz, City of Scotts Valley, Private Landowners, San Lorenzo Valley Water Agency, SWRCB							Water temperatures during drought will be directly affected by ongoing surface water diversions in the San Lorenzo River and its tributaries. Concerted efforts should be made to address these diversions during drought periods to minimize predictable adverse impacts to stream temperatures.
SLR-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
SLR-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Manage Loch Lomond reservoir to maintain suitable rearing conditions in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	3	5	City of Santa Cruz							
SLR-CCC-24.1.4.2	Action Step	Severe Weather Patterns	Evaluate City of Santa Cruz's water right for Loch Lomond Reservoir to determine whether dam re-operation could result in benefits to salmonids in the watershed.	3	10	CDFG, City of Santa Cruz, NMFS HCD, SWRCB						TBD	
SLR-CCC-24.1.4.3	Action Step	Severe Weather Patterns	Work with CDFG, County of Santa Cruz, municipalities (including all water districts in the San Lorenzo watershed), and knowledgeable biologists to develop emergency rules and adopt implementation agreements that will allow operations to continue and protect critical coho lifestages.	3	10	CDFG, Private Consultants, Santa Cruz County, SWRCB							Costs may include consulting expertise to construct a water budget for the San Lorenzo River.
SLR-CCC-24.1.4.4	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	3	10	CDFG Law Enforcement, NMFS OLE						0	Costs are anticipated to be absorbed into ongoing activities.
SLR-CCC-24.1.4.5	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.	3	10	CalFire, CalTrans, CDFG, NMFS, RWQCB, SWRCB						TBD	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-24.1.4.6	Action Step	Severe Weather Patterns	Evaluate performance of all existing fish ladders on the San Lorenzo River to pass migrating fish during drought and high flow conditions.	2	10	CalTrans, CDFG, San Lorenzo Valley Water Agency, Santa Cruz County	200.00	200.00				400	Evaluation should include an evaluation of existing maintenance requirements and development of landowner agreements where appropriate. Fish ladders that allow passage over barriers currently exist on several tributaries to the San Lorenzo River, including Fall, Zayante, Lompico, Branciforte, and Love Creeks. These existing fish ladders need to be inventoried and assessed for adequacy of passage, modified if necessary, and continually maintained to assure that they are allowing fish passage under most conditions. The timing of maintenance checks would vary depending on flows during the winter season.
SLR-CCC-24.1.5	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SLR-CCC-24.1.5.1	Action Step	Severe Weather Patterns	Develop floodplain protection guidelines for use by private and public entities specific to geological and hydrological constraints.	3	10	CDFG, NMFS HCD, Santa Cruz County							Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailored to general Santa Cruz County constraints. Costs may be higher if new guidelines are developed that do not rely on protocols from past studies.
SLR-CCC-24.1.5.2	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CalTrans, City of Santa Cruz, City of Scotts Valley, FEMA, Private Landowners, RWQCB, Santa Cruz County, USACE						TBD	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. Cost cannot be determined at this time due to a lack of information regarding where these existing habitats remain in juxtaposition to future development.
SLR-CCC-24.1.5.3	Action Step	Severe Weather Patterns	Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.	1	100	CalTrans, City of Santa Cruz, City of Scotts Valley, NRCS, Private Landowners, Santa Cruz County, USACE						0	Not building flood control projects will incur no expenses.
SLR-CCC-24.1.6	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
SLR-CCC-24.1.6.1	Action Step	Severe Weather Patterns	Develop Bank Stabilization and Floodplain Guidelines for use by private and public entities specific to geological constraints in Santa Cruz County.	2	5	CDFG, NMFS HCD, Santa Cruz County							Cost will likely consist of existing staff time. It is presumed that existing protocols could be tailored to general Santa Cruz County constraints. Costs may be higher if new guidelines are developed that do not rely on protocols from past studies.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-24.1.6.2	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	3	10	City of Santa Cruz, City of Scotts Valley, FEMA, Santa Cruz County						0	Outreach and education are ongoing, and additional costs are expected to be minimal.
SLR-CCC-24.1.6.3	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalTrans, Private Landowners, Santa Cruz County							Extreme flood events such as those that occurred in 1955 and 1982 could result in major input of sediment from upslope locations. Much of the watershed is comprised of highly erodible geology which would likely impact spawning and rearing habitats when sediment enters the stream channel. Changes and improvements in land use practices will likely result in lower sediment yield-rates following future flooding events than were experienced after 1955 and 1982 floods. However, much of the watershed is considered impaired and additional flooding events could slow the rate of recovery of instream habitat conditions.
SLR-CCC-24.1.6.4	Action Step	Severe Weather Patterns	Continue implementation of the County of Santa Cruz's Grading and Erosion Control Ordinances.	2	10	Santa Cruz County, Santa Cruz RCD						TBD	
SLR-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SLR-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										
SLR-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater, legal and illegal) do not further impair estuary water quality conditions for rearing juvenile salmonids.	1	100	City of Santa Cruz, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB							Ensuring compliance with State Water Law will likely result in significant benefits to summer rearing conditions in the SLR lagoon by improving water quality and accelerating the rate of freshwater conversion by increasing the volume of water entering the lagoon. Costs cannot be estimated because the location of illegal diversions are not known, quantities of water diverted are unknown, and willingness of those diverting water to come into compliance with State Law is unknown.
SLR-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	1	20	City of Santa Cruz, City of Scotts Valley, Lompico Water District, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB							Natural variations of flow in the San Lorenzo River watershed cause wide fluctuations in the amount of fish habitat available from year to year and these natural fluctuations are exacerbated by ongoing water diversions. During dry years, average available rearing habitat is reduced by more than 50 percent and stream diversions, as of 1978 (Santa Cruz County Planning Department, 1979), were estimated to further reduce available rearing habitat during dry years by approximately 20 percent. This conclusion on the impact of diversion was affirmed by Alley et al. (2004) in a review of historical flow data from the USGS gauge at Big Trees. These data suggest that during most months there has been a significant reduction in baseflow over the last 60 years and mean and minimum streamflow trends for October show a 17.2% and 32.1% decrease between 1937 and 1997. The reduction of mean and minimum baseflow conditions in October is likely due to water extraction from both surface diversions and well pumping in addition to a possible reduction in late season rainfall (e.g. – April and May) that would carry through the summer into fall. Alley et al. (2004) predicted that the reduction in flows lead to a reduction in density of larger juvenile steelhead densities that ranged from 9% in wet years to 27% in dry years. Impacts to coho salmon would likely be substantial.
SLR-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).	2	10	CDFG, NMFS HCD, NMFS OLE, NMFS PRD, Private Consultants, SWRCB							Depletion and diversion of natural flows have altered natural hydrological cycles, and subsequent flows, in significant portions of the San Lorenzo River. For example, Alley (1998, 1999, 2000, 2001, 2002) documented many physical changes to salmonid habitats due to changes in streamflow in the watershed. Reduction of flows negatively affect salmonid habitat due to: loss of usable habitats due to dewatering and blockage; stranding of fish resulting from rapid flow fluctuations; migration delays; entrainment of juveniles into unscreened or poorly screened diversions; and increased lethal and sublethal effects resulting from increased water temperatures (Berggren and Filardo 1993, Chapman and Bjornn 1969). In addition, reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas. The cumulative effect of these impacts to instream habitats is reduced juvenile populations in the action area.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Promote passive diversion devices designed to allow diversion of water only when minimum streamflow requirements are met or exceeded (CDFG 2004).	3	30	CDFG, City of Santa Cruz, Lompico Water District, San Lorenzo Valley Water Agency, Santa Cruz County, Santa Cruz RCD, SWRCB						TBD	Costs may be significant depending on site conditions and number of devices installed
SLR-CCC-25.1.2.4	Action Step	Water Diversion/Impoundment	Investigate feasibility of desalination to prevent stream dewatering and ensure a more stable source of water overtime.	3	10	CA Coastal Commission, CDFG, City of Santa Cruz, City of Scotts Valley, NMFS, San Lorenzo Valley Water Agency, Santa Cruz County, SWRCB						TBD	Costs may be significant. Desalination is an expensive alternative and should be implemented as an option to facilitate improvement in instream flows and not as an option to facilitate increased development within the watershed. If desalination is chosen as a preferred alternative, the facility should be adequately sized to facilitate significant reduction in water diversion impacts to the San Lorenzo River fishery. A regional facility would provide more benefits than a facility constructed to address the water needs of only one or a few water purveyors. Pooling of resources with other water agencies in Santa Cruz County could result in significant cost savings.
SLR-CCC-25.1.2.5	Action Step	Water Diversion/Impoundment	Encourage programs and entrepreneurial efforts by private organizations to purchase easements on water rights for maintenance of adequate surface flows via petition change of use and Section 1707.	1	20	CDFG, Private Landowners, Santa Cruz County, SWRCB							
SLR-CCC-25.1.2.6	Action Step	Water Diversion/Impoundment	Investigate the potential for expansion of the Scott Valley water reclamation system.	2	15	CDFG, City of Scotts Valley, RWQCB, SWRCB						TBD	Scotts Valley is located above the anadromous portions of the San Lorenzo River watershed (specifically Carbonera Creek). Water savings in Scotts Valley should result in increased flow into San Lorenzo River tributaries.
SLR-CCC-25.1.2.7	Action Step	Water Diversion/Impoundment	Investigate water recharge possibilities in Scotts Valley quarries as a water conservation strategy.	3	20	California Geological Survey, City of Scotts Valley, Santa Cruz County, SWRCB, USFWS							Aquifer recharge through the quarries should have the stated goal of replenishing overdrawn aquifers and contingent on not facilitating additional development in the watershed. Careful coordination will be necessary with the USFWS to ensure this strategy does not conflict with other ESA listed species.
SLR-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface or groundwater) do not impair migration patterns for listed salmonids in the San Lorenzo River.	2	100	City of Santa Cruz, City of Scotts Valley, Lompico Water District, Private Landowners, San Lorenzo Valley Water Agency, SWRCB							
SLR-CCC-25.1.3.2	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2	100	CDFG, CDFG Law Enforcement, City of Santa Cruz, Lompico Water District, NMFS, San Lorenzo Valley Water Agency, SWRCB							The Lompico Water District should install adequate fish screens on diversion intakes as soon as possible.
SLR-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
SLR-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure water diversions do not impair water temperatures in the San Lorenzo River.	1	100	City of Santa Cruz, City of Scotts Valley, Lompico Water District, RWQCB, San Lorenzo Valley Water Agency, SWRCB							As part of future 1600 agreement, CDFG should require installation of temperature thermographs upstream and downstream of the diversion. These results should be reviewed on a yearly basis by the SWRCB and CDFG.
SLR-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
SLR-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Develop and enforce stream flow bypass requirements for diversions in the San Lorenzo River and its tributaries Zayante, Fall, Bear, Boulder, and Branciforte creeks (CDFG 2004).	1	10	CDFG, NMFS, NMFS OLE, SWRCB						0	Cost may vary considerably depending on existing baseflow and existing uses of water being diverted. Aquatic conditions in the San Lorenzo River are adversely affected by water diversions and the watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board during the summer months. In addition to the impacts from water management operations to the riverine condition for the summer lifestage, water diversions reduce freshwater inflow to the estuary and extend the duration necessary for conversion to a freshwater lagoon during the summer. The City of Santa Cruz is the single largest diverter with diversions located at the Felton Diversion Dam, Newell Dam, and above the estuary at Tait Street. Other large diverters include the San Lorenzo Valley Water District, and City of Scotts Valley, combined with mid-sized diverters such as the Lompico Creek Water District and numerous other smaller diversions (> 130) adjacent to the river and its tributaries.
SLR-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004).	1	1	CDFG, SWRCB	100					100	Cost is based on a one year pilot study. The study would evaluate rates of compliance and overall impact of currently permitted diversion to coho salmon and steelhead survival and recovery. Efforts to address diversions could include increased oversight by the SWRCB for permitted diversions and enforcement of applicable laws for unpermitted diversions and increased oversight by DFG to ensure compliance with streambed alteration agreements (section 1600). Increased oversight by DFG would have the added benefit of addressing not only appropriative diversion but riparian diversions as well.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Petition the SWRCB to declare the Santa Margarita aquifer fully appropriated.	2	10	CDFG, NMFS, Santa Cruz County, SWRCB							The aquifer is currently over drawn resulting in water volumes in the San Lorenzo River. Areas with significant pumping occur in the Zayante and Bean Creek watersheds by the Scotts Valley Water District and the San Lorenzo Valley Water District (Alley et al., 2004). Ground water within the Lompico Aquifer in the San Lorenzo Valley is overdrafted by as much as 450 percent (Haynes, San Lorenzo Valley Water Management Agency, personal communication 2001) and ground water levels have dropped as low as 90 feet below historical levels (Denise Duffy & Associates, Inc. 1999). Baseflows in Bean Creek have been reduced by approximately one cfs during the summer and remaining available baseflows now average two cfs (Ricker, Santa Cruz County, personal communication, 2011).
SLR-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to eliminate depletion of summer base flows from unauthorized water uses. Coordinated efforts by Federal and State, and County law enforcement agencies to remove illegal diversions from streams.	1	100	SWRCB							The middle and lower mainstem of the San Lorenzo (as defined by Alley et al. 2004) experiences the biggest impact from upstream diversions since most of the tributaries flow into them. Reaches 1 and 2 (in the Gorge, and below Zayante Creek, respectively) show significant reductions in winter baseflow due to the diversion operation at Felton. The other two areas where baseflows during the summer months may have a significant impact on rearing salmonids are in Boulder Creek and Bean Creek. Groundwater pumping in Scotts Valley and diversions in many of the headwater tributaries to Boulder Creek may also have an impact. Other current and future impacts likely result from cannabis production.
SLR-CCC-25.2.1.5	Action Step	Water Diversion/Impoundment	Request the SWRCB conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance of water rights permits.	2	100	CDFG, NMFS, SWRCB						TBD	
SLR-CCC-25.2.1.6	Action Step	Water Diversion/Impoundment	Prohibit new or increased summer diversions.	1	100	CDFG, SWRCB						0	Of six rearing habitat variables identified by Alley et al. (2004) in the San Lorenzo River, streamflow rated as the primary or secondary limiting factor for five of the six. Additional water diversions will likely continue into the future due to increasing growth in the watershed. Increased development and demand for water will result in further declines in streamflow and fish habitat (Alley et al. (2004).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SLR-CCC-25.2.1.7	Action Step	Water Diversion/Impoundment	Work with the City of Santa Cruz (and other major diverters) to minimize impacts of their diversions.	1	10	CDFG, City of Santa Cruz, NMFS HCD, NMFS PRD, San Lorenzo Valley Water Agency, SWRCB						TBD	Currently, the City of Santa Cruz is working on a HCP to address impacts.
SLR-CCC-25.2.1.8	Action Step	Water Diversion/Impoundment	Work with the San Lorenzo Valley Water Agency to evaluate potential impacts to stream flow resulting from surface water diversions and timing of diversions. Encourage the San Lorenzo Valley Water Agency to adopt conservative protocols regarding yearly transition from surface water diversions to groundwater pumping.	2	5	CDFG, NMFS, San Lorenzo Valley Water Agency						TBD	The San Lorenzo Valley Water District and other major diverters should bring their diversion into ESA compliance and DFG Code 1600 compliance.
SLR-CCC-25.2.1.9	Action Step	Water Diversion/Impoundment	Encourage Lompico Water District to come into compliance with CDFG streambed alteration requirements.										The Lompico Water District has been informed by the regulatory agencies many times in the past regarding concerns over ongoing operations and impacts to listed salmonids.
SLR-CCC-25.2.1.10	Action Step	Water Diversion/Impoundment	Identify source of dewatering in Carbonera Creek near the City of Scotts Valley.	2	10	CDFG, CDFG Law Enforcement, City of Scotts Valley, NMFS, NMFS OLE, SWRCB							Upper Carbonera Creek now has major dry back section during the summer. Diversions from nearby wells are suspected.

San Vicente Creek

Location	•Santa Cruz County
Watershed Area	•11.0 Square Miles
Potential Habitat	•3.4 Stream Miles
Vegetation	•60% Coniferous, 30% Riparian or Montane Forest, or Shrubland
Erodability	•Moderate to High
Ownership Patterns	•99% Private; 1% Public
Dominant Land Uses	•Rural Residential, Timber
Housing Density	•Low to Moderate
TMDL Pollutants	•Sediment

Coho salmon smolt from San Vicente Creek Photo by Chris Berry, City of Santa Cruz Water Department

San Vicente Creek Coho Salmon: Persistent – Low Abundance

Recovery Goals

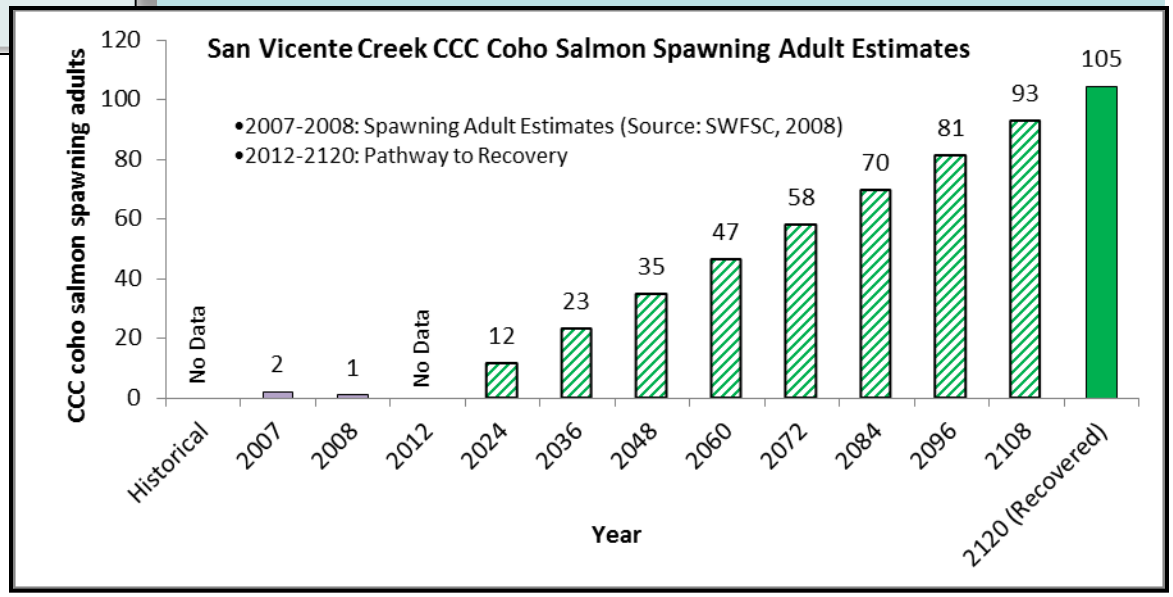
- ✓ Continue SWFSC evaluation of fish response to restoration actions
- ✓ Continue ongoing juvenile sampling efforts and conduct periodic surveys of adult abundance

San Vicente Creek Adult Spawner Targets

Downlisting to Threatened
53

Recovery
105

STEELHEAD: YES
CHINOOK SALMON: NO



San Vicente Creek

Potential Habitat: 3.4 miles
Recovery Target: 105 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	GOOD	VERY GOOD	FAIR	FAIR	GOOD	FAIR	GOOD	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Maintain current LWD, boulders, and other structure providing features to maintain current stream and habitat complexity, pool frequency, and depth
- Remove homeless encampments adjacent to anadromous fish streams where impacts to water quality and abundance are likely
- Ensure lower pond inlet in is adequately monitored and maintained

Priority 2 & 3: Long-Term Restoration Actions

- Monitor population response in off-channel habitats compared to instream habitat
- Implement standardized watershed assessments within sub-watersheds to define limiting factors, identify locations, develop and maintain sediment catchment basins

RESOURCE CONSERVATION DISTRICT OF SANTA CRUZ COUNTY

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

Recovery Partners

Coast Dairies, San Vicente TAC, NOAA SWFSC

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

THE TRUST for PUBLIC LAND

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH & GAME

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Gualala River Watershed Council, Campbell Timberland and Morgan Bond, SWFSC

San Vicente Creek

Potential Habitat: 3.4 miles
Recovery Target: 105 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
NA	MEDIUM	HIGH	MEDIUM	MEDIUM	NA	NA	MEDIUM	MEDIUM	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Remove invasive exotic vegetation from riparian zones in lower watershed
- Tailings, settling ponds, and other attributes of mining should be secured to ensure sediment, toxins, and other deleterious substances do not enter streams
- Existing areas with floodplains or off-channel habitats should be protected from future development of any kind
- Improve enforcement of Erosion Control Ordinance for private roads
- Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

Priority 2 & 3: Long-Term Threat Abatement Actions

- Discontinue practice of stocking ponds with exotic and predator fish in upper watershed
- Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography
- Abandoned mining areas in the San Vicente watershed should comport to the requirements of the Surface Mine Control and Reclamation Act
- Restore areas impaired by infrastructure near streams, historical floodplains or off channel habitats
- Petition the SWRCB to declare San Vicente Creek fully appropriated during summer and fall months

Passage impediment on San Vicente Creek
Photo by Jerry Smith, SJSU

Conservation Highlights

- The San Vicente TAC, Santa Cruz RCD, California Coastal Conservancy, and Balance Hydrologics are working to restore off channel habitats as well as implement side channel LWD projects
- The Santa Cruz RCD and Coastal Conservancy re-established the lower San Vicente pond which now functions as high quality off-channel habitat
- Funding has been awarded for a watershed assessment

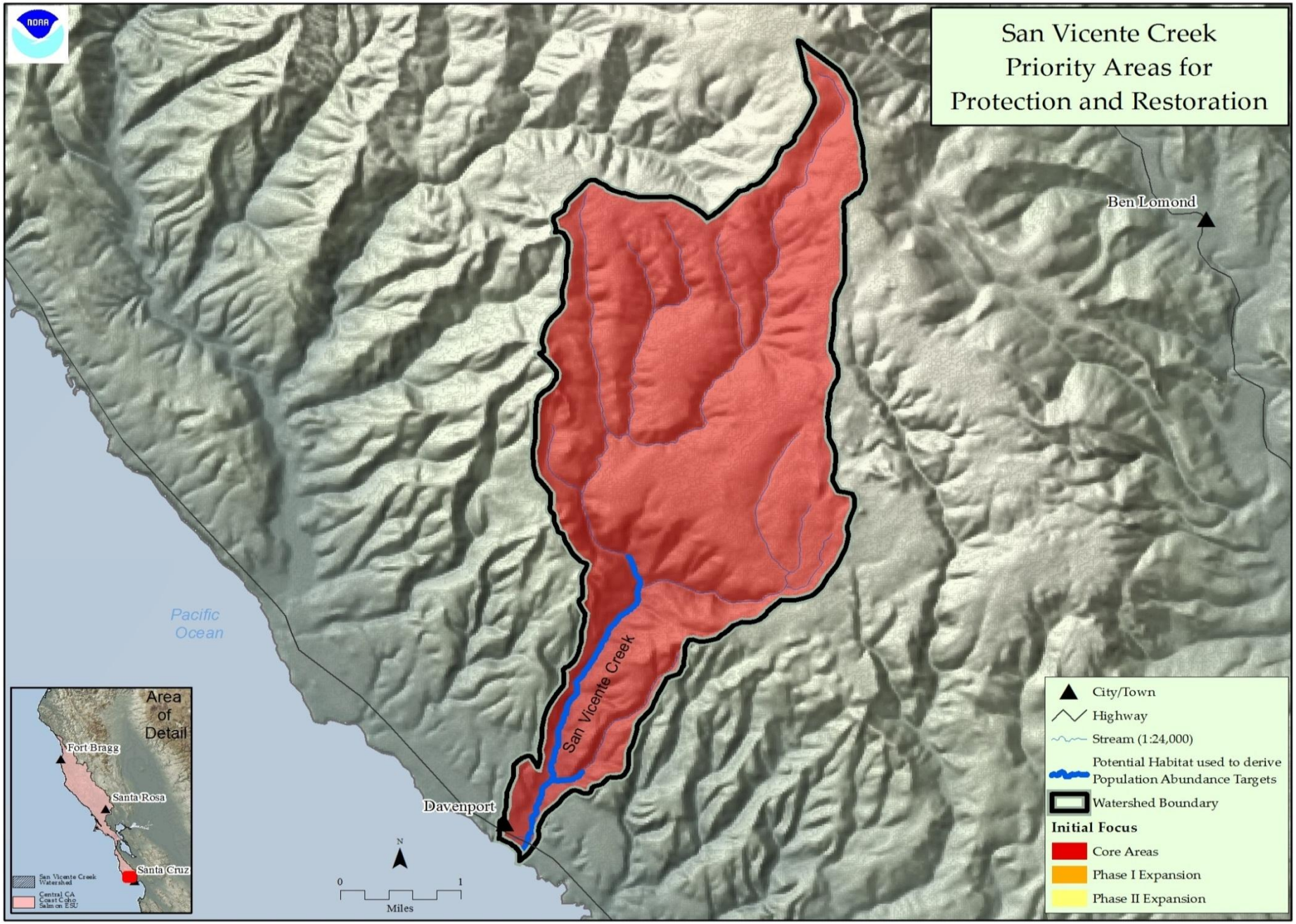


Figure 1: Map of San Vicente Creek

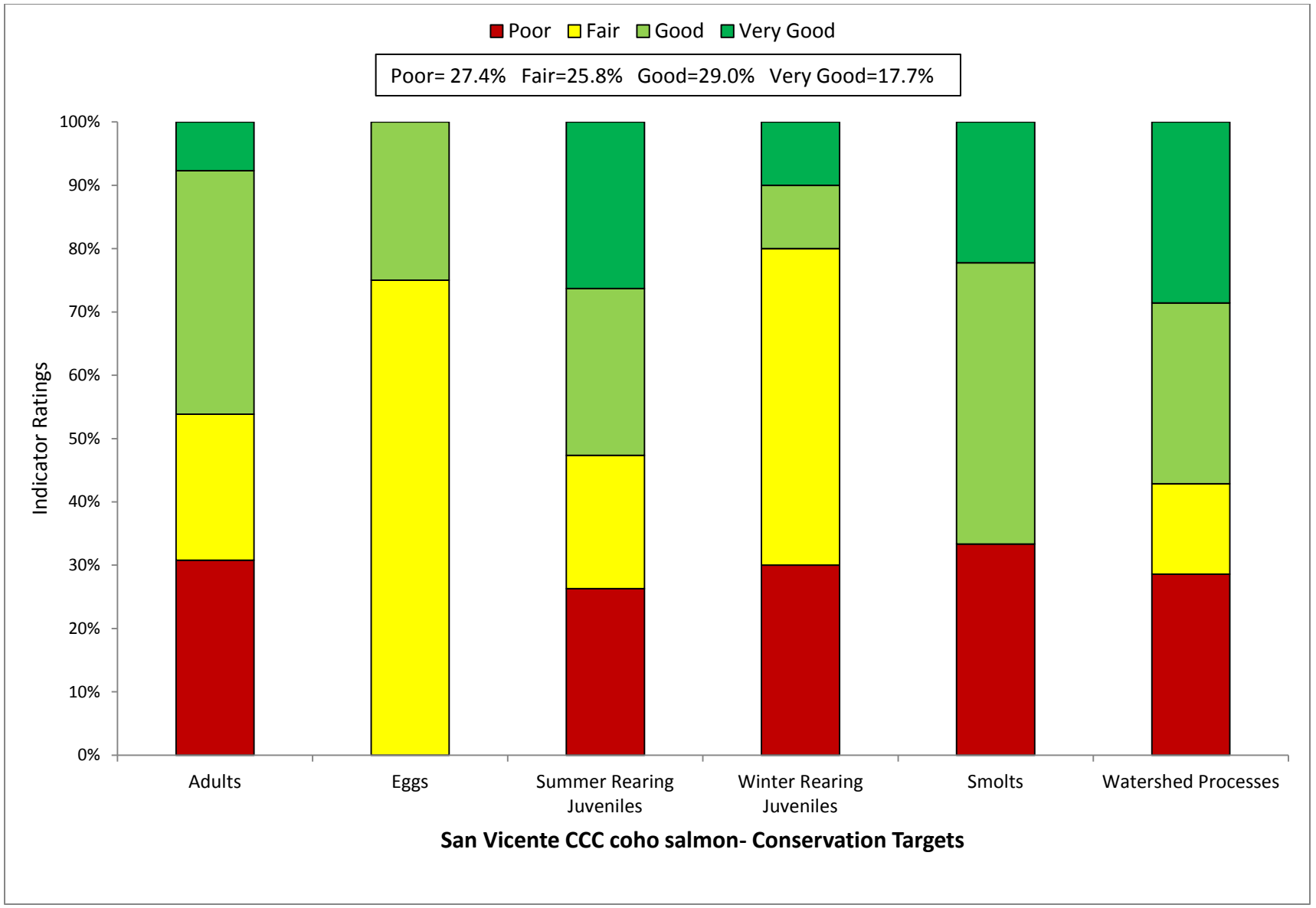


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ San Vicente Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**< 4 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**< 1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams 4% IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**50 to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**< 4 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**< 1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**100% of streams/ IP-Km (>49% of pools are primary pools)**	Very Good	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams 4% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-Km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =67**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = <35**	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0/10 IP-km but high magnitude above IP**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**78% of streams/ IP-km with average canopy >85%**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50 to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP-km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**>90% of streams/ IP-km maintains severity score of 3 or lower**	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**< 4 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**< 1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams 4% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50 to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired/non-functional**	Poor	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% of streams/ IP-Km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 Diversions /10 IP-km but high magnitude above IP**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =35-50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**>90% IP-km (>6 and <16 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.80% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**1.53% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**22% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**41% of watershed >1 unit/20 acres**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**25-50% Historical Species Composition**	Fair	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**2.3 Miles/Square Mile**	Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**2.3 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ San Vicente Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	-	-	-	-	-	-	-
2	Channel Modification	Medium	Low	Medium	Medium	Low	Medium	Medium
3	Disease, Predation and Competition	Medium	-	High	Medium	High	High	High
4	Fire, Fuel Management and Fire Suppression	Medium	Low	High	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	-	-	-	-	-	-	-
8	Logging and Wood Harvesting	Medium	Low	Medium	Medium	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Medium	Low	Low	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Low	Medium	High	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	Medium	Medium	Medium	Medium	Medium
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	Medium	High	High	High	High	High

Central CA Coast Coho Salmon ~ San Vicente Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Maintain current stream configuration.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.

2.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity.

2.1.1.1. **Action Step:** Ensure off channel habitats are adequately monitored and maintained. Develop landowner agreements.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Improve shelter rating

3.1.1.1. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem San Vicente Creek.

3.1.2. **Recovery Action:** Increase large wood frequency

3.1.2.1. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.2.2. **Action Step:** Install properly sized large woody material to viability table targets throughout mainstem San Vicente Creek

3.1.3. **Recovery Action:** Improve pool/riffle/flatwater ratios (hydraulic diversity)

3.1.3.1. **Action Step:** Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams).

4. **Restoration- Hydrology**

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

5.1.1.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Modify or remove physical passage barriers

6.1.1.1. **Action Step:** Evaluate Mill Creek dam for potential sediment input, fish passage constraints, and upstream habitat attributes.

6.1.1.2. **Action Step:** Remove the Mill Creek dam(s) if no long-term adverse impacts to the downstream fishery are predicted.

6.1.1.3. **Action Step:** Evaluate impact of Railroad and Caltrans bore to fish passage during high flow events.

6.1.1.4. **Action Step:** Install baffles in the tunnel bore as necessary.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

No species-specific actions were developed.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Monitor population response in off-channel habitats compared to instream habitat, similar to work conducted by Environmental Science Associates et al. (2004).

10.1.1.2. **Action Step:** Preserve the remaining genetic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce risk of extirpation.

10.1.1.3. **Action Step:** Develop and implement a monitoring program to evaluate the performance of recovery efforts.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Implement standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all landowners to develop similar assessment methods.

10.2.2. **Recovery Action:** Increase spawner density

10.2.2.1. **Action Step:** Conduct periodic surveys of adult abundance.

10.2.2.2. **Action Step:** Encourage planting of surplus coho salmon broodstock from the Monterey Bay Salmon and Trout Project into San Vicente Creek.

10.2.2.3. **Action Step:** Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery

10.2.2.4. **Action Step:** Ensure spawning adults are not harassed when migrating and spawning in the watershed.

10.2.2.5. **Action Step:** Remove homeless encampments adjacent to anadromous fish streams where impacts to water quality and abundance are likely.

10.2.2.6. **Action Step:** Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

14.1.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

14.1.1.1. **Action Step:** Remove invasive exotic vegetation from riparian zones.

14.1.1.2. **Action Step:** Work with landowners to discourage planting and dumping of non-native vegetation within the riparian corridor of lower San Vicente Creek.

14.2. **Objective:** Address disease or predation

14.2.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.2.1.1. **Action Step:** Evaluate impacts of fish disease (e.g., black spot) to the San Vicente population.

14.3. **Objective:** Address the inadequacy of existing regulatory mechanisms

14.3.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.3.1.1. **Action Step:** Identify and work with landowners in the upper watershed to discontinue practice of stocking ponds with exotic and predator fish .

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate

15.1.1.1. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.2. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.2.1. **Action Step:** Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

20.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

20.1.1. **Recovery Action:** Prevent impairment to instream substrate

20.1.1.1. **Action Step:** Tailings, settling ponds, and other attributes of mining should be secured to ensure sediment, toxins, and other deleterious substances do not enter streams through either direct runoff or subsurface flow.

20.1.1.2. **Action Step:** Abandoned mining areas in the San Vicente watershed should comply with all appropriate requirements of the Surface Mine Control and Reclamation Act.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity.

22.1.1.1. **Action Step:** Restore areas impaired by infrastructure near streams, historical floodplains or off channel habitats. Proactively work with landowners on lower San Vicente.

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

22.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity

22.2.1.1. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.1.1.2. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.

23.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.1.4. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

23.1.1.5. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.6. **Action Step:** For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.

23.1.1.7. **Action Step:** Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.

23.1.1.8. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.1.1.9. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

24. Threat- Severe Weather Patterns

No species-specific actions were developed.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

25.1.1.1. **Action Step:** Petition the SWRCB to declare San Vicente Creek fully appropriated during summer and fall months (CDFG 2004).

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

25.2.1. **Recovery Action:** Prevent impairment to watershed hydrology

25.2.1.1. **Action Step:** Develop and enforce stream flow bypass requirements for diversions on the mainstem San Vicente and Mill creeks (CDFG 2004).

25.2.1.2. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated through conservation programs.

25.2.1.3. **Action Step:** Determine and monitor 1600 program compliance related to water diversions (CDFG 2004).

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

26.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

26.1.1.1. **Action Step:** Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.

26.1.2. **Recovery Action:** Reduce adverse impacts to watershed processes associated with road density

26.1.2.1. **Action Step:** Forest managers should use the Handbook for Forest and Ranch Roads (Weaver and Hagans, 1994) or other similar guidance document to minimize sediment impacts resulting from unsurfaced roads in the upper San Vicente watershed.

26.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

26.2.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

26.2.1.1. **Action Step:** Discourage counties from rezoning forestlands to rural residential or other incompatible land uses.

Table 3: Implementation Schedule ~ San Vicente Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SVC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
SVC-CCC-1.1.1.1	Action Step	Estuary	Maintain current stream configuration.	3	100	Caltrans, Railroads							The San Vicente estuary was destroyed due to construction of the railroad and highway crossings. San Vicente Creek flows out to the ocean through a bore constructed in bedrock. Re-establishing an estuary is highly impractical and is not recommended.
SVC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.**										
SVC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Prevent impairment to floodplain connectivity.										
SVC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Ensure off channel habitats are adequately monitored and maintained. Develop landowner agreements.	1	10	BLM, CDFG, IWRP, Private Consultants, Santa Cruz RCD	4.00	4.00				8	Cost are reduced due to generally cooperative landowners in the San Vicente Watershed. Most costs are likely associated with staff time. The inlet to San Vicente pond should be monitored, and problems corrected, on a weekly basis. Cost for monitoring estimated at $4,000/project with a total of two projects.
SVC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SVC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve shelter rating										
SVC-CCC-3.1.1.1	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem San Vicente Creek.	2	10	IWRP, Santa Cruz County, Santa Cruz RCD	230.55	230.55				461	The most appropriate technique to increase shelter values in San Vicente Creek will likely involve installation of large woody material. Other instream habitat elements could include boulder installation and construction of features to facilitate creation of undercut stream banks. Cost based on treating 4 miles of stream at a cost of $115,276/mile.
SVC-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase large wood frequency										
SVC-CCC-3.1.2.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFG, NMFS, Santa Cruz County							Costs already incorporated as part of shelter rating. Assuming placement of LWD will increase shelter rating and increase LWD frequency.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-3.1.2.2	Action Step	Habitat Complexity	Install properly sized large woody material to viability table targets throughout mainstem San Vicente Creek	1	5	BLM, IWRP, Santa Cruz RCD						TBD	Most LWD structures will need some engineering design and will need to be secured to minimize concerns due to downstream infrastructure including the Highway 1 and railroad bores. Evaluation of potential impacts to water surface elevations per FEMA concerns may also be required.
SVC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										
SVC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams).	2	10		25.00	25.00				50	The most appropriate technique to increase pool frequency in San Vicente Creek will likely involve installation of large woody material. Other instream habitat elements could include boulder installation into responsive stream reaches. Cost based on treating 2 miles of stream at a rate of $25,000/mile for LWD placement. If constructing ELJ, assume 10/mile at a rate of 115,276/ELJ for a total of 2,305,000.
SVC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SVC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with urbanization										
SVC-CCC-5.1.1.1	Action Step	Landscape Patterns	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						In-Kind	
SVC-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SVC-CCC-6.1.1	Recovery Action	Passage	Modify or remove physical passage barriers										
SVC-CCC-6.1.1.1	Action Step	Passage	Evaluate Mill Creek dam for potential sediment input, fish passage constraints, and upstream habitat attributes.	3	10	CDFG, IWRP	1.00	1.00				2	Preliminary information indicates the habitat upstream of the dam is less conducive to coho salmon and more likely conducive to steelhead due to higher stream gradients.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-6.1.1.2	Action Step	Passage	Remove the Mill Creek dam(s) if no long-term adverse impacts to the downstream fishery are predicted.	3	20	CDFG, IWRP, Santa Cruz RCD	125.05	125.05	125.05	125.05		500	Little information available regarding the size of the dam(s) and associated constraints. Cost is likely an over estimate. Removing the dam is unlikely to increase the carrying capacity of the San Vicente coho salmon population, but may benefit steelhead. However this action should not move forward until issues regarding adverse affects to downstream survival of coho salmon is evaluated and determined to be insignificant. Removal costs will vary depending on sediment toxicity and quantity in the dam. Costs need to be weighed against quality and quantity of upstream habitat. Equipment access is likely the most significant constraint.
SVC-CCC-6.1.1.3	Action Step	Passage	Evaluate impact of Railroad and Caltrans bore to fish passage during high flow events.	3	10	CDFG, IWRP, Santa Cruz County Transportation Commission, Santa Cruz RCD							The historical estuary has been lost due to placement of fill and rerouting the stream channel for the railroad and highway crossing. The stream now flows through a tunnel (bore) directly to the ocean. The tunnel should be monitored to ensure no blockages that could impede migration accumulate. To date, no known blockages have occurred in the recent past, but could have significant adverse impacts to a coho year class.
SVC-CCC-6.1.1.4	Action Step	Passage	Install baffles in the tunnel bore as necessary.	3	10	CalTrans, CDFG, Santa Cruz County Transportation Commission	36.00	36.00				72	Cost based on $71,820/unit.
SVC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SVC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
SVC-CCC-10.1.1.1	Action Step	Viability	Monitor population response in off-channel habitats compared to instream habitat, similar to work conducted by Environmental Science Associates et al. (2004).	2	6	BLM, California Coastal Conservancy, IWRP	105.83	21.17				127	Monitoring is essential for the stream restoration actions in San Vicente in order to evaluate their effectiveness and to allow adaptive management based on predictions of population response. Monitoring should include smolt outmigration estimates from San Vicente pond similar to the efforts of ESA (Environmental Science Associates et al. 2004). Cost for fish/habitat restoration effectiveness monitoring estimated at $126,758/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-10.1.1.2	Action Step	Viability	Preserve the remaining genetic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce risk of extirpation.	1	6	CDFG, NOAA SWFSC	16.67	3.33				20	Extant coho run in San Vicente creek are likely extremely closely related to the Scott Creek coho population. However, this assumption should be evaluated and genetic resources preserved if important characteristics are identified.
SVC-CCC-10.1.1.3	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	2	10	CDFG, IWRP, NOAA SWFSC	75.00	75.00				150	Monitoring program should be initiated near the completion of restoration efforts. Program should be initiated soon after the initiation of restoration and enhancement actions.
SVC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
SVC-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
SVC-CCC-10.2.1.1	Action Step	Viability	Implement standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all landowners to develop similar assessment methods.	2	5	CDFG, IWRP, NOAA SWFSC, Santa Cruz RCD						TBD	
SVC-CCC-10.2.2	Recovery Action	Viability	Increase spawner density										
SVC-CCC-10.2.2.1	Action Step	Viability	Conduct periodic surveys of adult abundance.	2	10	CDFG, NOAA SWFSC	56.50	56.50				113	Surveys should assess a minimum of three cohorts. Although a Dependent watershed, San Vicente has recently reestablished its coho run and is a watershed where significant instream restoration actions have occurred and more are planned in the near future. Therefore, surveys of adult abundance (possibly through redd counts using the methods of Gallagher and Gallagher (2005) could provide an index of the last remaining coho populations in the Santa Cruz Mountains Diversity stratum. Cost for annual spawner ground surveys estimated at $56,470/year.
SVC-CCC-10.2.2.2	Action Step	Viability	Encourage planting of surplus coho salmon broodstock from the Monterey Bay Salmon and Trout Project into San Vicente Creek.	1	100	CDFG, Monterey Bay Salmon and Trout Project, NMFS, NOAA SWFSC						In-Kind	San Vicente is in better relative condition than many other watersheds and with the closure of mining operations it is less likely to be impaired by anthropogenic threats. Supplementation with surplus broodstock should only occur if the coho run in the watershed drops to low levels and habitat conditions remain suitable.
SVC-CCC-10.2.2.3	Action Step	Viability	Fund monitoring actions to evaluate success of adult reintroductions towards salmon recovery	2	20	CDFG, NMFS							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-10.2.2.4	Action Step	Viability	Ensure spawning adults are not harassed when migrating and spawning in the watershed.	1	100	CDFG Law Enforcement, NMFS OLE, Private Landowners						In-Kind	Harassment of migrating and spawning adults may occur due to the close proximity to the community of Davenport. Encourage citizen patrols as well as patrols by law enforcement agencies to minimize this threat.
SVC-CCC-10.2.2.5	Action Step	Viability	Remove homeless encampments adjacent to anadromous fish streams where impacts to water quality and abundance are likely.	1	100	CDFG Law Enforcement, NMFS OLE, Sheriff Department						In-Kind	Initial efforts should concentrate on the lower pond where previous encampments have been located.
SVC-CCC-10.2.2.6	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	2	10	CDFG, NOAA SWFSC	18.50	18.50				37	Cost for annual juvenile surveys estimated at $18,823/year for Santa Cruz diversity stratum.
SVC-CCC-14.1	**Objective**	**Disease/Predation/Competition**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SVC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent adverse alterations to riparian species composition and structure										
SVC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Remove invasive exotic vegetation from riparian zones.	1	20	IWRP, Santa Cruz RCD	903	903	903	903		3,610	Initial removal efforts should be concentrated in the lower portion of the watershed which is heavily infested with ivy. Removal will likely entail a sustained effort with periodic follow-ups to ensure suppression. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $45,114/acre.
SVC-CCC-14.1.1.2	Action Step	Disease/Predation/Competition	Work with landowners to discourage planting and dumping of non-native vegetation within the riparian corridor of lower San Vicente Creek.	3	100	IWRP, Santa Cruz County, Santa Cruz RCD						In-Kind	
SVC-CCC-14.2	**Objective**	**Disease/Predation/Competition**	**Address disease or predation**										
SVC-CCC-14.2.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-14.2.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of fish disease (e.g., black spot) to the San Vicente population.	3	3	CDFG, IWRP, NMFS, NOAA SWFSC, Private Consultants, Santa Cruz RCD	50.00					50	If possible, provide and implement recommendations to reduce black spot disease to the San Vicente population. Efforts should evaluate potential differences in stream rearing and off-channel rearing fish.
SVC-CCC-14.3	**Objective**	**Disease/Predation/Competition**	**Address the inadequacy of existing regulatory mechanisms**										
SVC-CCC-14.3.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
SVC-CCC-14.3.1.1	Action Step	Disease/Predation/Competition	Identify and work with landowners in the upper watershed to discontinue practice of stocking ponds with exotic and predator fish .	2	5	CDFG, IWRP, Santa Cruz County						In-Kind	Efforts should include educational outreach and regulatory oversight. Landowners should be encouraged to remove non-native fish from ponds. Non-native fish must not be placed into fish bearing streams.
SVC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SVC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate										
SVC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	1	100	CalFire						In-Kind	
SVC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	CalFire						In-Kind	
SVC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										
SVC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.	2	100	CalFire							Require all water truck/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
SVC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
SVC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.	2	100	BLM, CalFire							This recommendation only applies to situations where lives and structures are not immediately threatened by wildfire.
SVC-CCC-20.1	**Objective**	**Mining**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
SVC-CCC-20.1.1	Recovery Action	Mining	Prevent impairment to instream substrate										
SVC-CCC-20.1.1.1	Action Step	Mining	Tailings, settling ponds, and other attributes of mining should be secured to ensure sediment, toxins, and other deleterious substances do not enter streams through either direct runoff or subsurface flow.	1	100	CDFG, CEMEX, RWQCB, Santa Cruz County, USEPA						TBD	An assessment of potential site specific threats is needed in order to evaluate total costs. However, this recommendation is typically a standard business practice for mining operation due to a variety of regulatory requirements.
SVC-CCC-20.1.1.2	Action Step	Mining	Abandoned mining areas in the San Vicente watershed should comply with all appropriate requirements of the Surface Mine Control and Reclamation Act.	2	100	BLM, California Geological Survey, CEMEX						TBD	This should be considered a standard business practice. A site specific evaluation is likely needed. Costs of implementing this recommendation should be borne by the quarry operator.
SVC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SVC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity.										
SVC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Restore areas impaired by infrastructure near streams, historical floodplains or off channel habitats. Proactively work with landowners on lower San Vicente.	2	20	CDFG, IWRP, Santa Cruz RCD	63.50	63.50	63.50	63.50		254	Working with landowners in lower San Vicente to remove problematic infrastructure could facilitate creation and enhancement of off-stream habitats beneficial to winter rearing success. Cost based on assumption of 1 project per mile in high IP habitat, total of 2 projects at a cost of $127,000/acre.
SVC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms.**										
SVC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	FEMA, Santa Cruz County						In-Kind	The lower portion of San Vicente provides important over wintering habitat for coho salmon. Protecting these areas from future development is important for their survival and could provide future opportunities for off-channel restoration projects.
SVC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SVC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SVC-CCC-23.1.1.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	10	BLM, CalFire, Santa Cruz County						TBD	
SVC-CCC-23.1.1.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	10	CalFire, IWRP	56.00	56.00				112	Cost for road inventory estimated at $1,056/mile (assume 75% of road network). Cost for sediment assessment estimated at $13.90/acre (assume 25% of total watershed acres).
SVC-CCC-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	20	BLM, CalFire, CalTrans, IWRP, Private Landowners, Santa Cruz RCD	8.00	8.00	8.00	8.00		32	Decommissioning approximately ten percent of the riparian roads in San Vicente Creek targets 2.3 miles of riparian road. $13,680/mile at 2.3 miles. Costs may vary depending on site conditions and other constraints.
SVC-CCC-23.1.1.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	5	CalFire, California Geological Survey, CalTrans, Santa Cruz County						In-Kind	The cost estimate is low because NMFS believes relatively little grading will occur due to the small size of the watershed.
SVC-CCC-23.1.1.5	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	BLM, CEMEX, Private Landowners, Santa Cruz County, Santa Cruz RCD						0	These BMPs should be incorporated into all road management practices and may result in long term cost savings due to lower maintenance and repair costs.

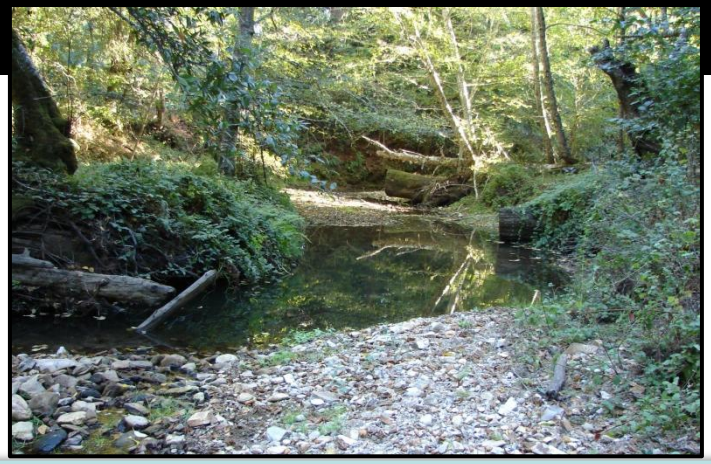
Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-23.1.1.6	Action Step	Roads/Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	100	CalFire, Private Landowners						In-Kind	
SVC-CCC-23.1.1.7	Action Step	Roads/Railroads	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.	1	5	Santa Cruz County						In-Kind	The number of visits per year to this important watershed will likely be minimal due to the small size of the watershed. Additional costs will be necessary to meet the obligations in the ordinance in other watersheds and this expense could be spread out across the County.
SVC-CCC-23.1.1.8	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	BLM, CalFire, CalTrans, CEMEX, Private Landowners, Santa Cruz County						In-Kind	Hydrologically disconnect roads in the watershed. This should be considered a standard business practice for all landowners and managers in the watershed.
SVC-CCC-23.1.1.9	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, Santa Cruz County						In-Kind	
SVC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
SVC-CCC-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, RPFs, RWQCB, Santa Cruz County						In-Kind	All new and replacement culverts should be sized to accommodate a 100 year flow event. This recommendation applies primarily to culverts on road crossings under timber harvest in the upper portion of the watershed above anadromy.
SVC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SVC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to watershed hydrology										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Petition the SWRCB to declare San Vicente Creek fully appropriated during summer and fall months (CDFG 2004).	2	5	CDFG, NMFS, Public, Santa Cruz County						In-Kind	The County of Santa Cruz and the California Coastal Commission stated in their conditional use permits for CEMEX construction of a new kiln in the General Plan, that San Vicente Creek is a fully allocated watershed. With the recent closure of CEMEX less water should be diverted from the watershed. Town of Davenport water use should comply with State law.
SVC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms**										
SVC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to watershed hydrology										
SVC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Develop and enforce stream flow bypass requirements for diversions on the mainstem San Vicente and Mill creeks (CDFG 2004).	2	5	CDFG, NMFS HCD, Santa Cruz County, SWRCB	72.00					72	This cost will require transects and measurements of streamflow in the lower reaches over a multiple year period. Costs may vary depending on gauging requirements per section 1600 stream diversion requirements. Bypass flow requirements should assess impacts to both coho and steelhead during all life stages. Cost for stream flow model estimated at $71,825/project.
SVC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated through conservation programs.	1	100	CDFG, CDFG Law Enforcement, NMFS OLE, NMFS PRD, SWRCB						TBD	Consider requiring federal and state incidental take permits for water diversions if determined to adversely affect coho salmon in San Vicente Creek. Cost likely accounted for in above action step.
SVC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Determine and monitor 1600 program compliance related to water diversions (CDFG 2004).	3	1	CDFG, CDFG Law Enforcement						In-Kind	
SVC-CCC-26.1	**Objective**	**Watershed Process**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SVC-CCC-26.1.1	Recovery Action	Watershed Process	Reduce adverse impacts to watershed processes associated with urbanization										
SVC-CCC-26.1.1.1	Action Step	Watershed Process	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.	1	100	Santa Cruz County, Santa Cruz County Land Trust						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SVC-CCC-26.1.2	Recovery Action	Watershed Process	Reduce adverse impacts to watershed processes associated with road density										
SVC-CCC-26.1.2.1	Action Step	Watershed Process	Forest managers should use the Handbook for Forest and Ranch Roads (Weaver and Hagans, 1994) or other similar guidance document to minimize sediment impacts resulting from unsurfaced roads in the upper San Vicente watershed.	3	100	CalFire						In-Kind	
SVC-CCC-26.2	**Objective**	**Watershed Process**	**Address the inadequacy of existing regulatory mechanisms**										
SVC-CCC-26.2.1	Recovery Action	Watershed Process	Reduce adverse impacts to watershed processes associated with urbanization										
SVC-CCC-26.2.1.1	Action Step	Watershed Process	Discourage counties from rezoning forestlands to rural residential or other incompatible land uses.	1	100	Public, Santa Cruz County						In-Kind	

Scott(s) Creek

Location	•Santa Cruz County
Watershed Area	•30.0 Square Miles
Potential Habitat	•13.9 Stream Miles
Vegetation	•70% Coniferous, 30% Riparian or Montane Forest, or Shrubland
Erodability	•Moderate to High
Ownership Patterns	•95% Private; 5% Public
Dominant Land Uses	•Rural Residential, Timber, Agricultural
Housing Density	•Low
TMDL Pollutants	•None



Scott Creek
Photo by Jerry Smith, SJSU

Scott(s) Creek Coho Salmon: Persistent – Low Abundance

Recovery Goals

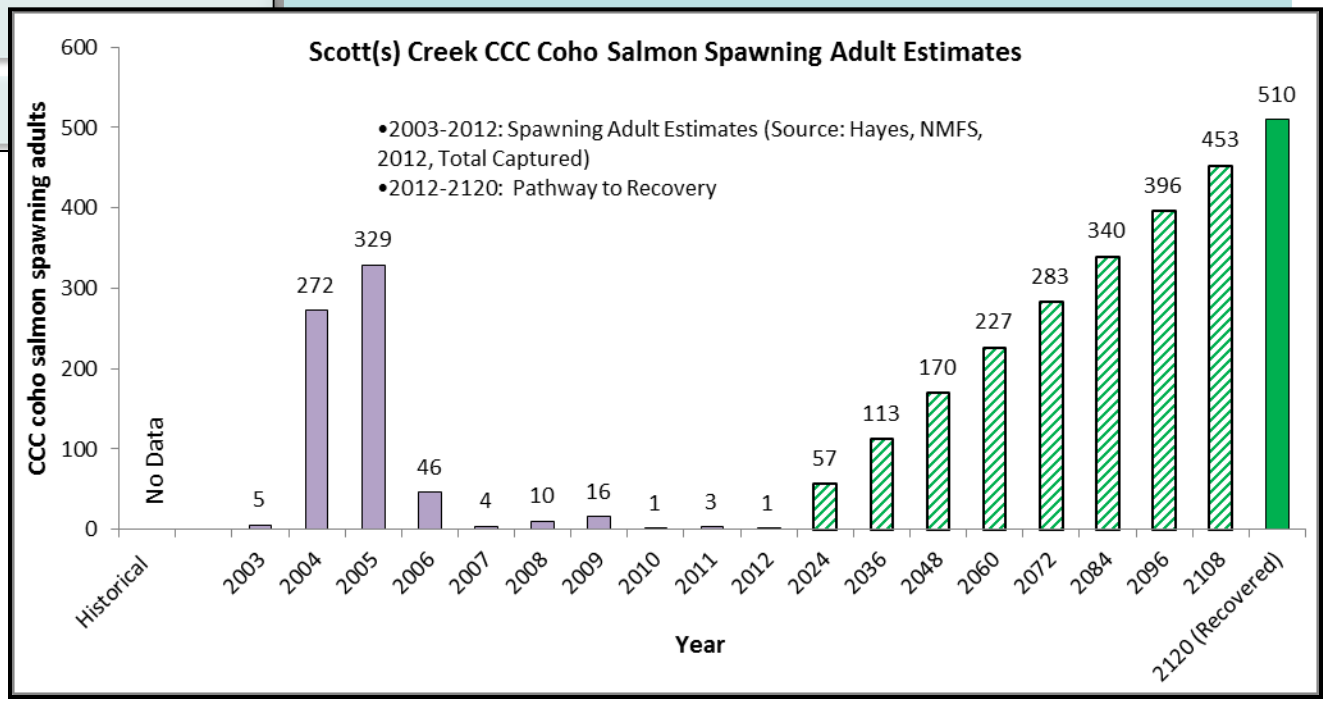
- ✓ Fund, support and expand rearing capacity at the Monterey Bay Salmon and Trout Project facility
- ✓ Continue ongoing juvenile and adult monitoring efforts in the watershed

Scott(s) Creek Adult Spawner Targets

Downlisting to Threatened
255

Recovery
510

STEELHEAD: YES
CHINOOK SALMON: NO



Scott(s) Creek

Potential Habitat: 13.9 miles
Recovery Target: 510 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	GOOD	FAIR	FAIR	FAIR	GOOD	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Remove structures impairing or reducing the historical tidal prism
- Highway 1 bridge reconstruction should restore river mouth dynamics
- Encourage breeching of old levees in the lower riparian reaches
- Reclaim alcove and side channels for winter-refugia and summer rearing
- Maintain and enhance current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth
- Provide incentives to water rights holders willing to convert some or all of their water right to instream use
- Continue funding the Scott Creek lifecycle station, and continue and expand operation of the MBSTP conservation hatchery

Priority 2 & 3: Long-Term Restoration Actions

- Restore estuarine habitat and the associated wetlands and slough
- Post interpretive signage at the beach to discourage breaching of the lagoon sandbar
- Evaluate timing and frequency of natural and artificial breeching events
- De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access
- Promote off-channel storage and efficient irrigation to reduce diversion impacts
- Minimize permitting constraints for hatchery operations critical to the broodstock program

Recovery Partners

Scott Creek Watershed Counsel, CDFG

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Campbell Timberland, City of Santa Rosa and Morgan Bond, SWFSC

Scott(s) Creek

Potential Habitat: 13.9 miles
Recovery Target: 510 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW	LOW	MEDIUM	NA	LOW	MEDIUM	HIGH	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Protect existing areas providing winter refuge and seasonal habitats from channelization actions in the lower watershed
- Install salmonid identification signs at all major fishing access points
- The proposed bridge replacement for Highway 1 over Scott Creek should be relocated to allow Scott Creek to re-establish its historical outlet
- Establish and enforce minimum summer releases from the Mill Creek reservoir
- Evaluate and prepare contingency plans to breach estuary sandbars to facilitate adult upmigration when instream flows are adequate for passage and spawning

Priority 2 & 3: Long-Term Threat Abatement Actions

- Avoid lowering stream flows, entraining salmonids, or causing erosion when drafting water for dust abatement or other purposes
- Prohibit offshore salmon fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth
- Avoid or minimize impacts to off channel habitat, floodplains, ponds, and oxbows during timber harvest activities
- Retain the largest trees in all riparian zones.

Scott(s) Creek
Photo by Jerry Smith, SJSU

Conservation Highlights

- Santa Cruz RCD sediment remediation projects
- CalPoly floodplain enhancement efforts
- Monterey Bay Salmon and Trout Project broodstock program and NOAA SWFSC population estimates.

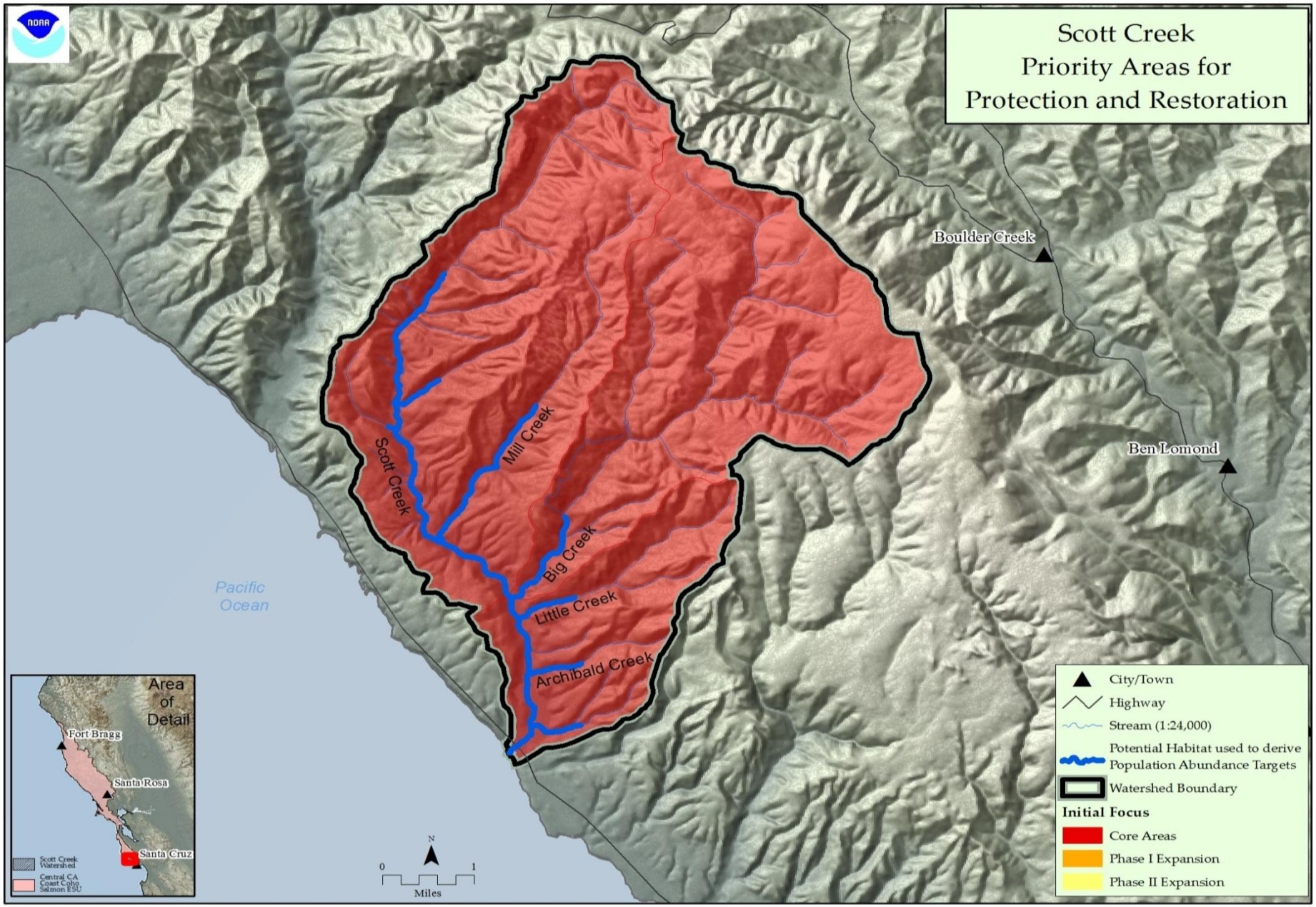


Figure 1: Map of Scott(s) Creek

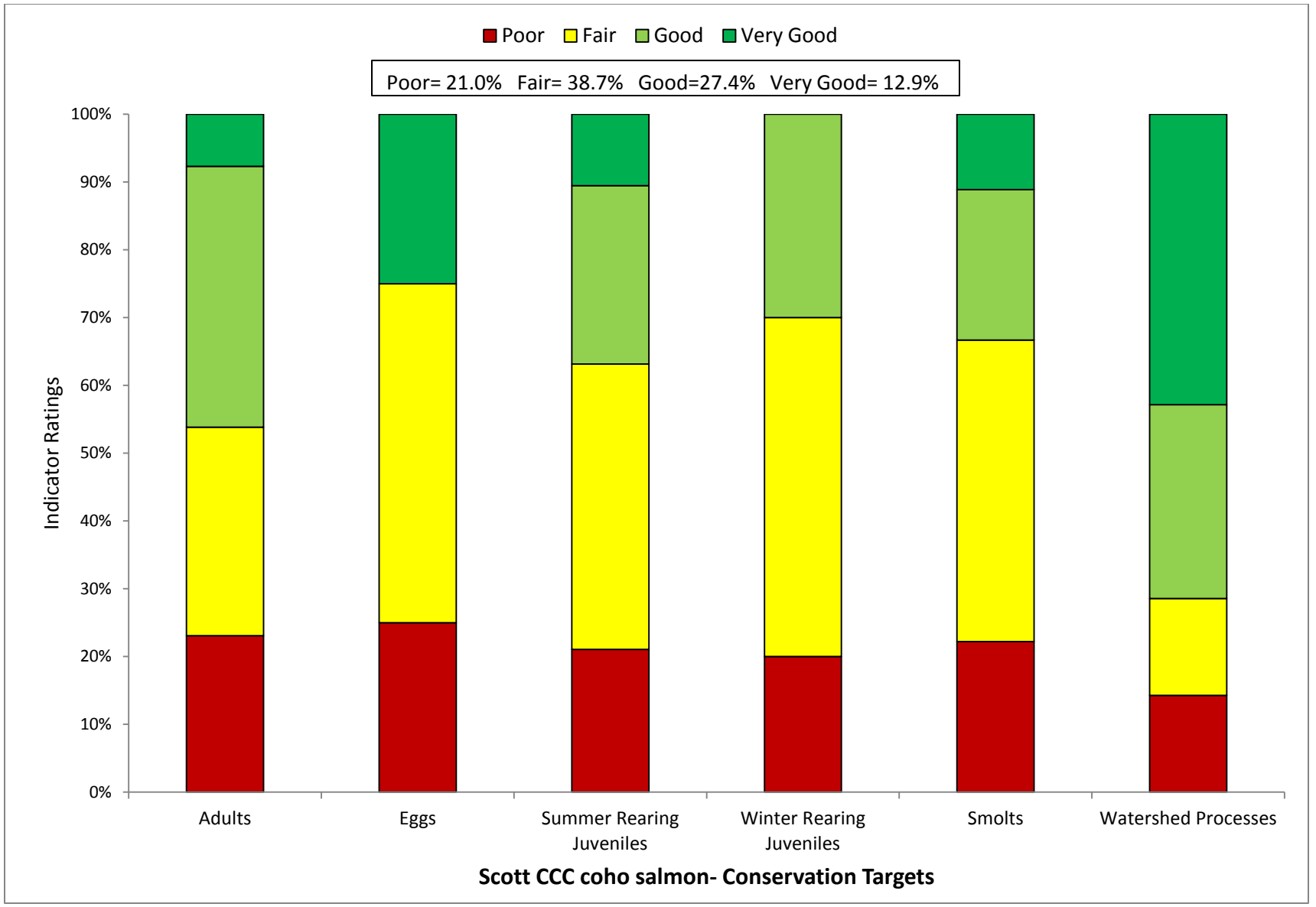


Figure 2 Viability Results by Lifestage

Table 1: CAP Viability Results ~ Scott(s) Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**20% streams 12% IP-km accessible (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**20% streams 2% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =33**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =83**	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**40% streams 68% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**60% streams 93% IP-km (>49% of pools are primary pools)**	Good	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**20% streams 12% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**20% streams 2% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =75**	Fair	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = <35**	Very Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.8 Diversions /10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**75% of IP-km to 90% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**100% streams 100% IP-km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**40% streams 68% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**< 0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**< 50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**20% streams 12% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**20% streams 2% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**75% of IP-km to 90% of IP-km accessible**	Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**40% streams 68% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**20% streams 2% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.8 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =67**	Fair	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-Km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Smolt abundance which produces moderate risk spawner density per Spence (2008)**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.104% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.478% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**25-15% of Watershed in Timber Harvest**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**0% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**3 Miles/Square Mile**	Fair	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**2.8 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Scott(s) Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Low	Medium
2	Channel Modification	Medium	Low	High	Low	Medium	Low	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Medium	Medium	High	Medium	Medium	Medium
5	Fishing and Collecting	Medium	-	Low	-	Medium	-	Medium
6	Hatcheries and Aquaculture	Low	-	Low	Low	Low	-	Low
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Low	Medium	Medium	Low	Low	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Medium	Low	Low	Medium
12	Roads and Railroads	Low	Medium	High	High	Medium	Medium	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	Low	Low	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	Medium	High	High	Medium	Medium	High

Central CA Coast Coho Salmon ~ Scott Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Increase the extent of estuarine habitat

1.1.1.1. **Action Step:** Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).

1.1.1.2. **Action Step:** Remove structures impairing or reducing the historical tidal prism, where feasible, and benefits to salmonids and/or the estuarine environment are predicted. Work with Caltrans to restore estuary tidal prism as part of the proposed bridge replacement for the Highway 1 bridge over Scott Creek lagoon.

1.1.2. **Recovery Action:** Reduce frequency of artificial breaching events

1.1.2.1. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

1.1.2.2. **Action Step:** Monitor sandbar to evaluate timing and frequency of natural and artificial breaching events.

1.1.3. **Recovery Action:** Rehabilitate natural river mouth dynamics

1.1.3.1. **Action Step:** Highway 1 bridge reconstruction should restore historical river mouth dynamics to minimize delayed natural breaching.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Encourage breaching of old levees in the lower riparian reaches of Scott Creek.

2.1.1.2. **Action Step:** Reclaim alcove and side channels for winter refugia and summer rearing.

2.1.1.3. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

3.1.1.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.1.1.3. **Action Step:** Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.

3.1.2. **Recovery Action:** Improve shelter rating

3.1.2.1. **Action Step:** Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).

3.1.3. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.3.1. **Action Step:** Increase the frequencies of riffles in 75% of the streams within the watershed

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Minimize redd scour

4.1.1.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

4.1.2. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.2.1. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.

4.1.2.2. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.1.2.3. **Action Step:** Promote irrigation efficiency projects for agricultural practices.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

9.1.1.2. **Action Step:** Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

9.1.1.3. **Action Step:** Restoration projects that upgrade or decommission high risk roads or other infrastructure in Core areas should be considered an extremely high priority for funding (e.g., PCSRF).

9.1.1.4. **Action Step:** Evaluate and remove roadside berms and other infrastructure that lead to increased runoff velocities and result in increased sediment discharge.

9.1.1.5. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).

10. Restoration- Viability

10.1. **Objective:** Address other natural or manmade factors affecting the species continued existence

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Continue funding the Scott Creek lifecycle station.

10.1.1.2. **Action Step:** Implement standardized watershed assessments to identify limiting factors specific to the watershed. Encourage all major landowners to adopt consistent assessment methods.

10.1.1.3. **Action Step:** Work with landowners to conduct actions (e.g., maintain road and trail closures) to minimize or prevent trespass and poaching.

10.1.1.4. **Action Step:** Improve NMFS and CDFG coordination to minimize permitting constraints for hatchery operations critical to the broodstock program.

10.1.1.5. **Action Step:** Develop and implement a monitoring program to evaluate the performance of recovery efforts.

10.1.1.6. **Action Step:** Preserve the remaining genetic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce risk of extirpation.

10.1.2. **Recovery Action:** Increase abundance

10.1.2.1. **Action Step:** Continue operation of the MBSTP Kingfisher Flat Hatchery as a conservation hatchery, following the guidelines of the CDFG and NMFS (CDFG 2004).

10.1.2.2. **Action Step:** Expand the Kingfisher Flat Hatchery.

10.1.3. **Recovery Action:** Increase spawner density

10.1.3.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Encourage a watershed-wide HCP for all or multiple landowners within a watershed to pool resources as a means to facilitate long-term survival and recovery for coho salmon and their habitat.

10.2.1.2. **Action Step:** Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.

10.2.1.3. **Action Step:** Initiate a new habitat typing effort in Scott Creek to guide future restoration actions.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment to instream substrate

13.1.1.1. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.

13.1.1.2. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.1.1.3. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. where critical infrastructure is located) for bank hardening projects.

13.1.1.4. **Action Step:** Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.

13.1.2. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

13.1.2.1. **Action Step:** Minimize the use of rip-rap in future bank stabilization projects. Thoroughly evaluate all alternatives to rip-rap, and at a minimum, incorporate complexity features into stabilization projects.

13.1.3. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

13.1.3.1. **Action Step:** Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.

13.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

13.2.1.1. **Action Step:** Protect existing areas that provide winter refuge and seasonal habitats for juvenile salmonids from channelization projects.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.1.3. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.

15.2.1.2. **Action Step:** Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the Scott Creek watershed (and all other watersheds in the County).

15.2.1.3. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.

15.2.2. **Recovery Action:** Prevent impairment to hydrology

15.2.2.1. **Action Step:** Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Install/construct permanent signs at all major public access points along Scotts Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).

16.1.1.2. **Action Step:** Promote CalTip to discourage poaching (CDFG 2004).

16.1.1.3. **Action Step:** Prohibit offshore salmon fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.

16.1.1.4. **Action Step:** Work with CDFG to improve the Fishing Regulation manual to clearly identify differences in body morphology of all potentially present adult salmonids with color photos of diagnostic features (e.g., caudal fin spotting, caudal fin shape, coloration of lower jaw, peduncle width, etc.).

16.1.1.5. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Scotts Creek.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize impacts to off channel habitat, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.

19.1.3. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

19.1.3.1. **Action Step:** Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.

19.1.4. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, dams, etc.)

19.1.4.1. **Action Step:** Avoid the new road construction in riparian zones (< 100 feet).

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate

23.1.1.1. **Action Step:** Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.

23.1.1.2. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

23.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.2. **Recovery Action:** Prevent impairment to the estuary

23.1.2.1. **Action Step:** Relocate or extend the proposed replacement bridge for Highway 1 over Scott Creek in order to allow Scott Creek to re-establish its historical outlet into the ocean. Relocating or extending the replacement bridge could facilitate the re-establishment of the historical tidal prism in the lower lagoon.

23.1.3. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.3.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanism

23.2.1. **Recovery Action:** Prevent impairment to instream substrate

23.2.1.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

23.2.1.2. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.2.1.3. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

23.2.1.4. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.2.1.5. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.2.1.6. **Action Step:** Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.2.1.7. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary

24.1.1.1. **Action Step:** Work with water users to minimize depletion of summer base flows.

24.1.1.2. **Action Step:** Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.

24.1.2. **Recovery Action:** Prevent impairment to hydrology

24.1.2.1. **Action Step:** Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

24.1.2.2. **Action Step:** If predicted flows are below a level considered critical to maintain habitat conditions for coho salmon, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.

24.1.2.3. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

24.1.2.4. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.2.1. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

24.2.1.1. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

24.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

24.2.2.1. **Action Step:** Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.2.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.2.3.1. **Action Step:** Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

24.2.3.2. **Action Step:** Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

24.2.4. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.2.4.1. **Action Step:** Establish and enforce minimum summer releases from the Mill Creek reservoir to ensure rearing habitat is maintained in Mill Creek.

24.2.4.2. **Action Step:** Agencies and landowners should develop contingencies for drought conditions in a manner compatible with CCC coho salmon recovery needs.

24.2.4.3. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).

24.2.4.4. **Action Step:** Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.

24.2.4.5. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

24.2.4.6. **Action Step:** Encourage CalFire to modify water right for diversion in upper headwaters of Scott Creek.

24.2.4.7. **Action Step:** Evaluate dam and impact of water diversions in Boyer Creek (trib to Big Cr)

24.3. **Objective:** Address other natural or manmade factors affecting the species' continued existence

24.3.1. **Recovery Action:** Prevent impairment to passage and migration

24.3.1.1. **Action Step:** Evaluate and prepare contingency plans to breach estuary sandbars to facilitate adult upmigration when instream flows are adequate for passage and spawning IF sandbar remains closed by mid-January and conservation hatchery remains in operation.

24.4. **Objective:** Address the overutilization for commercial, recreational, scientific or educational purposes

24.4.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

24.4.1.1. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Scott(s) Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ScC-CCC-1.1.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
ScC-CCC-1.1.1.1	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (CDFG 2004).	2	5	CA Coastal Commission, CalPoly, CalTrans, NOAA SWFSC, USACE	931					931	Scott Creek estuary was reduced in size following European arrival and this habitat loss is currently believed to be a major limiting factor for salmonids. The upper estuary was converted for agricultural purposes, and much of the historical tidal prism is reduced due to channelization for the Highway 1 Bridge constructed in the early 1940's. Estuary/lagoons on California's central coast have been extensively documented as superior rearing habitat for steelhead and can contribute a disproportionate total number of returning adults compared to stream habitats when conditions are even marginally suitable (Bond et al., 2008). This recommendation includes restoration of complex habitat features such as large woody material to facilitate creation of deeper pools and cover. Coho will benefit from restoration during smolt transition and adult upmigration. Cost for treating three acres (assume 10% of total estuarine acres) at a rate of $310,216/acre.
ScC-CCC-1.1.1.2	Action Step	Estuary	Remove structures impairing or reducing the historical tidal prism, where feasible, and benefits to salmonids and/or the estuarine environment are predicted. Work with Caltrans to restore estuary tidal prism as part of the proposed bridge replacement for the Highway 1 bridge over Scott Creek lagoon.	1	10	CA Coastal Commission, CalPoly, CalTrans, NOAA SWFSC						TBD	Caltrans is currently evaluating bridge replacement - differentiating between anticipated replacement costs and additional actions for coho recovery benefits can not be estimated at this time due to uncertainty regarding Caltrans preferred alternative. Replacement of the bridge offers a rare opportunity to restore two sharp bends to the lower channel and replace the leveed and straightened channel.
ScC-CCC-1.1.2	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
ScC-CCC-1.1.2.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	2	10	CalTrans, CDFG, Santa Cruz County	1.50	1.50				3	Cost of signs vary widely depending on materials used and content of signs. Assume $1,000/sign with a minimum of 3 signs for lagoon.
ScC-CCC-1.1.2.2	Action Step	Estuary	Monitor sandbar to evaluate timing and frequency of natural and artificial breaching events.	2	10	CalPoly, CalTrans, CDFG, NOAA SWFSC						In-Kind	
ScC-CCC-1.1.3	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-1.1.3.1	Action Step	Estuary	Highway 1 bridge reconstruction should restore historical river mouth dynamics to minimize delayed natural breaching.	1	10	CA Coastal Commission, CalPoly, CalTrans, Santa Cruz County						TBD	The major channel modification on Scott Creek is at the lagoon where Caltrans realigned (straightened) the stream to a new location for the original Highway 1 bridge. The original channel made a sharp bend to the west and then a second sharp bend at the cliff to enter the ocean. Both of these bends would have produced deep scour holes in the lagoon, serving as good feeding and transition habitat for down-migrating smolts. The sandbar at the mouth would also have been less likely to have delayed opening in the winter as currently occurs with the current alignment. Re-establishing the historical alignment will have major benefits to both steelhead and coho salmon.
ScC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
ScC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
ScC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Encourage breaching of old levees in the lower riparian reaches of Scott Creek.	1	10	CalPoly, CDFG, NOAA SWFSC, Scotts Creek Watershed Council, USACE	62.00	62.00				124	Breaching will improve floodplain function and provide high water refuge for juvenile salmonids. Levees were constructed on the lower Scott Creek floodplain to facilitate farming and to concentrate and direct flows under the Highway 1 bridge in the estuary. These levees receive little if any maintenance, and in the riverine reach the levees are well vegetated. Nonetheless, the levees continue to impair habitat quality by reducing the extent of available winter refugia. The levees also reduce the total amount of rearing habitat in the estuary and reduce the extent and duration of floodplain connectivity. Cost estimate based on treating 3 miles (assume 1 project/mile in 25% High IP) at a rate of $41,092/mile.
ScC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Reclaim alcove and side channels for winter refugia and summer rearing.	1	15	Big Creek Lumber Co., CalPoly, Santa Cruz County, Scotts Creek Watershed Council						TBD	Cost accounted for in above action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	20	Big Creek Lumber Co., CalFire, CalPoly, Santa Cruz County						TBD	In areas where highly entrenched channels occur adjacent to structures, roads, and similar improvements, landowners often attempt to stabilize the streambanks to protect their property, which results in a net degradation of riparian and instream habitats. Due to the proximity of roads adjacent to stream channels, it is likely that future bank hardening will occur in the watershed. Some stream reaches in Scott Creek appear entrenched, and it is anticipated that future bank hardening will occur in some areas of the watershed. De-commissioning of these roads will preclude future bank hardening and should enhance floodplain connectivity. Cost accounted for in SEDIMENT.
ScC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										
ScC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	5	Big Creek Lumber Co., CalFire, CalPoly, Scotts Creek Watershed Council	100.00					100	Cost based on $28,500/mile of stream complexity improvement for 3.5 miles of high IP. If engineered wood structures are used in replacement for the same 6.5 miles, costs would equal approximately $750,000. Recovery actions should focus on improving spawning habitat through placement of standard log/boulder habitat structures that can effectively increase holding and rearing habitat. In stream reaches with little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation. Winter LWD enhancement projects should be implemented and designed to provide continuous velocity refuges for juvenile salmonids from winter baseflows and floods, while summer habitat LWD projects should provide cover and facilitate scour during high flows to increase pool volume and frequency. Both single log and multiple log configurations can be used depending on site-specific conditions. Naturally occurring LWD should be left in place unless it can be demonstrated to threaten adjacent infrastructure. See 4.1.1 for more information.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-3.1.1.2	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	Big Creek Lumber Co., CalFire, CalPoly, Lockheed	65.00	65.00				130	Returning riparian corridors to properly functioning condition is unlikely to address instream habitat conditions in a timely manner. While improved riparian function will ultimately increase wood recruitment into streams, near-term restoration measures will be required to fix degraded instream conditions. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $1,621/acre.
ScC-CCC-3.1.1.3	Action Step	Habitat Complexity	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	1	100	CDFG, Santa Cruz County, USACE						In-Kind	
ScC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating										
ScC-CCC-3.1.2.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure providing features to maintain current stream complexity, pool frequency, and depth (CDFG 2004).	1	100	CDFG, Santa Cruz County, USACE						In-Kind	
ScC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
ScC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase the frequencies of riffles in 75% of the streams within the watershed	2	10	CDFG, NMFS							Cost accounted for in above action steps (i.e. increase large wood frequency).
ScC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-4.1.1	Recovery Action	Hydrology	Minimize redd scour										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-4.1.1.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5	Big Creek Lumber Co., CalPoly	749					749	Redd scour is likely a limiting factor in some reaches of Scott Creek, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of steelhead egg and alevin mortality. Cost based on $115,276/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $182,250 for treating 6.5 miles of high IP. Co-related to habitat complexity. See 3.1.1.1 for more information.
ScC-CCC-4.1.2	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
ScC-CCC-4.1.2.1	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (storage tanks for rural residential users) in the upper watershed.	2	20	CalPoly, CDFG, IWRP, Santa Cruz RCD, Scotts Creek Watershed Council, Trout Unlimited						TBD	The major land use requiring large quantities of water are the organic farms in lower Scotts Creek owned by CalPoly. Most of the water diverted comes from wells. Harvesting of water during the winter could reduce the potential impact that these wells may have on surface flows in lower Scott Creek.
ScC-CCC-4.1.2.2	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	1	20	Big Creek Lumber Co., CalFire, CalPoly, CDFG, Lockheed, SWRCB						TBD	
ScC-CCC-4.1.2.3	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	2	10	CalPoly, Farm Bureau, IWRP, Santa Cruz RCD							
ScC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-9.1.1.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Santa Cruz County	6.25	6.25	6.25	6.25		25	Costs will vary on landowner participation and year to year variation in rainfall patterns. This cost estimate does not include maintenance obligations.
ScC-CCC-9.1.1.2	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	3	100	CalFire, CDFG, NMFS PRD, NRCS, RWQCB, Santa Cruz County, USACE, USFWS						In-Kind	This should be considered a standard business practice for all regulatory and oversight agencies.
ScC-CCC-9.1.1.3	Action Step	Sediment	Restoration projects that upgrade or decommission high risk roads or other infrastructure in Core areas should be considered an extremely high priority for funding (e.g., PCSRF).	1	10	Big Creek Lumber Co., CalFire, California Coastal Conservancy, CalPoly, CalTrans, NRCS, Santa Cruz County	21.00	21.00				42	Cost based on assumption of $13,680/mile to decommission 10% (~3 miles) of road network in the watershed. Road upgrades for the same 10% of the road network would equate to $71,820.
ScC-CCC-9.1.1.4	Action Step	Sediment	Evaluate and remove roadside berms and other infrastructure that lead to increased runoff velocities and result in increased sediment discharge.	3	10	Big Creek Lumber Co., CalFire, CalPoly	35.91	35.91				72	Roadside berms are a common feature on many private and county roads in Santa Cruz County. Many of the private timberland roads have been upgraded and are hydrologically disconnected. A similar effort should occur on the remaining roads in the watershed. The cost of this action assumes 10% of roads (~3 miles) will be treated at a cost of $23,940/mile.
ScC-CCC-9.1.1.5	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) and other infrastructure delivering sediment into watercourses (CDFG 2004).	3	10	Big Creek Lumber Co., CalFire, CalPoly	10.50	10.50				21	Costs to decommission 1.5 miles of riparian roads based on $13,680/mile. The costs are related to Roads and Railroads.
ScC-CCC-10.1	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species continued existence**										
ScC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-10.1.1.1	Action Step	Viability	Continue funding the Scott Creek lifecycle station.	1	5	CalPoly, NOAA SWFSC	235.00					235	Cost for life cycle monitoring station estimated at $234,600. NMFS Southwest Fisheries Science Center currently operates the only lifecycle station in the Santa Cruz Mountains Diversity Stratum on lower Scott Creek. This station provides essential information on the population size of adult and smolt salmonids in Scott Creek, and has been in continuous operation since 2003. Information from the station can be used to calibrate future population estimates for other watersheds in the Santa Cruz Mountains. Upgrades to the facility (i.e., construction of a permanent weir) would ultimately reduce operational costs, increase research opportunities, increase worker safety, and provide a more accurate estimate of the coho salmon population in Scott Creek. Continued operation is strongly recommended.
ScC-CCC-10.1.1.2	Action Step	Viability	Implement standardized watershed assessments to identify limiting factors specific to the watershed. Encourage all major landowners to adopt consistent assessment methods.	1	5	Big Creek Lumber Co., CalFire, CalPoly, CDFG, IWRP, NMFS, Santa Cruz RCD, USFWS							Standardized assessments are a high priority in Scott Creek due to imperiled status of coho salmon and immediate need to secure the Scott Creek population. Scott Creek could serve as a key demonstration watershed in the Santa Cruz Mountains Diversity Stratum.
ScC-CCC-10.1.1.3	Action Step	Viability	Work with landowners to conduct actions (e.g., maintain road and trail closures) to minimize or prevent trespass and poaching.	3	20	Big Creek Lumber Co., CalFire, CalPoly, Private Landowners						In-Kind	Cost is expected to be minimal and already largely covered as part of an existing outreach program to landowners and concerned citizen in the Scott Creek watershed.
ScC-CCC-10.1.1.4	Action Step	Viability	Improve NMFS and CDFG coordination to minimize permitting constraints for hatchery operations critical to the broodstock program.	2	50	CDFG, Monterey Bay Salmon and Trout Project, NMFS						In-Kind	
ScC-CCC-10.1.1.5	Action Step	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.	3	10	CalPoly, CDFG, NOAA SWFSC	63.50	63.50				127	Cost for fish/habitat effectiveness monitoring estimated at $126,758/project.
ScC-CCC-10.1.1.6	Action Step	Viability	Preserve the remaining genetic and phenotypic characteristics that promote life history variability through captive broodstock, supplementation, and gene-bank programs to reduce risk of extirpation.	1	100	Monterey Bay Salmon and Trout Project, NOAA SWFSC						In-Kind	
ScC-CCC-10.1.2	Recovery Action	Viability	Increase abundance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-10.1.2.1	Action Step	Viability	Continue operation of the MBSTP Kingfisher Flat Hatchery as a conservation hatchery, following the guidelines of the CDFG and NMFS (CDFG 2004).	1	20	CDFG, Monterey Bay Salmon and Trout Project, NMFS PRD, NOAA SWFSC, Pacific States Marine Fisheries Commission						TBD	Operation of this facility is essential to conservation of coho populations and preservation of southern coho salmon genetic resources. It is anticipated that the hatchery will need to operate as a broodstock facility for more than 20 years due to the severely compromised status of coho salmon south of the Golden Gate. Under current conditions, this broodstock operation is likely the key reason coho salmon continue to persist in the Santa Cruz Diversity Stratum. Efforts should be expended to assist the MBSTP to obtain secure funding sources to ensure long term operation of the facility. Currently funding sources to operate this facility are not secure, much of the current funding comes from donations which have decreased in recent years due to decreased angling opportunities in local streams.
ScC-CCC-10.1.2.2	Action Step	Viability	Expand the Kingfisher Flat Hatchery.	1	5	Big Creek Lumber Co., CDFG, Monterey Bay Salmon and Trout Project, NOAA SWFSC, Pacific States Marine Fisheries Commission	600					600	Expansion by replacing the existing concrete raceways with numerous individual rearing tanks should be evaluated. This could increase operational flexibility for the Scott Creek population and populations in other watersheds. Expansion should only occur if water supply reliability, in quantity and quality, can be reasonably ensured.
ScC-CCC-10.1.3	Recovery Action	Viability	Increase spawner density										
ScC-CCC-10.1.3.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20		28.00	28.00	28.00	28.00		112	Standardized surveys should not occur until a small sustained run of CCC coho salmon is re-established in the watershed. Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum. Redd monitoring using (GTRS sampling design) may be less expensive than establishing life cycle station to count migrating adults and smolts. All assessments should use standardized methods. Methods should be consistent across the ESU or at a minimum the Santa Cruz Mtns Diversity Stratum. Cost for spawner surveys are estimated at $56,470/year.
ScC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
ScC-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-10.2.1.1	Action Step	Viability	Encourage a watershed-wide HCP for all or multiple landowners within a watershed to pool resources as a means to facilitate long-term survival and recovery for coho salmon and their habitat.	3	5	Big Creek Lumber Co., CalPoly, CDFG, Lockheed, NMFS	600					600	If existing information is adequate regarding watershed conditions for covered species, it is possible to reduce overall costs considerably. However, if HCP negotiations are contentious and protracted, costs could increase considerably.
ScC-CCC-10.2.1.2	Action Step	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	2	10	Big Creek Lumber Co., CalPoly, NOAA SWFSC, Private Consultants	50.00	50.00				100	Juvenile monitoring is currently being conducted by J Smith of SJSU and to a lesser degree by the SWFSC.
ScC-CCC-10.2.1.3	Action Step	Viability	Initiate a new habitat typing effort in Scott Creek to guide future restoration actions.	1	2	Big Creek Lumber Co., CalPoly, CDFG, NOAA SWFSC	40.00					40	Information collected should be used to identify key areas for instream habitat restoration efforts and compare changes in stream conditions since the original habitat typing effort in the mid - 1990s.
ScC-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to instream substrate										
ScC-CCC-13.1.1.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	3	100	California Coastal Conservancy, California Geological Survey, CalTrans, CDFG, FEMA, NMFS, NRCS, RWQCB, Santa Cruz County, Santa Cruz RCD, USACE, USFWS						0	This recommendation should be adopted as a standard business practice for all agencies and consulting firms involved in actions to address channel and bank stability.
ScC-CCC-13.1.1.2	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	3	100	CalTrans, CDFG, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, USACE						0	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-13.1.1.3	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. where critical infrastructure is located) for bank hardening projects.	3	100	California Coastal Conservancy, CalTrans, FEMA, NMFS, NRCS, RWQCB, Santa Cruz County, USACE							
ScC-CCC-13.1.1.4	Action Step	Channel Modification	Flood control projects or other modifications facilitating new development (as opposed to protecting existing infrastructure) should be avoided.	2	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Lockheed, Santa Cruz County, USACE							
ScC-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										
ScC-CCC-13.1.2.1	Action Step	Channel Modification	Minimize the use of rip-rap in future bank stabilization projects. Thoroughly evaluate all alternatives to rip-rap, and at a minimum, incorporate complexity features into stabilization projects.	3	100	Big Creek Lumber Co., CalPoly, NRCS, Santa Cruz County, USACE							
ScC-CCC-13.1.3	Recovery Action	Channel Modification	Prevent adverse alterations to riparian species composition and structure										
ScC-CCC-13.1.3.1	Action Step	Channel Modification	Where riprap and other bank hardening is necessary, integrate other habitat-forming features – including large woody debris and riparian plantings and other techniques to minimize habitat alteration effects.	3	100	CalFire, CalPoly, Caltrans, Santa Cruz County, Santa Cruz RCD, Scotts Creek Watershed Council, USACE							
ScC-CCC-13.2	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms**										
ScC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-13.2.1.1	Action Step	Channel Modification	Protect existing areas that provide winter refuge and seasonal habitats for juvenile salmonids from channelization projects.	1	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, CDFG, Santa Cruz County, Scotts Creek Watershed Council, USACE							Stream channels in Scott Creek have been modified through three methods: (1) channel straightening and levee construction, (2) removal of instream structure, and (3) bank stabilization to protect roads. These actions have impaired floodplain connectivity in some stream reaches. Remaining areas should be protected.
ScC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity										
ScC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire						TBD	This recommendation should be considered a standard practice. Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out. Methods should include out-sloping, waterbars, breaks in fire lines (pick up blades on dozers occasionally, especially where fuels are sparse), minimize gradient of fire lines, change fire-line alignment onto occasional flats as often as possible (and especially near watercourses) to allow flows to dissipate and settle sediment. To the maximum extent possible, maintain natural topography - eliminate concentrating water velocities.
ScC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire						In-Kind	Standard business practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire						In-Kind	Some areas in the Scott Creek watershed have a high fire hazard rating according to CalFire data. A major fire occurred in the watershed in 2009. While fuel loading has been reduced following the 2009 fire, future wildfires are probable. A major fire, particularly if located in areas with a high erosion hazard rating, could substantially increase fine sediment input and further compromise the altered rate of large wood recruitment into stream channels. Furthermore, if existing riparian areas were lost to fire, higher instream temperatures would likely result.
ScC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										
ScC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
ScC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas throughout the current range of CCC coho salmon.	1	100	CalFire							
ScC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the Scott Creek watershed (and all other watersheds in the County).	1	5	CalFire						In-Kind	Cost of providing the plan is minimal.
ScC-CCC-15.2.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire						In-Kind	The resource agencies can provide guidance regarding critical resources in the area that may be affected by the fire and firefighting actions.
ScC-CCC-15.2.2	Recovery Action	Fire/Fuel Management	Prevent impairment to hydrology										
ScC-CCC-15.2.2.1	Action Step	Fire/Fuel Management	Draft water from non-fish bearing waters if at all possible. In larger fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	2	100	CalFire							Avoid drafting water by helicopter from the Scotts Creek lagoon and obtain water from the nearby Pacific Ocean. Require all water truck/tenders be fitted with DFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
ScC-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
ScC-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-16.1.1.1	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along Scotts Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	1	5	CDFG, Santa Cruz County, Scotts Creek Watershed Council	38.00					38	Cost of signs varies widely. Assume $500/sign with a minimum of 15 signs.
ScC-CCC-16.1.1.2	Action Step	Fishing/Collecting	Promote CalTip to discourage poaching (CDFG 2004).	2	100	CDFG							
ScC-CCC-16.1.1.3	Action Step	Fishing/Collecting	Prohibit offshore salmon fishing until January 15 (or until sandbar opens naturally) within one mile of the river mouth.	2	20	CDFG							
ScC-CCC-16.1.1.4	Action Step	Fishing/Collecting	Work with CDFG to improve the Fishing Regulation manual to clearly identify differences in body morphology of all potentially present adult salmonids with color photos of diagnostic features (e.g., caudal fin spotting, caudal fin shape, coloration of lower jaw, peduncle width, etc.).	1	3	CDFG, NMFS							
ScC-CCC-16.1.1.5	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Scotts Creek.	1	10	CDFG, NMFS						In-Kind	Low flow closures should take priority over a fishing start date. Low flow closure should be based on flow conditions from a nearby watershed (e.g., the San Lorenzo River) in the coastal Santa Cruz Mountains. If capture of hatchery steelhead is sanctioned by DFG for Scott Creek, it is anticipated increased fishing pressure will likely occur and intercept of CCC coho salmon will also occur. If steelhead capture is authorized by DFG the fishing start date for Scott Creek should be pushed back until at least Jan 15th.
ScC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
ScC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										
ScC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize impacts to off channel habitat, floodplains, ponds, and oxbows.	2	100	Big Creek Lumber Co., CalFire, CalPoly							
ScC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	3	100	Big Creek Lumber Co., CalFire, CalPoly							Temporary road surface treatments such as Dope30 should be evaluated.
ScC-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										
ScC-CCC-19.1.3.1	Action Step	Logging	Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	2	100	Big Creek Lumber Co., CalFire, CalPoly, CDFG						In-Kind	Logging is a potential future threat to summer rearing juveniles due to the potential of timber management to reduce future recruitment of LWD into stream channels and increase instream temperatures. California Forest Practice Rules require retention of riparian trees adjacent to Class 1 fish bearing streams, which will ameliorate the impacts of reduced LWD and overstory canopy reduction. Santa Cruz County rules do not allow even aged management.
ScC-CCC-19.1.4	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, dams, etc.)										
ScC-CCC-19.1.4.1	Action Step	Logging	Avoid the new road construction in riparian zones (< 100 feet).	2	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Santa Cruz County							
ScC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										
ScC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
ScC-CCC-19.2.1.1	Action Step	Logging	Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County						In-Kind	Applications are currently approved without review.
ScC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-23.1.1.1	Action Step	Roads/Railroads	Maintain adequate energy dissipators for culverts and other drainage pipe outlets where needed.	2	10	Big Creek Lumber Co., CalFire, CalPoly, RWQCB, Santa Cruz County Department of Public Works	13.50	13.50				27	Cost for a road inventory of 26 miles of road estimated at $1,056/mile. Number of culverts and feasibility of energy dissipaters should be identified from road assessment.
ScC-CCC-23.1.1.2	Action Step	Roads/Railroads	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	100	CalFire, CDFG, RWQCB						In-Kind	
ScC-CCC-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	10	Big Creek Lumber Co., CalFire, Lockheed, Scotts Valley Water District	11.00	11.00				22	This is a long term plan that would require cooperation from the majority of the landowners in the watershed. It is unknown if this is a feasible alternative for Scott Creek. Primary emphasis should be placed on removing riparian roads with high sediment delivery potential adjacent to key spawning and rearing areas. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on $13,680/mile to decommission 1.5 miles of riparian roads.
ScC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to the estuary										
ScC-CCC-23.1.2.1	Action Step	Roads/Railroads	Relocate or extend the proposed replacement bridge for Highway 1 over Scott Creek in order to allow Scott Creek to re-establish its historical outlet into the ocean. Relocating or extending the replacement bridge could facilitate the re-establishment of the historical tidal prism in the lower lagoon.	1	10	CalPoly, CalTrans, CDFG, NMFS, Santa Cruz County						TBD	Increased costs may be associated with the proposed recommendation but this information is currently unavailable. This is a very rare opportunity to re-establish an estuary to historical conditions. This is also an opportunity to proactively address impacts of sea level rise so as to not further impair the estuary with additional bank stabilization features and channelizing. See ESTUARY for more information.
ScC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
ScC-CCC-23.1.3.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	3	10	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, Santa Cruz County	215.50	215.50				431	Cost based on $71,820/unit for 6 identified stream crossings.
ScC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
ScC-CCC-23.2.1.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	10	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, RWQCB, Santa Cruz County						In-Kind	Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile of watershed area, and at 4.0 miles per square mile of riparian area. Many of these roads are poorly situated, unpaved, and are sources of chronic sediment input. Paved and unpaved roads parallel many of the waterways within Scotts Creek and impinge upon channel migration. Some roads in the watershed are used for timber harvest and receive heightened levels of maintenance and review, as least for a short time (currently three years) following completion of a timber harvest plan. A well designed road management plan should result in overall cost savings due to reduced flood fighting actions, and stream bank and road stabilization projects.
ScC-CCC-23.2.1.2	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	1	100	Big Creek Lumber Co., CalFire, CalPoly, Lockheed, Private Landowners, Santa Cruz County						In-Kind	This should be considered a standard road management practice for all landowners.
ScC-CCC-23.2.1.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	Big Creek Lumber Co., CalFire, California Geological Survey, CalPoly, RWQCB, Santa Cruz County						In-Kind	This is a cost that is frequently absorbed into new road projects and should be considered a standard business practice.
ScC-CCC-23.2.1.4	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	1	100	Big Creek Lumber Co., CalFire, California Geological Survey, CalPoly, NRCS, Private Landowners, RPFs, RWQCB, Santa Cruz County, Santa Cruz RCD						TBD	These practices should be adopted as part of future road actions and maintenance practices.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-23.2.1.5	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	3	100	Big Creek Lumber Co., CalFire, Private Landowners						TBD	This recommendation may involve increased intra-watershed coordination among the landowners (locking and installing gates, etc.). Cost likely accounted for in road inventory.
ScC-CCC-23.2.1.6	Action Step	Roads/Railroads	Stream crossings should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	2	40	Big Creek Lumber Co., CalFire, CalPoly, RWQCB, Santa Cruz County, USACE							
ScC-CCC-23.2.1.7	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, Santa Cruz County						In-Kind	
ScC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
ScC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary										
ScC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Work with water users to minimize depletion of summer base flows.	1	100	Big Creek Lumber Co., CalPoly, Lockheed, Private Landowners, Scotts Creek Watershed Council, SWRCB							Bypass flows at the Mill Creek dam should be the first area of focus, particularly during dry water years.
ScC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	2	20	CalPoly, CalTrans, IWRP, USACE							Cost accounted for in ESTUARY.
ScC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
ScC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	100	Big Creek Lumber Co., CalPoly, Lockheed, SWRCB						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
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ScC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain habitat conditions for coho salmon, measures to reduce water consumption should be initiated by users in the watershed through conservation programs.	1	10	Big Creek Lumber Co., CalPoly, CDFG, NMFS, Private Landowners, SWRCB	36.00	36.00				72	Cost for stream flow model estimated at $71,825/project.
ScC-CCC-24.1.2.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	3	100	California Coastal Conservancy, CalPoly, Lockheed, NRCS						TBD	The price water is sold on environmental markets is determined by negotiations between landowners and purchasing entity. In circumstances where potential agricultural sellers of water rights do not shift to groundwater pumping or make other arrangements such that lands are not left fallow, potential sellers may forgo the agricultural profits they would have gained from irrigating. Cost will vary depending on water availability and landowner participation. It is unknown if this program will gain widespread acceptance in the watershed and therefore costs cannot be estimated. However, it is recommended that the equations used in the State Coho Plan for socioeconomic costs be utilized when more information regarding landowner participation is gathered. Water Acquisitions are estimated to range between $87 - 650/acre-foot.
ScC-CCC-24.1.2.4	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	3	100	Big Creek Lumber Co., CalFire, CalPoly, CalTrans, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, USACE							Costs will vary significantly depending on site specific conditions and landowner willingness to have roads and other infrastructure addressed to improve hydrologic function. Due to relative paucity of infrastructure and the high percentage of roads regulated by the CFPR's this recommendation is a lower priority in Scott Creek than in other coastal watersheds.
ScC-CCC-24.2	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
ScC-CCC-24.2.1	Recovery Action	Severe Weather Patterns	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
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ScC-CCC-24.2.1.1	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	1	100	Big Creek Lumber Co., CalPoly, CDFG, FEMA, Private Landowners, Santa Cruz County, Scotts Creek Watershed Council, USACE						In-Kind	According to Stillwater Sciences et al. (2010), California coastal streams do not naturally have channel morphology conducive to forming extensive flood plains or off-channel rearing areas. This is particularly true in the streams in the Santa Cruz Mountains, which contain little of the low-gradient, wide-valley streams that provide productive rearing habitat for salmonids. Thus, the role of large wood in these steeper streams was, in all likelihood, absolutely essential for providing refuge habitat during high flow events in winter, because there were fewer opportunities for off-channel habitat refuges (Moyle et al., 2008). Therefore LWD is an even more critical habitat element than in more northern streams to form pools or areas of refuge from high flows. Wood in the past was frequently cut up in Scotts Creek due to fears by some landowners that it will lead to increased flooding and property damage. These practices adversely affect the summer and winter rearing lifestages. Low LWD abundance in the lower portion of Scotts Creek is likely the result of past logging practices that removed trees from riparian areas, followed by Santa Cruz County funded stream clearance efforts following the 1982 flood. Santa Cruz County has essentially stopped removing LWD since 2009. Low instream LWD volume is likely the major contributor to the lower shelter values estimated in the watershed; only 20 percent of stream reaches had a shelter value >80, which constituted less than three percent of available IP. Maintaining wood is essential to improving habitat conditions and should be a major consideration for future flood management actions.
ScC-CCC-24.2.2	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
ScC-CCC-24.2.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	10	Big Creek Lumber Co., CalFire, CalPoly, Santa Cruz County	33.00	33.00				66	Extreme flood events such as those that occurred in 1955 and 1982 could result in major sediment input from upslope locations. Changes and improvements to land-use practices (i.e., avoiding road construction at the toe of a landslide) will likely result in lower sediment yields following future flooding events than were likely experienced after the 1955 and 1982 floods. However, future severe weather events could slow the rate of recovery of instream habitat conditions. Cost for erosion assessment estimated at $13.90/acre. (assume 25% of total watershed acres).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
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ScC-CCC-24.2.3	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
ScC-CCC-24.2.3.1	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns, Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	2	100	FEMA, NRCS, RWQCB, Santa Cruz County, USACE						In-Kind	Avoiding building in channel migration zones can result in long term cost saving due to reduced flood fighting and consequent stabilization measures.
ScC-CCC-24.2.3.2	Action Step	Severe Weather Patterns	Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	3	100	FEMA, Private Landowners, Santa Cruz County, USACE							Some infrastructure may be relatively easy to remove while other infrastructure will be extremely difficult. This recommendation should be viewed as an opportunistic strategy in Scott Creek.
ScC-CCC-24.2.4	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
ScC-CCC-24.2.4.1	Action Step	Severe Weather Patterns	Establish and enforce minimum summer releases from the Mill Creek reservoir to ensure rearing habitat is maintained in Mill Creek.	1	5	CDFG, Lockheed, NMFS, SWRCB	45.00					45	This important coho salmon rearing stream dried down to isolated pools during the drought years of 1988, 2007, and 2008. A contingency plan should also be developed to provide a pulse release from the reservoir in drought years to facilitate adult entry (for broodstock capture for the hatchery) as well as for wild spawning.
ScC-CCC-24.2.4.2	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for drought conditions in a manner compatible with CCC coho salmon recovery needs.	2	10	Big Creek Lumber Co., CalFire, CalPoly, CDFG, Monterey Bay Salmon and Trout Project, NMFS, Santa Cruz County, Scotts Creek Watershed Council, SWRCB	20.00	20.00				40	Impacts of a severe drought in conjunction with ongoing water diversion could affect all lifestages of coho in the watershed. A severe drought could reduce total water yield and delay or limit adult coho migration to spawning areas; reduce juvenile rearing habitat; and expose winter rearing, summer rearing, and smolt coho to increased predation. Work with DFG, SWRCB, Scotts Creek Watershed Council, and knowledgeable biologist to develop emergency rules and adopt implementation agreements. Emergency rules should be sure to include diversions in upper Mill Creek where contingency emergency releases should be addressed to provide for adult passage in drought year (this would at least allow adult coho salmon to enter the stream where they could be captured broodstock for the Kingfisher Flat Restoration Hatchery.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-24.2.4.3	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon. These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality (CDFG 2004).	3	10	Big Creek Lumber Co., CalPoly, CDFG, NMFS, RWQCB, SWRCB						In-Kind	
ScC-CCC-24.2.4.4	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	3	100	CDFG, NMFS, Scotts Creek Watershed Council, SWRCB							
ScC-CCC-24.2.4.5	Action Step	Severe Weather Patterns	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	2	50	CDFG, NMFS, SWRCB						In-Kind	
ScC-CCC-24.2.4.6	Action Step	Severe Weather Patterns	Encourage CalFire to modify water right for diversion in upper headwaters of Scott Creek.			CalFire, CDFG, NMFS, SWRCB							
ScC-CCC-24.2.4.7	Action Step	Severe Weather Patterns	Evaluate dam and impact of water diversions in Boyer Creek (trib to Big Cr)	3	5	CDFG, NMFS, Private Landowners, SWRCB							
ScC-CCC-24.3	**Objective**	**Severe Weather Patterns**	**Address other natural or manmade factors affecting the species' continued existence**										
ScC-CCC-24.3.1	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
ScC-CCC-24.3.1.1	Action Step	Severe Weather Patterns	Evaluate and prepare contingency plans to breach estuary sandbars to facilitate adult upmigration when instream flows are adequate for passage and spawning IF sandbar remains closed by mid-January and conservation hatchery remains in operation.	2	5	CA Coastal Commission, CDFG, Monterey Bay Salmon and Trout Project, NMFS, NOAA SWFSC, RWQCB, Santa Cruz County, Scotts Creek Watershed Council, State Parks, USACE, USFWS	20.00					20	This option is likely most viable in Scott Creek due to the Kingfisher Flat Hatchery and the importance of obtaining CCC coho for the current Broodstock program. This recommendation must be viewed with extreme caution in other watersheds. This recommendation should only be implemented in close cooperation with the NOAA SWFSC, USFWS, MBSTP, DFG, and land owners. Permitting issues should be worked out well in advance by the regulatory agencies.
ScC-CCC-24.4	**Objective**	**Severe Weather Patterns**	**Address the overutilization for commercial, recreational, scientific or educational purposes**										
ScC-CCC-24.4.1	Recovery Action	Severe Weather Patterns	Prevent reduced density, abundance, and diversity										
ScC-CCC-24.4.1.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	2	100	CDFG Law Enforcement, NMFS OLE						In-Kind	Costs are expected to be absorbed into ongoing activities.

Soquel Creek

Location	•Santa Cruz County
Watershed Area	•42.0 Square Miles
Potential Habitat	•31.9 Stream Miles
Vegetation	•64% Coniferous, 20% Shrubland, 16% Urban, Riparian, or Agriculture
Erodability	•Moderate to High
Ownership Patterns	•88% Private; 12% Public
Dominant Land Uses	•Urban, Rural Residential, Timber
Housing Density	•Moderate to High
TMDL Pollutants	•Pathogens, Sediment

Soquel Creek
Photo by USGS

Soquel Creek Coho Salmon: Nearly Extirpated

Recovery Goals

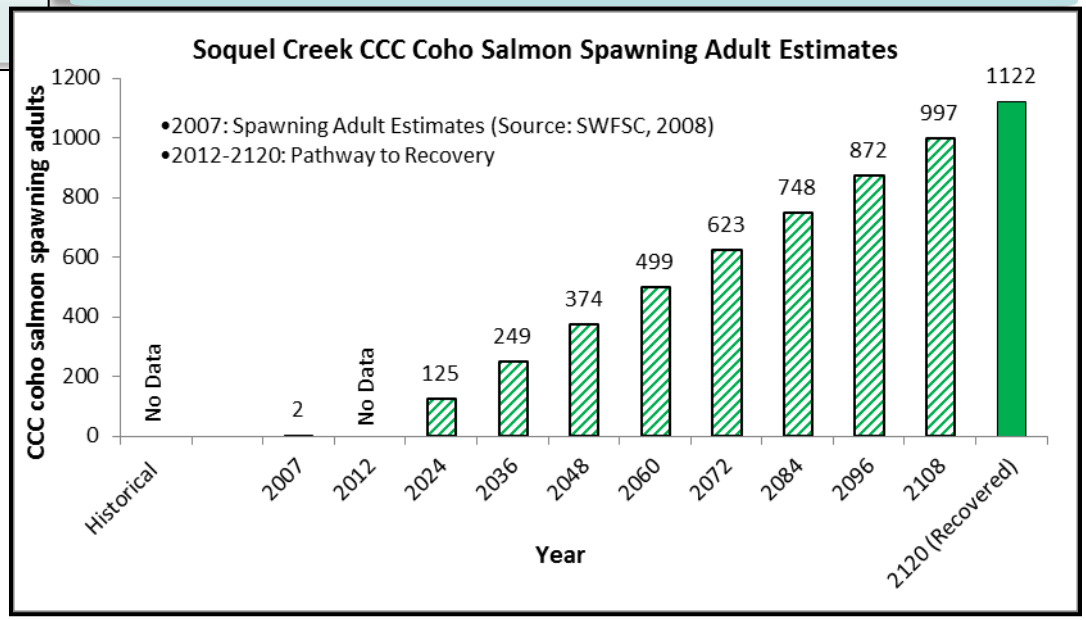
- ✓ Implement a monitoring program to evaluate presence and the performance of recovery efforts
- ✓ Conduct periodic, standardized juvenile and spawning adult surveys in the watershed

Soquel Creek
Adult Spawner Targets

Downlisting to Threatened
561

Recovery
1,122

STEELHEAD: YES
CHINOOK SALMON: NO



Soquel Creek

Potential Habitat: 31.9 miles
Recovery Target: 1,122 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	POOR	GOOD	GOOD	POOR	FAIR	FAIR	FAIR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Delineate reaches possessing both potential winter rearing habitat and floodplain areas
- Implement a long term study project in Soquel Demonstration State Forest to demonstrate effective LWD projects to citizens of Santa Cruz County
- Promote conjunctive use of water for water projects whenever possible
- Provide incentives to water rights holders willing to convert some or all of their water right to instream use
- Re-establish a naturally reproducing run of coho salmon

Priority 2 & 3: Long-Term Restoration Actions

- Install structures to enhance scour to increase residual pool depths in the estuary
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Promote off-channel storage and conservation measures to reduce impacts of summer and early fall water diversion
- Promote irrigation efficiency projects for ongoing agricultural practices
- Remediate slides and gullies delivering sediment to fish bearing streams

Recovery Partners
Cal Fire Soquel Demonstration State Forest

Photo courtesy from left to right: Campbell Timberland, David Hines, NMFS, Campbell Timberland, Eli Asarian and Morgan Bond, SWFSC

Soquel Creek

Potential Habitat: 31.9 miles
Recovery Target: 1,122 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	HIGH	MEDIUM	HIGH	HIGH	NA	MEDIUM	HIGH	MEDIUM	MEDIUM	VERY HIGH	VERY HIGH	VERY HIGH	VERY HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- New development should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flows, and allowed to meander
- Develop water education and conservation programs to reduce water use
- Ensure water diversions do not impair water temperatures in Soquel Creek
- Appoint and adequately fund a Water Master to carry out the adjudication of water rights

Priority 2 & 3: Long-Term Threat Abatement Actions

- Wet weather and/or winter timber operations should be discouraged
- All roads, landings, and skid trails associated with timber operations should be hydrologically disconnected
- Monitor quarry operations to ensure compliance
- Sediment from existing and future commercial and urban development should be reduced to magnitudes appropriate to the geological setting
- Discourage new construction in undeveloped areas within the 100-year flood prone zones
- Implement water conservation strategies

Soquel Lagoon
Photo by Michelle Leicester, CDFG

Conservation Highlights

- The City of Capitola has an active lagoon management program
- NMFS recently issued a final rule extending the range of CCC coho salmon to include Soquel Creek.
- Soquel Demonstration State Forest has implemented actions to improve habitat complexity
- NOAA SWFSC recently document first successful coho spawning in East Branch Soquel Creek

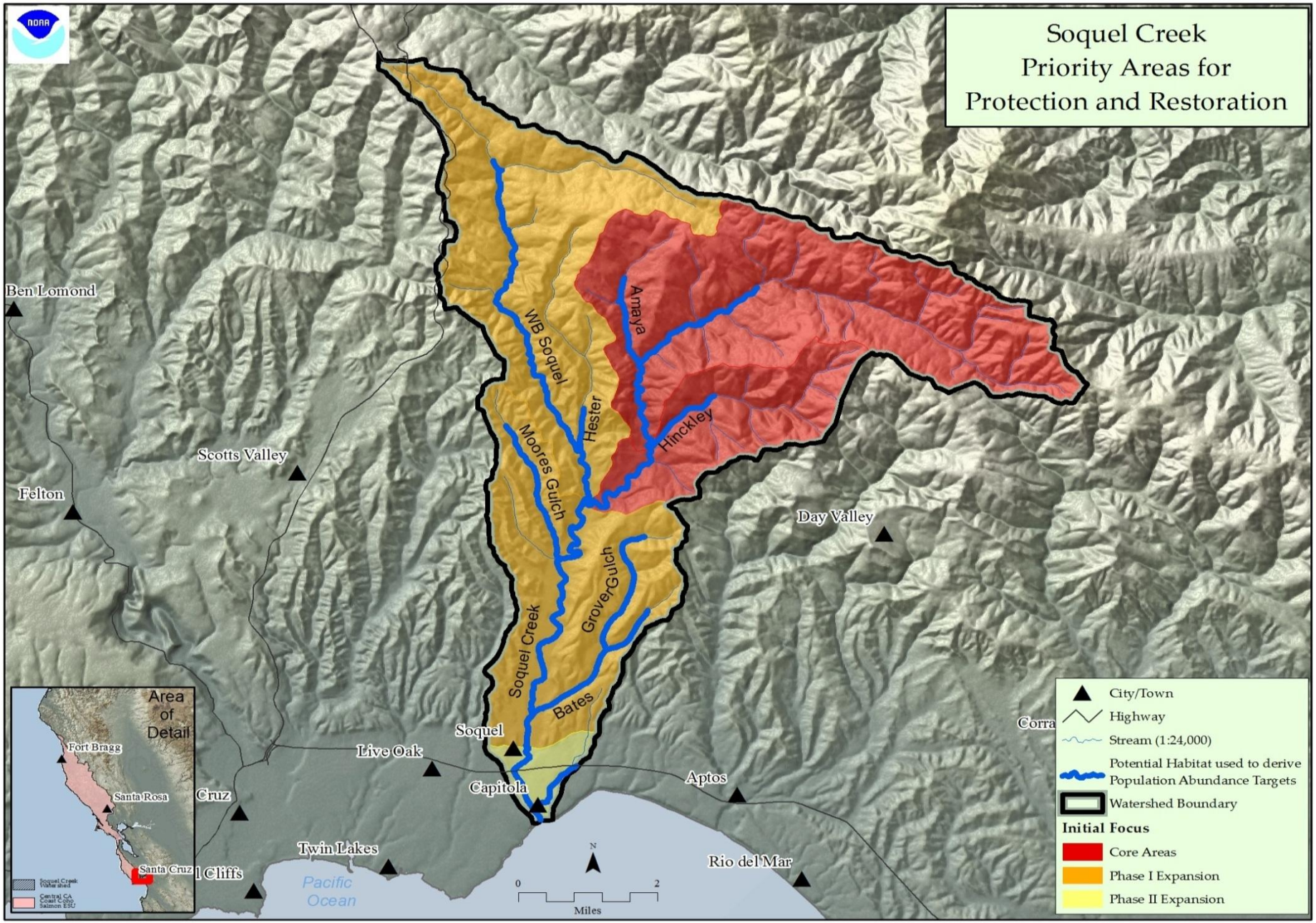


Figure 1: Map of Soquel Creek

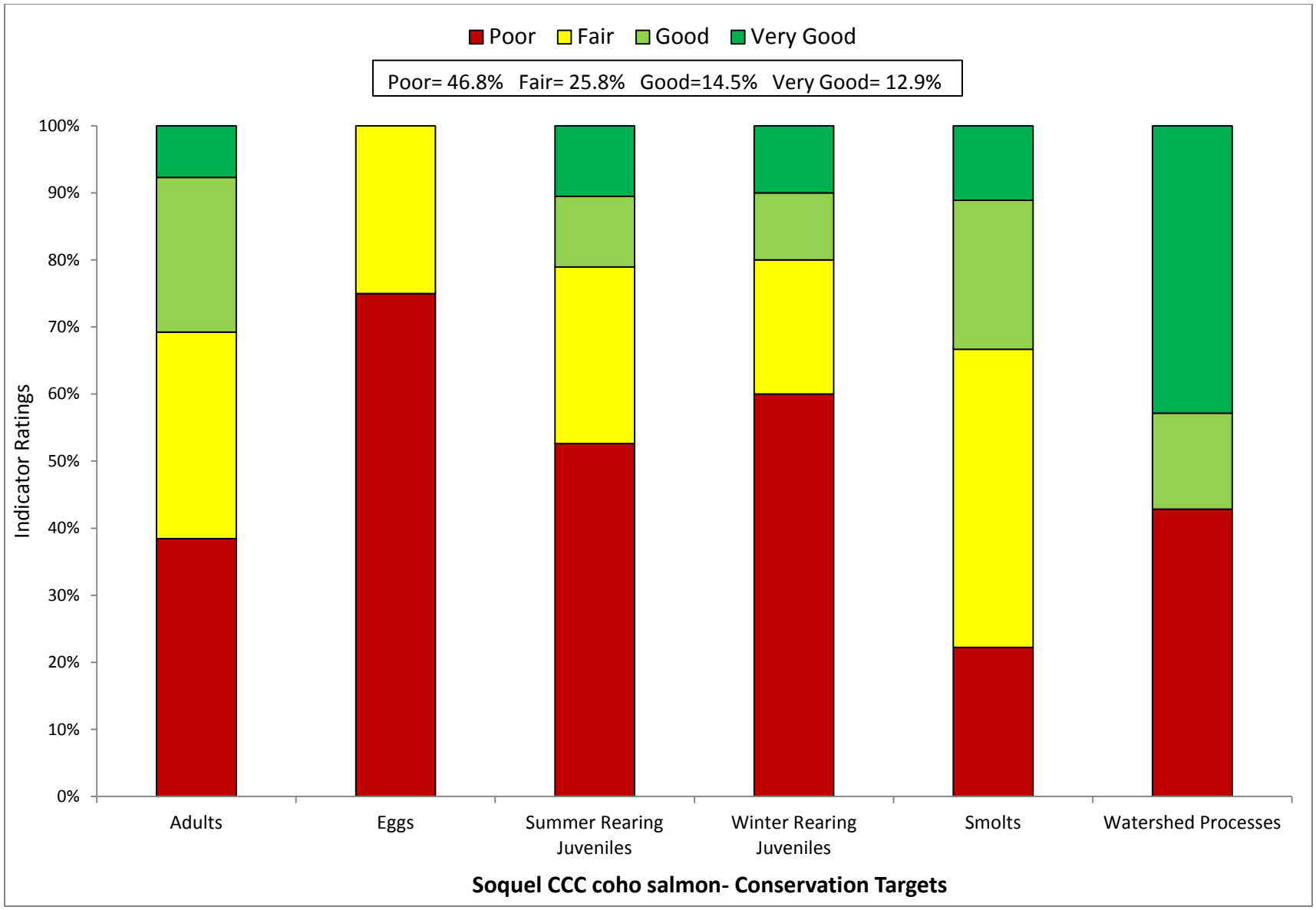


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Soquel Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0.55 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**29% streams 16% IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**78% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = 51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score = >75**	Poor	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**29% streams 25% IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.55 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**29% streams 75% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**29% streams 16% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score = >75**	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = >75**	Poor	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**4.84 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**95.2% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**100% streams 100% IP-km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**29% streams 25% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.55 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**29% streams 16% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**95.2% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**≥80% Density rating "D" across IP-km**	Good	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**29% streams 25% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**<50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% of streams/ IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**4.84 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score = <35**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-Km (>6 and <16 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**2.5% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**1.26% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**7% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**59% of watershed >1 unit/20 acres**	Poor	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**4.1 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.0 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Soquel Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Medium	Medium	Medium	Medium	Medium	Low	Medium
2	Channel Modification	Medium	Medium	High	High	Medium	Low	High
3	Disease, Predation and Competition	Medium	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	High	Medium	High	Medium	High
5	Fishing and Collecting	High	-	Medium	-	High	-	High
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Medium	Low	Medium
8	Logging and Wood Harvesting	Medium	Medium	High	Medium	High	Medium	High
9	Mining	Medium	Medium	Medium	Medium	Medium	Medium	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Medium	Low	Medium
11	Residential and Commercial Development	High	Medium	Very High	High	Very High	High	Very High
12	Roads and Railroads	High	High	High	High	High	High	Very High
13	Severe Weather Patterns	Medium	High	Very High	High	High	High	Very High
14	Water Diversion and Impoundments	Medium	Medium	Very High	Medium	Very High	High	Very High
Threat Status for Targets and Project		High	High	Very High	High	Very High	High	Very High

Central CA Coast Coho Salmon ~ Soquel Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Reduce toxicity and pollutants

1.1.1.1. **Action Step:** Re-direct storm drains away from Soquel lagoon during summer.

1.1.1.2. **Action Step:** Screen the railroad trestle to discourage roosting and nesting by rock doves.

1.1.1.3. **Action Step:** Sediment and grease traps leading into lower Soquel Creek should be annually inspected and cleaned.

1.1.2. **Recovery Action:** Increase freshwater lagoon elevation during seasonal closures

1.1.2.1. **Action Step:** Ensure flume is properly maintained throughout the summer low flow season.

1.1.2.2. **Action Step:** Secure flume boards at all times to prevent their removal by vandals or bay back-flushing.

1.1.3. **Recovery Action:** Reduce adverse impacts associated with exotic and pest species.

1.1.3.1. **Action Step:** Continue to use gull-proof lids on refuse cans at and around the lagoon and beach.

1.1.3.2. **Action Step:** Install bird deterrents on Esplanade roofs to deter gulls and other sea birds.

1.1.4. **Recovery Action:** Improve the quality of each estuarine habitat zone

1.1.4.1. **Action Step:** Remove and replace exotic tree and understory species in the stream reaches above the lagoon.

1.1.4.2. **Action Step:** Maintain existing pilings along the eastern margin downstream of Stockton Avenue Bridge where restaurants are still on pilings.

1.1.4.3. **Action Step:** Plant tules in the Soquel Creek estuary.

1.1.4.4. **Action Step:** Plant redwoods in upslope areas of the western estuary to increase lagoon shading.

1.1.5. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.5.1. **Action Step:** Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.

1.1.5.2. **Action Step:** Allow large instream wood to remain in the lagoon/estuary as potential scour objects and fish cover, unless it is jammed on the Stockton Avenue Bridge.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Increase and enhance velocity refuge

2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.2. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.2.1. **Action Step:** Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.

2.1.2.2. **Action Step:** Target habitat restoration and enhancement that will function between winter base flow and flood stage.

2.1.2.3. **Action Step:** De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency.

3.1.1.1. **Action Step:** Identify historical CCC coho salmon habitats lacking in channel complexity and initiate restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.

3.1.1.2. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

3.1.1.3. **Action Step:** Implement a long term study project in Soquel Demonstration State Forest to demonstrate effective LWD projects to residents of the Santa Cruz County and region.

3.1.1.4. **Action Step:** Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.

3.1.1.5. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.2. **Recovery Action:** Improve shelter rating

3.1.2.1. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem Soquel Creek.

3.1.3. **Recovery Action:** Improve pool/riffle/flatwater ratios (hydraulic diversity)

3.1.3.1. **Action Step:** Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams).

3.1.4. **Recovery Action:** Increase frequency of primary pools

3.1.4.1. **Action Step:** Excavate sediment and build up channel bars.

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Promote irrigation efficiency projects for agricultural practices.

4.1.1.2. **Action Step:** Promote off-channel storage and conservation measures to reduce impacts of summer and early fall water diversions (e.g. storage tanks for rural residential users).

4.1.1.3. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.

4.1.1.4. **Action Step:** Promote conjunctive use of water for water projects whenever possible to maintain or restore salmonid habitat.

4.1.2. **Recovery Action:** Minimize redd scour

4.1.2.1. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization

5.1.1.1. **Action Step:** Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources

6. Restoration- Passage

6.1. **Objective:** Address other natural or manmade factors affecting the species' continued existence

6.1.1. **Recovery Action:** Improve access of spawning adults and juveniles

6.1.1.1. **Action Step:** Evaluate the two natural falls at the Girl Scout Camp on West Branch Soquel and determine the benefits of providing passage for coho salmon into upper reaches.

6.1.1.2. **Action Step:** Evaluate the Soquel Creek Water District Weir for potential impacts to coho migration on East Branch Soquel.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.

9.1.1.2. **Action Step:** Remediate slides and gullies delivering sediment to fish bearing streams.

9.1.1.3. **Action Step:** Initiate education program for landowners in the watershed regarding practices to minimize sediment input.

9.1.2. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

9.1.2.2. **Action Step:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Re-establish a naturally reproducing run of coho salmon.

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

10.2.1. **Recovery Action:** Increase abundance

10.2.1.1. **Action Step:** Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.

10.2.1.2. **Action Step:** Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.

10.2.1.3. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.2.2. **Recovery Action:** Increase spatial structure and diversity

10.2.2.1. **Action Step:** Implement standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

13.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.1.1. **Recovery Action:** Prevent impairment of floodplain connectivity

13.1.1.1. **Action Step:** For riparian roads, promote road relocation as a preferred alternative to bank stabilization.

13.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

13.1.2.1. **Action Step:** Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.

13.2. **Objective:** Address inadequacies of regulatory mechanisms

13.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity

13.2.1.1. **Action Step:** Eliminate the use of gabion baskets and undersized rock within the bankfull channel.

13.2.1.2. **Action Step:** Protect existing areas that provide winter refuge and seasonal habitats for juvenile salmonids from channelization projects.

13.2.1.3. **Action Step:** Modify Federal, State, city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historical CCC coho salmon watersheds.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

15.1.1. **Recovery Action:** Prevent increased landscape disturbance

15.1.1.1. **Action Step:** Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.

15.1.1.2. **Action Step:** Disseminate plan to all local firefighting agencies.

15.1.1.3. **Action Step:** Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the Soquel Creek watershed (and all other watersheds in the County).

15.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity

15.1.2.1. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.2.2. **Action Step:** Avoid use of aerial fire retardants and foams within 300 feet of riparian areas.

15.1.3. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

15.1.3.1. **Action Step:** Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.

15.2.1.2. **Action Step:** In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident.

16. Threat- Fishing/Collecting

16.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

16.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

16.1.1.1. **Action Step:** Reduce poaching of adult coho salmon by increasing law enforcement.

16.1.1.2. **Action Step:** Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Soquel Creek.

16.1.1.3. **Action Step:** Install/construct permanent signs at all major public access points along Soquel Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.

19.1.3. **Recovery Action:** Prevent future impacts to habitat complexity

19.1.3.1. **Action Step:** Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.

19.1.3.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

19.1.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.4.1. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.4.2. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.4.3. **Action Step:** Wet weather and/or winter operations should be discouraged in areas with high erosion potential.

19.1.4.4. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.5.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.6. **Recovery Action:** Prevent increased landscape disturbance

19.1.6.1. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.6.2. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc).

19.1.7. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, dams, etc.)

19.1.7.1. **Action Step:** To the maximum extent practicable, all roads, landings, and skid trails associated with timber operations should be hydrologically disconnected to prevent sediment runoff and delivery to streams.

19.1.7.2. **Action Step:** Avoid new road construction in riparian zones (< 100 feet).

19.1.7.3. **Action Step:** Avoid road construction near headwater channels.

19.1.8. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

19.1.8.1. **Action Step:** Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).

19.2.1.2. **Action Step:** Encourage a watershed-wide HCP/GCP/Natural Community Conservation Plan or other procedures for multiple forest landowners within the Soquel Creek watershed to pool resources as a means to facilitate long-term survival and recovery for coho salmon and their habitat.

19.2.1.3. **Action Step:** Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.

19.2.1.4. **Action Step:** Discourage Santa Cruz County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.5. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core CCC coho salmon areas.

19.2.1.6. **Action Step:** Erosion control measures and road maintenance should be maintained during the entire period between re-entrys.

19.2.1.7. **Action Step:** Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.

19.2.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

19.2.2.1. **Action Step:** Increase buffer widths on Class II streams.

20. Threat- Mining

20.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

20.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

20.1.1.1. **Action Step:** Monitor quarry operations to ensure compliance with County and State policies.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

22.1.1.1. **Action Step:** Develop an incentive program for a roof runoff collection system for detaining runoff and providing for landscape irrigation.

22.1.1.2. **Action Step:** Incorporate rain harvesting, storm-water wetland catchment basins, and pervious surfaces into existing and new development.

22.1.1.3. **Action Step:** Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.

22.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

22.1.2.1. **Action Step:** Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.

22.1.2.2. **Action Step:** Sediment from existing and future commercial and urban development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.

22.1.2.3. **Action Step:** Design new developments to avoid unstable slopes, and wetlands areas of high habitat value, and similarly constrained sites.

22.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity.

22.1.3.1. **Action Step:** Encourage Santa Cruz to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.

22.1.3.2. **Action Step:** Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channels migration zones to avert future bank erosion controls projects.

22.1.3.3. **Action Step:** Encourage establishment of conservation easements on floodplain habitat in key stream reaches.

22.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.1.4.1. **Action Step:** Assess efficacy and necessity of ongoing stream maintenance practices and avoid, minimize and/or mitigate their impacts to rearing and migrating CCC coho salmon.

22.1.4.2. **Action Step:** Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.

22.1.4.3. **Action Step:** Remove non-native riparian vegetation via thinning and removal programs.

22.1.5. **Recovery Action:** Prevent increased landscape disturbance

22.1.5.1. **Action Step:** Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.

22.1.5.2. **Action Step:** Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.

22.1.6. **Recovery Action:** Prevent reduced density, abundance, and diversity

22.1.6.1. **Action Step:** Design and implement education programs to promote public awareness of salmonid habitats within urban creek settings and life history requirements.

22.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

22.2.1. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

22.2.1.1. **Action Step:** Encourage county and city planning departments to designate special assessment districts for properties with infrastructure located in high risk flood prone zones. Revenue generated should be used to raise or relocate infrastructure away from high risk flood zones.

22.2.1.2. **Action Step:** Encourage Santa Cruz County to improve riparian ordinances to be more protective of watershed processes in regard to pre-existing development and allowances for riparian exemptions.

22.2.2. **Recovery Action:** Prevent impairment to watershed hydrology

22.2.2.1. **Action Step:** Support the development and implementation of regulations for activities that adversely impact groundwater recharge.

22.2.2.2. **Action Step:** New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.

22.2.3. **Recovery Action:** Prevent increased landscape disturbance

22.2.3.1. **Action Step:** Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.

22.2.3.2. **Action Step:** Enforce existing building permit programs to minimize unpermitted construction.

22.2.3.3. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

22.2.4. **Recovery Action:** Prevent impairment to floodplain connectivity.

22.2.4.1. **Action Step:** Santa Cruz County should continue policies that discourage new construction in undeveloped areas within the 100-year flood prone zones.

22.2.4.2. **Action Step:** Minimize redevelopment within the 100 year floodplain.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate

23.1.1.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.2. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.

23.1.1.3. **Action Step:** Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.

23.1.1.4. **Action Step:** Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.

23.1.1.5. **Action Step:** Prioritize decommissioning of riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.1.6. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.

23.1.1.7. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.1.8. **Action Step:** Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.

23.1.1.9. **Action Step:** Educate road associations and informal road maintenance collectives regarding the benefit of integrating into the Santa Cruz County Service Area process.

23.1.1.10. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.3. **Recovery Action:** Prevent impairment to passage and migration

23.1.3.1. **Action Step:** Evaluate SCCRCD (2003) recommendations for passage improvements and prioritize accordingly.

23.1.3.2. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.4. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.4.1. **Action Step:** Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Prevent impairment to instream substrate

23.2.1.1. **Action Step:** Encourage Redwood Empire and State Parks to address wetted road crossings and sediment runoff from their riparian roads located on Hinckley Creek, tributary to East Branch Soquel.

23.2.1.2. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

23.2.1.3. **Action Step:** Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.

23.2.1.4. **Action Step:** Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

23.2.1.5. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.

23.2.1.6. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary

24.1.1.1. **Action Step:** Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.

24.1.2. **Recovery Action:** Prevent impairment to stream hydrology.

24.1.2.1. **Action Step:** Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.

24.1.2.2. **Action Step:** If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.

24.1.2.3. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

24.2.1. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

24.2.1.1. **Action Step:** Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).

24.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

24.2.2.1. **Action Step:** Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.2.3. **Recovery Action:** Prevent impairment to stream hydrology.

24.2.3.1. **Action Step:** Agencies and landowners should develop contingencies for, drought conditions in a manner compatible with CCC coho salmon recovery needs.

24.2.3.2. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust

control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon during droughts.

24.2.3.3. **Action Step:** Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.

24.2.3.4. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

24.2.3.5. **Action Step:** Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).

24.3. **Objective:** Address the overutilization for commercial, recreational, scientific or educational purposes

24.3.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

24.3.1.1. **Action Step:** Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

25.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

25.1.1.1. **Action Step:** Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.

25.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.2.1. **Action Step:** Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.

25.1.2.2. **Action Step:** Develop water education programs to reduce water use directed at both municipal water users and those with riparian and appropriative water rights.

25.1.2.3. **Action Step:** Work with water diverters in the lower West Branch of Soquel to evaluate and modify diversions that may impact rearing habitat quality.

25.1.2.4. **Action Step:** Coordinate timing of water diversions to minimize the likelihood of fish stranding and stream dewatering.

25.1.2.5. **Action Step:** Install passive flow bypass devices designed to allow diversion of water only when minimum streamflow requirements are exceeded.

25.1.2.6. **Action Step:** Encourage programs and entrepreneurial efforts by private organizations to purchase easements on water rights for maintenance of adequate surface flows.

25.1.2.7. **Action Step:** Encourage riparian water users that were assigned Class 2 water rights at the time of the adjudication to lease their water right portion to the City of Capitola.

25.1.2.8. **Action Step:** Evaluate recycling waste water as a supplemental supply for irrigation and possibly groundwater recharge.

25.1.3. **Recovery Action:** Prevent impairment to passage and migration

25.1.3.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

25.1.4. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

25.1.4.1. **Action Step:** Ensure water diversions do not impair water temperatures in Soquel Creek.

25.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

25.2.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.2.1.1. **Action Step:** Appoint and adequately fund a Water Master to carry out the adjudication of water rights on Soquel Creek.

25.2.1.2. **Action Step:** Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.

25.2.1.3. **Action Step:** Install gauging devices to acquire hydrologic data on stream flows.

25.2.1.4. **Action Step:** Request the SWRCB to conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance, perfection, or changes to water rights permits.

25.2.1.5. **Action Step:** Identify and work with the SWRCB to address depletion of summer base flows from authorized and unauthorized water uses. Coordinated efforts by Federal, State, and County law enforcement agencies to remove illegal diversions from all streams in the Soquel Creek watershed.

25.2.1.6. **Action Step:** Prohibit new or increased surface water diversions, or groundwater pumping that depletes surface flows, for existing permit holders in Soquel Creek.

25.2.1.7. **Action Step:** Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004) in Soquel Creek.

25.2.1.8. **Action Step:** Encourage SWRCB to bring illegal water diverters (those unpermitted and permitted but out-of-compliance with permit terms) into compliance with State law.

25.2.1.9. **Action Step:** Evaluate major groundwater diversions for impacts to surface flow.

26. Threat- Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

26.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with urbanization.

26.1.1.1. **Action Step:** Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.

Table 3: Implementation Schedule ~ Soquel Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SoC-CCC-1.1.1	Recovery Action	Estuary	Reduce toxicity and pollutants										
SoC-CCC-1.1.1.1	Action Step	Estuary	Re-direct storm drains away from Soquel lagoon during summer.	3	100	City of Capitola							
SoC-CCC-1.1.1.2	Action Step	Estuary	Screen the railroad trestle to discourage roosting and nesting by rock doves.	3	10	CDFG, City of Capitola, RWQCB							
SoC-CCC-1.1.1.3	Action Step	Estuary	Sediment and grease traps leading into lower Soquel Creek should be annually inspected and cleaned.	3	100	City of Capitola, RWQCB, Santa Cruz County							
SoC-CCC-1.1.2	Recovery Action	Estuary	Increase freshwater lagoon elevation during seasonal closures										
SoC-CCC-1.1.2.1	Action Step	Estuary	Ensure flume is properly maintained throughout the summer low flow season.	3	100	CDFG, City of Capitola							
SoC-CCC-1.1.2.2	Action Step	Estuary	Secure flume boards at all times to prevent their removal by vandals or bay back-flushing.	1	100	City of Capitola						In-Kind	
SoC-CCC-1.1.3	Recovery Action	Estuary	Reduce adverse impacts associated with exotic and pest species.										
SoC-CCC-1.1.3.1	Action Step	Estuary	Continue to use gull-proof lids on refuse cans at and around the lagoon and beach.	3	100	City of Capitola							
SoC-CCC-1.1.3.2	Action Step	Estuary	Install bird deterrents on Esplanade roofs to deter gulls and other sea birds.	3	100	City of Capitola							
SoC-CCC-1.1.4	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
SoC-CCC-1.1.4.1	Action Step	Estuary	Remove and replace exotic tree and understory species in the stream reaches above the lagoon.	3	100	City of Capitola, IWRP, Santa Cruz County							Residents on the eastern margin have expressed concerns over attempts to re-establish riparian trees due to negative attitudes towards anything that might obstruct their views of the lagoon or Monterey Bay. Ongoing education and monitoring would be needed to successfully implement this recommendation.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-1.1.4.2	Action Step	Estuary	Maintain existing pilings along the eastern margin downstream of Stockton Avenue Bridge where restaurants are still on pilings.	2	100	CA Coastal Commission, CDFG, City of Capitola, Santa Cruz County, USACE						In-Kind	This area provides backwater and overwintering shelter for fish during winter stormflows and provides summer rearing and shelter. This is the only backwater habitat in the lower estuary and should be protected from further development.
SoC-CCC-1.1.4.3	Action Step	Estuary	Plant tules in the Soquel Creek estuary.	3	5	CDFG, City of Capitola, IWRP, Santa Cruz RCD	5.00					5	Tules could be planted in the cove on the east side of the estuary, downstream of the Stockon Avenue Bridge and in the cove on the eastern margin under the railroad trestle to enhance summer fishery habitat.
SoC-CCC-1.1.4.4	Action Step	Estuary	Plant redwoods in upslope areas of the western estuary to increase lagoon shading.	3	10	City of Capitola, IWRP, Santa Cruz RCD	171.50	171.50				343	This action may ultimately help reduce water temperature of inflows to the lagoon and within the lagoon. Cost based on treating 0.75 miles of riparian habitat at a rate of $11,432/acre (assume treating only one side of riparian corridor).
SoC-CCC-1.1.5	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
SoC-CCC-1.1.5.1	Action Step	Estuary	Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.	3	10	, CA Coastal Commission, CDFG, City of Capitola, IWRP, Santa Cruz RCD	136.50	136.50				273	Costs may vary depending on the total number of structures and necessary engineering. Permitting costs are anticipated to be negligible to likely use of programmatic permits. The most appropriate location is likely near the railroad trestle under overhanging trees on the west side. The trestle may retain more saline water from tidal influxes. Any scour objects must be positioned so as not to undermine existing bulkheads or collect floating debris. Evaluate the installation of a series of J-hook vanes. The goals should be to scour two holes with dimensions at least six to ten feet wide, 30-40 feet long and four to six feet deeper than the present bed elevation. Cost for treating 1 acre (assume 10% of total estuarine habitat) at a rate of $272,120/acre.
SoC-CCC-1.1.5.2	Action Step	Estuary	Allow large instream wood to remain in the lagoon/estuary as potential scour objects and fish cover, unless it is jammed on the Stockton Avenue Bridge.	2	100	CDFG, City of Capitola, Santa Cruz County, USACE							
SoC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SoC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	20	CDFG, City of Capitola, FEMA, NMFS, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						TBD	A lack of available winter refuge habitat, in part from lack of access to inundated floodplain or off-channel habitats is likely a limiting factor for salmonids in Soquel Creek. The lower mainstem Soquel Creek may have been a relatively un-confined, low gradient channel, with low terraces and floodplains providing refuge habitat for salmonids during high flows. These areas are largely lost due to past agricultural practices, rural residential and urban encroachment. Efforts should be made to assess the mainstem channel and low gradient stream reaches in tributaries to target opportunities to restore floodplain connectivity. Restoring these existing areas could disproportionately benefit the salmonid populations by providing key winter refuge habitats. Costs will vary depending on site specific conditions and degree of landowner participation. Some of these areas have urban infrastructure which increases the importance of those remaining floodplain areas in Soquel. Cost accounted for in action steps below.
SoC-CCC-2.1.2	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
SoC-CCC-2.1.2.1	Action Step	Floodplain Connectivity	Institutionalize programs to purchase land/conservation easements to encourage the re-establishment and/or enhancement of natural riparian communities.	2	50	Santa Cruz County, Santa Cruz County Land Trust						TBD	The floodplain limitations currently present in the Soquel watershed are primarily due to urbanization and existing roads. The associated effects of these landuse practices to channel confinement have resulted in riparian encroachment, channel degradation, and floodplain/stream channel disconnection. FEMA flood zone maps show significant overlap of areas designated as 100-year flood prone zones and areas with high housing and commercial density. Due to the high amount of development in these areas the overall degraded condition of important floodplain habitat is expected to persist and likely worsen in the future.
SoC-CCC-2.1.2.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter base flow and flood stage.	2	10	CalFire, CDFG, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, USACE	102.50	102.50				205	Cost for treating 5 miles (assume 1 project/mile in 25% High IP) at a rate of $41,092/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-2.1.2.3	Action Step	Floodplain Connectivity	De-commission elevated road alignments through riparian zones or adjacent to stream channels which functionally limit seasonal floodplain access.	3	30	CalFire, CDFG, City of Capitola, IWRP, Redwood Empire, Santa Cruz RCD, Soquel Demonstration State Forest						TBD	Cost accounted for in ROADS/RAILROADS.
SoC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SoC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency.										
SoC-CCC-3.1.1.1	Action Step	Habitat Complexity	Identify historical CCC coho salmon habitats lacking in channel complexity and initiate restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	10	CDFG, City of Capitola, Private Landowners, Public, Santa Cruz County, Santa Cruz RCD	63.50	63.50				127	Restoration actions in Soquel Creek would likely benefit from an updated habitat typing effort. However, restoration should not be delayed while awaiting results from habitat typing. Areas of high potential include the lower mainstem from Bates Creek confluence to Moores Gulch Confluence, the lower mainstem from Nob Hill to Soquel Drive Bridge, and East Branch Soquel Creek. The mainstem locations should be assessed for current complexity. Cost for fish/habitat monitoring estimated at $126,758/project.
SoC-CCC-3.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	City of Capitola, IWRP, NRCS, Private Landowners, Redwood Empire, Santa Cruz County Land Trust, Santa Cruz RCD, State Parks	315.00	315.00				630	Cost based on treating 22 miles of stream at a rate of $28,500/mile. Soquel Creek is bordered by rural residential properties in many areas. Due to the extensive amount of infrastructure in some reaches and development in the lower watershed it is likely that the majority of structures will need to be anchored. Unanchored and properly sized large wood structures could likely be installed in upper East Branch Soquel Creek. Anchored wood will likely be necessary in the upper mainstem above Moore's Gulch. Transport of large woody material to downstream reaches is less likely due extensive channel meanders in these areas. Restoration activities should carefully evaluate summer flow conditions prior to proceeding to ensure adequate water is available for projects designed to increase summer rearing habitat. Prior to installation, instream conditions should be carefully assessed for effectiveness in Bates Creek, Hinckley Creek, Amaya Creek, and Hester Creek. Summer flow assessment should be focus in mainstem areas below the Moore's Gulch.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-3.1.1.3	Action Step	Habitat Complexity	Implement a long term study project in Soquel Demonstration State Forest to demonstrate effective LWD projects to residents of the Santa Cruz County and region.	1	10	CalFire, CDFG, IWRP, NOAA SWFSC, Santa Cruz County, Santa Cruz RCD, Soquel Demonstration State Forest						TBD	Cost accounted for in above action steps. Effectiveness should evaluate the biological response of salmonids to LWD supplementation as well as fate of the structures over time.
SoC-CCC-3.1.1.4	Action Step	Habitat Complexity	Educate landowners, land managers, and County and municipal staffs on the importance of LWD for recovery and re-establishment of properly functioning instream conditions.	1	10	IWRP, Public, Santa Cruz County, Santa Cruz RCD						In-Kind	Initial efforts should be directed at landowners in the reach near the West Branch and East Branch confluence and then expanded to other areas. Large wood is reportedly removed in these stream reaches. Loss of wood in these reaches adversely affects downstream pool formation. County of Santa Cruz implemented a large wood evaluation program in 2009. The program has been largely successful. Additional outreach and education are needed with private landowners in Soquel watershed. Many streamside landowners cut up the large wood material without regulatory permits. These unsanctioned actions have resulted in a significant diminishment of rearing habitat quality. Education programs could consist of fliers, workshops, public service announcements, etc.
SoC-CCC-3.1.1.5	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	2	100	CDFG, City of Capitola, FEMA, Santa Cruz County, Soquel Demonstration State Forest, USACE						In-Kind	
SoC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating										
SoC-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem Soquel Creek.	2	20	CDFG, City of Capitola, IWRP, NMFS, NRCS, Santa Cruz County, Santa Cruz RCD, Soquel Creek Water District, Soquel Demonstration State Forest							An increase in shelter rating would largely occur as a consequence of other instream enhancement actions.
SoC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve pool/riffle/flatwater ratios (hydraulic diversity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams).	2	10		25.00	25.00				50	The most appropriate technique to increase pool frequency in Soquel Creek will likely involve installation of large woody material. Other instream habitat elements could include boulder installation into responsive stream reaches. Cost based on treating 2 miles of stream at a rate of $25,000/mile for LWD placement. If constructing ELJ, assume 10/mile at a rate of 115,276/ELJ for a total of 2,305,000.
SoC-CCC-3.1.4	Recovery Action	Habitat Complexity	Increase frequency of primary pools										
SoC-CCC-3.1.4.1	Action Step	Habitat Complexity	Excavate sediment and build up channel bars.	2	10		37.50	37.50				75	Using an excavator/backhoe, remove sediment from incipient pools or adjacent to incipient bars, and place the sediment on incipient bars. Grade the placed sediment to contoured form and attach to banks, mimicking alternate bars in general shapes. Bars should confine the active channel approximately 50% in width. This rough design estimate should be refined by results from field survey and hydraulic model analysis. Place LWD and available coarse sediment on bar surfaces to increase resistance to erosion.
SoC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SoC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
SoC-CCC-4.1.1.1	Action Step	Hydrology	Promote irrigation efficiency projects for agricultural practices.	3	20	Farm Bureau, IWRP, NRCS, Santa Cruz RCD						TBD	
SoC-CCC-4.1.1.2	Action Step	Hydrology	Promote off-channel storage and conservation measures to reduce impacts of summer and early fall water diversions (e.g. storage tanks for rural residential users).	2	30	CDFG, IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD, Soquel Creek Water District, Trout Unlimited						TBD	Costs are difficult to predict due to uncertainties regarding landowner participation.
SoC-CCC-4.1.1.3	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707.	1	20	CDFG, Santa Cruz County, Soquel Creek Water District, SWRCB, Trout Unlimited						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-4.1.1.4	Action Step	Hydrology	Promote conjunctive use of water for water projects whenever possible to maintain or restore salmonid habitat.	1	20	City of Capitola, Santa Cruz County, Soquel Creek Water District, SWRCB						TBD	Conjunctive water use involves utilization of multiple water sources, usually both surface and groundwater sources, in a way that maximizes water storage and availability under different climatic conditions. One of the guiding goals of a conjunctive water effort is to ensure increased summer stream flows for fish habitat.
SoC-CCC-4.1.2	Recovery Action	Hydrology	Minimize redd scour										
SoC-CCC-4.1.2.1	Action Step	Hydrology	Install properly sized large woody debris to appropriate viability table targets.	1	5		749					749	Redd scour is likely a limiting factor in some reaches, particularly during high flow events. Portions of the stream bed are prone to scour; in some areas, the existing geology contributes finer (sandy) sediments that are more prone to mobilization during higher flow events than stream reaches with well sorted stream gravels. Reduced instream habitat complexity (i.e., a lack of LWD that helps hold gravels in place), increases the likelihood of redd scour during high flow events. It was not known if scour is widespread or whether it is a significant cause of coho egg and alevin mortality. Cost based on $115,276/mile of Engineered Log Jam for 6.5 miles of high IP. If placement of LWD used in replacement of Engineered Log Jam, cost would equal $182,250 for treating 6.5 miles of high IP. Co-related to habitat complexity.
SoC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SoC-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with urbanization										
SoC-CCC-5.1.1.1	Action Step	Landscape Patterns	Residential landowners should utilize BMP's from Basins Of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds (OAEC, 2007), Slow it. Spread it. Sink it! (Santa Cruz Resource Conservations District, 2009) to conserve water resources	2	100							In-Kind	
SoC-CCC-6.1	**Objective**	**Passage**	**Address other natural or manmade factors affecting the species' continued existence**										
SoC-CCC-6.1.1	Recovery Action	Passage	Improve access of spawning adults and juveniles										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-6.1.1.1	Action Step	Passage	Evaluate the two natural falls at the Girl Scout Camp on West Branch Soquel and determine the benefits of providing passage for coho salmon into upper reaches.	3	10	CDFG, IWRP, NMFS HCD, Santa Cruz RCD	145.00	145.00				290	If modification is feasible (this recommendation may conflict with some existing policies) the benefits of the upstream habitat should be accessed. Areas where there is less disturbance and a greater probability of spawning and rearing success, should be carefully considered in light of the status of the species in the Santa Cruz Mountains Diversity Stratum. The West Branch reach above Girl Scout Falls II has 3-4 miles of low gradient potential coho habitat. Cost estimate is for evaluation only. Cost based on treating two natural falls at a rate of $143,640/unit. Cost could be lower if minimal modifications are needed.
SoC-CCC-6.1.1.2	Action Step	Passage	Evaluate the Soquel Creek Water District Weir for potential impacts to coho migration on East Branch Soquel.	2	5	CDFG, Soquel Creek Water District							
SoC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SoC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
SoC-CCC-9.1.1.1	Action Step	Sediment	Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.	3	10	CalFire, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD	47.00	47.00				94	Cost for erosion assessment estimated at $13.90/acre (assume 25% of total watershed acres).
SoC-CCC-9.1.1.2	Action Step	Sediment	Remediate slides and gullies delivering sediment to fish bearing streams.	3	30	IWRP, NRCS, Santa Cruz County, Santa Cruz RCD							The ultimate causes of slope and stream bank instability should be addressed where practicable and financially feasible. In some circumstances remediation in the Soquel Creek watershed may not be practicable due to geologic constraints and instability in some stream reaches. Stabilization techniques should involve appropriate bioengineering practices as the first priority. Areas of high interest include a large older landslide upstream of Girl Scott Falls II and the Highland Way Slide on East Branch Soquel Creek. Protection of streambanks below unconsolidated deposits of large rotation landslides should be considered priorities for threat abatement and restoration.
SoC-CCC-9.1.1.3	Action Step	Sediment	Initiate education program for landowners in the watershed regarding practices to minimize sediment input.	3	10	City of Capitola, IWRP, NRCS, Santa Cruz County, Santa Cruz RCD	10.00	10.00				20	Existing material could be used rather than tailoring an education program to constraints and issues within Soquel Creek. Education should be ongoing with frequent workshops (yearly).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-9.1.2	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
SoC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	20	CalFire, CalTrans, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD	10.00	10.00	10.00	10.00		40	This cost estimate does not include long-term maintenance obligations.
SoC-CCC-9.1.2.2	Action Step	Sediment	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	1	100	CalFire, CDFG, NRCS, Santa Cruz County, Santa Cruz RCD, USACE						In-Kind	This should be considered a standard business practice for all permitting agencies.
SoC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction of the species habitat or range**										
SoC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
SoC-CCC-10.1.1.1	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon.	1	10	CDFG, Monterey Bay Salmon and Trout Project, NMFS, NOAA SWFSC, Private Landowners							Re-establishment should only occur in stream reaches where water diversions have not limited rearing habitat. Instream habitat should also be evaluated and enhanced where necessary to increase survival success. East Branch Soquel may be the most appropriate location for initial reintroduction efforts. Efforts should occur in close coordination with NOAA SWFSC, CDFG, landowners, and NMFS.
SoC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
SoC-CCC-10.1.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	21		28.57	28.57	28.57	28.57	5.71	120	Periodic monitoring should have sufficient funding to document size of all three cohorts and should occur concurrently with smolt monitoring to the maximum extent possible. Cost for annual spawner surveys in Santa Cruz Mtns. diversity stratum estimated at $56,470/year.
SoC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**										
SoC-CCC-10.2.1	Recovery Action	Viability	Increase abundance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-10.2.1.1	Action Step	Viability	Conduct periodic, standardized smolt outmigration surveys to estimate smolt abundance in the watershed. Surveys should occur during the same period as adult spawning surveys.	3	9	CDFG, IWRP, NMFS	292.22	233.78				526	Periodic surveys are likely the preferred alternative in Soquel (a Dependent watershed) due to the other monitoring already occurring in other Dependent watersheds in the Santa Cruz Mtn. Diversity Stratum. Costs will vary depending on sampling intensity, duration, and location. Survey effort should include all three cohorts. Cost for smolt outmigration monitoring estimated at $58,404/year.
SoC-CCC-10.2.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.	2	10	CDFG, Private Consultants, Santa Cruz County, Soquel Creek Water District, Soquel Demonstration State Forest	95.00	95.00				190	Cost for annual juvenile distribution surveys estimated at $18,823/year for Santa Cruz Mtns.
SoC-CCC-10.2.1.3	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	2	9	CDFG, NMFS, NOAA SWFSC, Private Consultants	283.33	226.67				510	Periodic surveys (redd surveys may be the most viable survey method in Soquel) are likely the preferred alternative in Soquel (a Dependent watershed) due to the other adult monitoring already occurring in other Dependent watersheds in the Santa Cruz Mtn. Diversity Stratum. Cost for annual spawner ground surveys estimated at $56,470/year for Santa Cruz Mtn. Diversity Stratum.
SoC-CCC-10.2.2	Recovery Action	Viability	Increase spatial structure and diversity										
SoC-CCC-10.2.2.1	Action Step	Viability	Implement standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	3	10	CalFire, CDFG, IWRP, Private Consultants, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						TBD	Existing DFG habitat survey protocols may be utilized at little or no cost.
SoC-CCC-13.1	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SoC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment of floodplain connectivity										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-13.1.1.1	Action Step	Channel Modification	For riparian roads, promote road relocation as a preferred alternative to bank stabilization.	2	100	CalFire, CalTrans, CDFG, City of Capitola, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks, USACE							Road relocation should be carefully and thoughtfully evaluated as an alternative to bank hardening prior to designing new bank stabilization measures. Road relocation in some circumstances can result in long term cost savings and significant fisheries benefits.
SoC-CCC-13.1.2	Recovery Action	Channel Modification	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SoC-CCC-13.1.2.1	Action Step	Channel Modification	Evaluate whether proposed stabilization projects will lead to additional instability either up- or downstream.	2	100	CalFire, CalTrans, City of Capitola, FEMA, NRCS, Santa Cruz County, Santa Cruz RCD, USACE						In-Kind	This should be considered a standard practice for all individuals, agencies, and companies engaged in instream work. The Soquel watershed consists of three distinctive geologic blocks separated by the San Andreas and Zayante fault zones (SCCRCD 2003). The distribution and activity of the major fault zones has contributed to a large number of landslides, which have periodically dumped large quantities of sediment to the watercourse. Additionally, shorts periods of net sediment aggradation within the stream channel have been documented following major floods (SCCRCD 2003). In reaction to large sediment input events, there is a potential for future bank destabilization due to bed aggradation as pulses of sediment move through the system.
SoC-CCC-13.2	**Objective**	**Channel Modification**	**Address inadequacies of regulatory mechanisms**										
SoC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity										
SoC-CCC-13.2.1.1	Action Step	Channel Modification	Eliminate the use of gabion baskets and undersized rock within the bankfull channel.	2	100	CalFire, CalTrans, City of Capitola, FEMA, NRCS, Santa Cruz County Department of Public Works, Santa Cruz RCD, Soquel Demonstration State Forest, USACE						TBD	Adoption of this standard practice will result in increased costs for some projects but will ultimately result in long term savings due to better designed and constructed projects with long term persistence.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-13.2.1.2	Action Step	Channel Modification	Protect existing areas that provide winter refuge and seasonal habitats for juvenile salmonids from channelization projects.	1	100	CDFG, FEMA, NRCS, Santa Cruz County, USACE							
SoC-CCC-13.2.1.3	Action Step	Channel Modification	Modify Federal, State, city and county regulatory and planning processes to eliminate provisions allowing new construction of permanent infrastructure that will adversely affect watershed processes, particularly within the 100-year flood prone zones in all historical CCC coho salmon watersheds.	2	10	CalTrans, City of Capitola, FEMA, NMFS, Santa Cruz County, USACE							
SoC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SoC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
SoC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.	3	10	CalFire, Santa Cruz County, Santa Cruz RCD						In-Kind	
SoC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Disseminate plan to all local firefighting agencies.	3	10	CalFire, Santa Cruz County, Santa Cruz RCD						In-Kind	
SoC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Encourage CalFire to provide plan to all non-County firefighters when providing firefighting assistance in the Soquel Creek watershed (and all other watersheds in the County).	3	10	CalFire, Santa Cruz County, Santa Cruz RCD						In-Kind	
SoC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity										
SoC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	1	100	CalFire, Santa Cruz County						In-Kind	Sediment control is a requirement for all post firefighting actions. Immediately implementing these measures (when feasible) when equipment and crews are available will minimize mobilization costs and result in a long term cost savings.
SoC-CCC-15.1.2.2	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams within 300 feet of riparian areas.	2	100	CalFire						In-Kind	
SoC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent adverse alterations to riparian species composition and structure										
SoC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Review prescribed fire plans to ensure they provide adequate protection for riparian corridors.	3	10	CalFire, Santa Cruz County						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms**										
SoC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
SoC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Use non-toxic retardants. Avoid dropping fire retardant into streams. To the maximum extent feasible, orient air drops so that the drop goes perpendicular to streams as opposed to parallel.	2	100	CalFire							
SoC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFG, NMFS, Santa Cruz County, Santa Cruz RCD, USEPA, USFWS						In-Kind	The resource agencies can provide guidance regarding critical resources in the areas that may be impacted by firefighting actions.
SoC-CCC-16.1	**Objective**	**Fishing/Collecting**	**Address the inadequacy of existing regulatory mechanisms**										
SoC-CCC-16.1.1	Recovery Action	Fishing/Collecting	Prevent reduced density, abundance, and diversity										
SoC-CCC-16.1.1.1	Action Step	Fishing/Collecting	Reduce poaching of adult coho salmon by increasing law enforcement.	1	100	CDFG Law Enforcement, NMFS OLE							Initial focus should be directed towards the East Branch of Soquel Creek where coho salmon juveniles were detected in 2008.
SoC-CCC-16.1.1.2	Action Step	Fishing/Collecting	Work with CDFG to modify Section 8.00 (b) (1) low flow minimum flow closure for Soquel Creek.	2	5	CDFG, NMFS PRD, Public						In-Kind	Additional consideration should be given to starting the fishing season later in the year in an effort to reduce incidental bycatch of coho salmon. Low flow closures should be based on gage information from a watershed in the Santa Cruz Mountains. Consideration for extending the season to later in the year could also be evaluated so as to minimize loss of fishing days.
SoC-CCC-16.1.1.3	Action Step	Fishing/Collecting	Install/construct permanent signs at all major public access points along Soquel Creek that clearly identify differences in body morphology of all potentially present adult salmonids with color photos (e.g., caudal fin spotting, caudal fork shape, coloration of lower jaw, peduncle width, etc.).	2	5	CDFG, CDFG Law Enforcement, NMFS OLE, Santa Cruz County Fish and Wildlife Advisory Board	7.50					8	Cost for signs vary widely depending on materials and content. Assume $500/sign with a minimum of 15 signs.
SoC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SoC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	1	100	CalFire, CDFG, RPFs, RWQCB						In-Kind	
SoC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										
SoC-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	2	100	CalFire, CDFG, RPFs, Santa Cruz County, SWRCB						TBD	
SoC-CCC-19.1.3	Recovery Action	Logging	Prevent future impacts to habitat complexity										
SoC-CCC-19.1.3.1	Action Step	Logging	Retain the largest trees in all riparian zones (including intermittent and ephemeral streams) for bank stability and long-term wood recruitment.	3	100	CalFire, Private Landowners, Redwood Empire, RPFs, Soquel Demonstration State Forest						In-Kind	The current Forest Practices Rules require retention of a proportion of the largest riparian trees.
SoC-CCC-19.1.3.2	Action Step	Logging	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, CDFG, Santa Cruz County, Soquel Demonstration State Forest, State Parks	130.00	130.00				260	Costs will vary depending on landowner participation and site specific needs. This strategy can be implemented at relatively little costs in areas zoned for timber production as a component of future harvest plans. Cost based on treating 2 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,621/acre.
SoC-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SoC-CCC-19.1.4.1	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Private Landowners, Redwood Forest Foundation, RPFs, Soquel Demonstration State Forest						In-Kind	
SoC-CCC-19.1.4.2	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	3	100	CalFire, CDFG, Private Landowners, Redwood Empire, RPFs, Santa Cruz County, Soquel Demonstration State Forest						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-19.1.4.3	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, RWQCB, Soquel Demonstration State Forest						In-Kind	
SoC-CCC-19.1.4.4	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	3	100	CalFire, RPFs, Santa Cruz County							
SoC-CCC-19.1.5	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
SoC-CCC-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, CDFG, Private Landowners, Public, Redwood Empire, RPFs, Santa Cruz County, Soquel Demonstration State Forest, State Parks						In-Kind	Cost of managing riparian areas is anticipated to be minimal.
SoC-CCC-19.1.6	Recovery Action	Logging	Prevent increased landscape disturbance										
SoC-CCC-19.1.6.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, Soquel Demonstration State Forest						In-Kind	Logging was identified as a potential future threat to summer rearing juveniles due to the potential of timber management to reduce future LWD recruitment and increase instream temperatures. California Forest Practice Rules require retention of riparian trees adjacent to Class 1 fish-bearing streams, which will ameliorate the impacts of reduced LWD and over story canopy reduction (Santa Cruz County rules do not allow even-aged management). Despite these restrictions it is likely future timber management may reduce or delay the rate of future recruitment by harvesting trees that could potentially be recruited into the stream channel. This impact could be partially offset if, mitigation measures for future timber harvest plans, included a large wood augmentation program. An augmentation program would need to include an evaluation of limiting factors, including riparian canopy cover and instream temperature regimes.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-19.1.6.2	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	25	CalFire, CDFG, RPFs, RWQCB, Santa Cruz County						In-Kind	
SoC-CCC-19.1.7	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, dams, etc.)										
SoC-CCC-19.1.7.1	Action Step	Logging	To the maximum extent practicable, all roads, landings, and skid trails associated with timber operations should be hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, RWQCB, Santa Cruz County, Soquel Demonstration State Forest						In-Kind	
SoC-CCC-19.1.7.2	Action Step	Logging	Avoid new road construction in riparian zones (< 100 feet).	1	100	CalFire, CDFG, NMFS, RPFs, RWQCB, Santa Cruz County						In-Kind	
SoC-CCC-19.1.7.3	Action Step	Logging	Avoid road construction near headwater channels.	2	100	CalFire, Private Landowners, Redwood Empire, RPFs, RWQCB, Santa Cruz County, Soquel Demonstration State Forest						In-Kind	
SoC-CCC-19.1.8	Recovery Action	Logging	Prevent impairment to water quality (impaired instream temperature)										
SoC-CCC-19.1.8.1	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	3	100	CalFire, IWRP, Private Landowners, Redwood Empire, RPFs, RWQCB, Santa Cruz County, Soquel Demonstration State Forest						In-Kind	Wider riparian zones are critical to maintaining water temperature in Soquel Creek. Lower Soquel is temperature impaired for CCC coho salmon during the summer low flow season. However canopy, while an important determinant in water temperature conditions, is likely a secondary factor when compared to the magnitude of temperature impacts resulting from surface and ground water diversions in the watershed.
SoC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										
SoC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-19.2.1.1	Action Step	Logging	Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS draft, 2004) or "Short Term HCP Guidelines" (NMFS 1999).	2	10	CalFire, CDFG, NMFS, Redwood Empire, RWQCB, Santa Cruz County, Soquel Demonstration State Forest						In-Kind	Initial focus for THP review should be directed at harvest actions near anadromous waters of East Branch Soquel Creek. CCC coho salmon were detected in the East Branch in 2008, and represent the southern most known population of coho salmon and should be afforded heightened oversight and protection. The need for this action may change if the California Forest Practice Rules change and reach a no-take standard.
SoC-CCC-19.2.1.2	Action Step	Logging	Encourage a watershed-wide HCP/GCP/Natural Community Conservation Plan or other procedures for multiple forest landowners within the Soquel Creek watershed to pool resources as a means to facilitate long-term survival and recovery for coho salmon and their habitat.	3	30	CDFG, City of Capitola, NMFS PRD, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust, Soquel Creek Water District, Soquel Demonstration State Forest, State Parks, USFWS	200.00	200.00	200.00	200.00	200.00	1,200	The HCP should not exceed 30 years in duration and should focus on the larger landowners and water diverters. HCPs can be developed for multiple landowners engaged in multiple (otherwise legal) practices. Cost estimate is for development of the HCP. Development costs are highly variable and are contingent on proposed covered activities, regulatory agency staffing, and interpersonal dynamics during negotiations.
SoC-CCC-19.2.1.3	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.	2	100	CalFire, CDFG, Private Landowners, Redwood Empire, Santa Cruz County, Soquel Demonstration State Forest						In-Kind	
SoC-CCC-19.2.1.4	Action Step	Logging	Discourage Santa Cruz County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	Santa Cruz County						In-Kind	A significant portion of the watershed consists of small rural residential ownership parcels. Rural residential development is generally deleterious to watershed processes.
SoC-CCC-19.2.1.5	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core CCC coho salmon areas.	1	20	CalFire, CDFG, NMFS, RWQCB, Santa Cruz County						In-Kind	Initial focus should be directed towards proposed harvest plans in the East Branch of Soquel Creek.
SoC-CCC-19.2.1.6	Action Step	Logging	Erosion control measures and road maintenance should be maintained during the entire period between re-entrys.	2	100	CalFire, CDFG, Redwood Empire, RPFs, RWQCB						In-Kind	
SoC-CCC-19.2.1.7	Action Step	Logging	Review "fire-safe" exemptions to prevent illegal conversions, riparian corridor impacts and other watershed impacts.	2	100	CalFire, Santa Cruz County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-19.2.2	Recovery Action	Logging	Prevent impairment to water quality (impaired instream temperature)										
SoC-CCC-19.2.2.1	Action Step	Logging	Increase buffer widths on Class II streams.	2	10	Board of Forestry, CalFire, Private Landowners, RPFs, RWQCB							Increasing buffer width (to be consistent with CFPR standards throughout the rest of the CCC ESU) to a 30 foot no-harvest buffer will ensure water temperatures are protected to downstream reaches critical for coho salmon rearing.
SoC-CCC-20.1	**Objective**	**Mining**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
SoC-CCC-20.1.1	Recovery Action	Mining	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
SoC-CCC-20.1.1.1	Action Step	Mining	Monitor quarry operations to ensure compliance with County and State policies.	2	100	RWQCB, Santa Cruz County						TBD	Mining was considered a potential future threat due to existing sediment controls potentially failing during a major storm event. Only one quarry is present in the watershed, but its configuration and proximity to the East Branch Soquel Creek (the only location in the watershed where coho salmon were recently detected) appears to place the stream channel at risk for major sediment input if containment devices should fail. Particular focus should be directed at water retention facilities and check dams during periods of high rainfall to ensure proper operation and that no unauthorized occurrences of turbidity or sediment input enter fish bearing watercourses. Cost are difficult to determine because of timing and extent of occurrences of turbidity are unknown at this time.
SoC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SoC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to stream hydrology (impaired water flow)										
SoC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Develop an incentive program for a roof runoff collection system for detaining runoff and providing for landscape irrigation.	3	10	Santa Cruz County, Santa Cruz RCD, Soquel Creek Water District						In-Kind	
SoC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Incorporate rain harvesting, storm-water wetland catchment basins, and pervious surfaces into existing and new development.	3	100	City of Capitola, Private Landowners, Santa Cruz County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Disperse discharge from new or upgraded commercial and residential areas into a spatially distributed network rather than a few point discharges, which can result in locally severe erosion and disruption of riparian vegetation and instream habitat.	3	100	City of Capitola, Private Landowners, Santa Cruz County						TBD	Cost to upgrade stormwater discharge points cannot be determined at this time, but it may be significant.
SoC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
SoC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Maintain intact and properly functioning riparian buffers to filter and prevent fine sediment input from entering streams.	2	100	City of Capitola, Private Landowners, RWQCB, Santa Cruz County						In-Kind	
SoC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Sediment from existing and future commercial and urban development should be reduced to magnitudes appropriate to the geological setting of the watershed, resulting in no net increase in sedimentation over natural limits.	2	100	City of Capitola, Private Landowners, RWQCB, Santa Cruz County						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SoC-CCC-22.1.2.3	Action Step	Residential/Commercial Development	Design new developments to avoid unstable slopes, and wetlands areas of high habitat value, and similarly constrained sites.	2	100	CalTrans, City of Capitola, Private Landowners, RWQCB, Santa Cruz County						In-Kind	Stringent review by permitting agencies is expected to reduce costs associated with poorly planned and poorly located developments.
SoC-CCC-22.1.3	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity.										
SoC-CCC-22.1.3.1	Action Step	Residential/Commercial Development	Encourage Santa Cruz to develop property easement acquisition funds and acquire grant monies to purchase eroding private properties in riparian corridors or properties subject to frequent flooding though a buyout program.	3	20	FEMA, Private Landowners, Santa Cruz County, Santa Cruz County Land Trust						TBD	This recommendation may be difficult to implement unless Santa Cruz realizes a cost savings (due to reduced flood fighting, etc.). A financial analysis will likely be needed.
SoC-CCC-22.1.3.2	Action Step	Residential/Commercial Development	Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channels migration zones to avert future bank erosion controls projects.	1	100	City of Capitola, FEMA, Private Landowners, Public, RWQCB, Santa Cruz County, USACE						In-Kind	
SoC-CCC-22.1.3.3	Action Step	Residential/Commercial Development	Encourage establishment of conservation easements on floodplain habitat in key stream reaches.	2	100	CalTrans, CDFG, Santa Cruz County Land Trust, USACE						TBD	Cost will vary depending on location and desirability of parcel for future development.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-22.1.4	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SoC-CCC-22.1.4.1	Action Step	Residential/Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and avoid, minimize and/or mitigate their impacts to rearing and migrating CCC coho salmon.	2	5	CDFG, FEMA, NMFS PRD, Santa Cruz County, USACE						In-Kind	The purpose of this recommendation is to ensure that any stream maintenance that continues to occur is not the result of the legacy of past management practices but is in fact occurring for a demonstrable benefit to public/private property. Actions that have no or minimal benefit to public/private property should be discontinued.
SoC-CCC-22.1.4.2	Action Step	Residential/Commercial Development	Encourage the use of native vegetation in new landscaping to reduce the need for watering and application of herbicides, pesticides, and fertilizers.	3	100	City of Capitola, Santa Cruz RCD, Soquel Creek Water District							
SoC-CCC-22.1.4.3	Action Step	Residential/Commercial Development	Remove non-native riparian vegetation via thinning and removal programs.	3	20	City of Capitola, IWRP, Private Landowners, Santa Cruz RCD	792	792	792	792		3,166	Non native vegetation is most problematic in the urbanized lower reaches of Soquel Creek. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP with a 1 mile minimum) at a rate of $39,574/acre.
SoC-CCC-22.1.5	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
SoC-CCC-22.1.5.1	Action Step	Residential/Commercial Development	Encourage infill and high density developments over dispersal of low density rural residential in undeveloped areas.	2	100	City of Capitola, Santa Cruz County							
SoC-CCC-22.1.5.2	Action Step	Residential/Commercial Development	Identify areas at high risk of conversion, and develop incentives and alternatives for landowners that discourage conversion.	2	100	City of Capitola, Santa Cruz County							
SoC-CCC-22.1.6	Recovery Action	Residential/Commercial Development	Prevent reduced density, abundance, and diversity										
SoC-CCC-22.1.6.1	Action Step	Residential/Commercial Development	Design and implement education programs to promote public awareness of salmonid habitats within urban creek settings and life history requirements.	2	10	City of Capitola, IWRP, Santa Cruz County, Santa Cruz RCD						In-Kind	Education programs could consist of fliers, workshops, public service announcements, etc. Some of these materials have been developed by the Santa Cruz RCD and County of Santa Cruz and should be used in initial efforts to promote public awareness.
SoC-CCC-22.2	**Objective**	**Residential/Commercial Development**	**Address the inadequacy of existing regulatory mechanisms.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-22.2.1	Recovery Action	Residential/Commercial Development	Prevent adverse alterations to riparian species composition and structure										
SoC-CCC-22.2.1.1	Action Step	Residential/Commercial Development	Encourage county and city planning departments to designate special assessment districts for properties with infrastructure located in high risk flood prone zones. Revenue generated should be used to raise or relocate infrastructure away from high risk flood zones.	3	10	City of Capitola, Santa Cruz County						In-Kind	
SoC-CCC-22.2.1.2	Action Step	Residential/Commercial Development	Encourage Santa Cruz County to improve riparian ordinances to be more protective of watershed processes in regard to pre-existing development and allowances for riparian exemptions.	2	5	Santa Cruz County						In-Kind	Santa Cruz County should develop incentives to promote private landowners to pull back from riparian zones. Exemption process for riparian development should be made more stringent.
SoC-CCC-22.2.2	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
SoC-CCC-22.2.2.1	Action Step	Residential/Commercial Development	Support the development and implementation of regulations for activities that adversely impact groundwater recharge.	2	10	Santa Cruz County, Soquel Creek Water District							
SoC-CCC-22.2.2.2	Action Step	Residential/Commercial Development	New development in all historical CCC coho salmon watersheds should meet a zero net increase in storm-water runoff, changes in duration, or magnitude of peak flow.	1	100	RWQCB, Santa Cruz County, USACE, USEPA						TBD	Cost may vary significantly. In more urbanized areas costs will likely be absorbed into SWMP requirements per the RWQCB. Costs in rural areas where these storm water plans are not required may be significant on a project by project basis.
SoC-CCC-22.2.3	Recovery Action	Residential/Commercial Development	Prevent increased landscape disturbance										
SoC-CCC-22.2.3.1	Action Step	Residential/Commercial Development	Standards and recommendations regarding development should apply to all jurisdictions, including school districts and other special districts not subject to county and/or state related ordinances or policies.	3	100	FEMA, HUD, Santa Cruz County, USACE						In-Kind	
SoC-CCC-22.2.3.2	Action Step	Residential/Commercial Development	Enforce existing building permit programs to minimize unpermitted construction.	3	100	Santa Cruz County							
SoC-CCC-22.2.3.3	Action Step	Residential/Commercial Development	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	2	100	CalFire, Santa Cruz County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-22.2.4	Recovery Action	Residential/Commercial Development	Prevent impairment to floodplain connectivity.										
SoC-CCC-22.2.4.1	Action Step	Residential/Commercial Development	Santa Cruz County should continue policies that discourage new construction in undeveloped areas within the 100-year flood prone zones.	2	100	Santa Cruz County						In-Kind	Remaining undeveloped floodplains provide critical high water refugia for listed salmonids. These habitats are typically converted to landuses incompatible with salmonid life history requisites. Costs should be minimal if incorporated into updated general plan. Significant cost savings would result due to avoidance of emergency response and repair on part of local, Federal, and state governments. Evaluate effectiveness of the policies and update to augment provisions as necessary in General Plan updates.
SoC-CCC-22.2.4.2	Action Step	Residential/Commercial Development	Minimize redevelopment within the 100 year floodplain.	2	100	Santa Cruz County							The County of Santa Cruz currently prohibits new development in 100 year floodplains and riparian zones. The prohibition should be expanded to include upgrades, additions, and in some situations, bank protection.
SoC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SoC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
SoC-CCC-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	CalFire, California Department of Mines and Geology, CalTrans, CDFG, City of Capitola, NRCS, Redwood Empire, RWQCB, Santa Cruz County, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-23.1.1.2	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	15	IWRP, Santa Cruz RCD							Plan should establish areas for prioritization and implementation timelines. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile of watershed area, and at 4.0 miles per square mile of riparian area. Many of these roads are poorly situated, constructed, and improperly maintained. Even though chronic fine sediment production decreases as the roads become vegetated, roads can deteriorate with age, becoming more susceptible to many forms of erosion, including culvert plugging and subsequent stream crossing failure, stream diversion and gullying, as well as failure of both road and landing fills (Environmental Science Associates 2004). Legacy roads from past logging activity, having been adopted as year-round roads and recreational trails, continue to impact the Soquel watershed. On many roads, located on both public and private lands, periodic maintenance occurs without any attempt to address chronic, localized erosion problems. In these circumstances, grading poorly drained roads and repairing failed fills and stream crossings can continue, and even exacerbate, the rate of fine sediment delivery into streams. Additionally, paved and unpaved roads parallel many of the waterways within Soquel Creek, likely constraining natural channel migration.
SoC-CCC-23.1.1.3	Action Step	Roads/Railroads	Develop a private road improvement fund to share costs and encourage private road associations to upgrade poorly constructed or improperly located roads.	3	30	City of Capitola, RWQCB, Santa Cruz County, Santa Cruz RCD	16.67	16.67	16.67	16.67	16.67	100	Costs would depend on outreach success of the program.
SoC-CCC-23.1.1.4	Action Step	Roads/Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	3	20	CalFire, IWRP, Private Landowners, Santa Cruz County, Santa Cruz RCD							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-23.1.1.5	Action Step	Roads/Railroads	Prioritize decommissioning of riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	20	CalFire, CalTrans, NRCS, Private Landowners, Redwood Empire, RWQCB, Santa Cruz County, Santa Cruz County Land Trust, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks	13.75	13.75	13.75	13.75		55	Cost will depend on landowner willingness to participate and site specific conditions. The most likely candidates for this recommendation include roads on State Parks, private timberlands, and Soquel Demonstration State Forest. Mainline public roads, although a major issue, are unlikely to be decommissioned due to common infrastructure and high property acquisition expense. Cost based on decommissioning 4 miles of riparian road network at a rate of $13,680/mile. If upgrading riparian roads, cost are estimated to total $96,000.
SoC-CCC-23.1.1.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	3	5	CalFire, City of Capitola, Santa Cruz County							
SoC-CCC-23.1.1.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, City of Capitola, Santa Cruz County	490.00	490.00	490.00	490.00		1,960	Cost based on treating 20 stream crossings at a rate of $97,673/culvert (assume average size to be 10-20').
SoC-CCC-23.1.1.8	Action Step	Roads/Railroads	Evaluate stream crossings for their potential to impair natural geomorphic processes. Replace or retrofit crossings to achieve more natural conditions that meet sediment transport goals.	3	5	CalFire, City of Capitola, NRCS, Redwood Empire, RWQCB, Santa Cruz County, Soquel Demonstration State Forest, State Parks	255.00					255	Encourage Soquel Demonstration State Forest to install a bridge or decommission a wet ford crossing on East Branch Soquel. Cost for providing passage (assume bottomless arch) at a rate of $255,000.
SoC-CCC-23.1.1.9	Action Step	Roads/Railroads	Educate road associations and informal road maintenance collectives regarding the benefit of integrating into the Santa Cruz County Service Area process.	2	5	IWRP, Santa Cruz County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-23.1.1.10	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	3	20	CalFire, IWRP, NRCS, Santa Cruz RCD	55.00	55.00	55.00	55.00		220	This action should carefully balance impacts of riparian roads, future risks, and juxtaposition to important spawning and rearing areas. Although ambitious, this recommendation, by focusing on infrequently used and infrequently maintained high risk areas; should be considered a realistic goal with long-term benefits. Areas targeted will most likely included unsurfaced and infrequently used roads in the upper portion of the Soquel watershed. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on treating 16 miles of road network at a rate of 13,680/mile.
SoC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
SoC-CCC-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	100	CalFire, City of Capitola, Private Landowners, Redwood Empire, Santa Cruz County, Soquel Demonstration State Forest, State Parks							Cost accounted for in prevent impairment to instream substrate.
SoC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
SoC-CCC-23.1.3.1	Action Step	Roads/Railroads	Evaluate SCCRCD (2003) recommendations for passage improvements and prioritize accordingly.	2	10	IWRP, Santa Cruz County, Santa Cruz RCD, USACE	3,526	3,526				7,051	Cost based on treating 14 barriers at a rate of $503,675/barrier. Cost may vary depending on size of stream and land use. Box culverts on Bates Creek and Hester Creek (Soquel-San Jose Road) restrict movement of large instream wood. Locations that impede wood movement in addition to salmonid movement should be considered a high priority for remediation.
SoC-CCC-23.1.3.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, CalTrans, City of Capitola, NRCS, Redwood Empire, RWQCB, Santa Cruz County, Soquel Demonstration State Forest, USACE						In-Kind	Adopt NMFS (2001) Guideline for Stream Crossings.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										
SoC-CCC-23.1.4.1	Action Step	Roads/Railroads	Encourage ongoing implementation of the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	2	100	Santa Cruz County							
SoC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
SoC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
SoC-CCC-23.2.1.1	Action Step	Roads/Railroads	Encourage Redwood Empire and State Parks to address wetted road crossings and sediment runoff from their riparian roads located on Hinckley Creek, tributary to East Branch Soquel.	2	5	IWRP, Redwood Empire, Santa Cruz County, State Parks							This road is used by residents in an inholding on Hinckley Creek and is a significant source of fine sediment input into a reach of stream close to where the southern most coho population was detected in 2009. The sediment should be stabilized within five years. Ultimately, this road should be closed and decommissioned.
SoC-CCC-23.2.1.2	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, California Geological Survey, CalTrans, NRCS, Private Landowners, Santa Cruz County Department of Public Works, Soquel Demonstration State Forest, State Parks						TBD	This is a cost that is frequently absorbed into road projects.
SoC-CCC-23.2.1.3	Action Step	Roads/Railroads	Improve enforcement of Erosion Control Ordinance for private roads. The current Santa Cruz Erosion Control Ordinance has provisions requiring the responsible parties to repair and alleviate erosion problems that are deemed severe. Santa Cruz Planning should create new erosion control staff positions to help coordinate the County's cooperative efforts, but also to conduct inspections and enforcement actions as necessary.	2	10	Santa Cruz County	250.00	250.00				500	Cost likely amounts to a 1/2 time position in the Soquel Creek/Aptos Creek watersheds. Costs were estimated over a ten year interval and will likely need further refinement if this recommendation is carried out over a longer duration.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-23.2.1.4	Action Step	Roads/Railroads	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	20	Private Landowners, Santa Cruz RCD, Soquel Demonstration State Forest, State Parks						In-Kind	Constant diligence will be necessary to minimize the impacts of unsanctioned trials and roads.
SoC-CCC-23.2.1.5	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.	2	100	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD						TBD	Inadequate road maintenance practices is most problematic on rural residential road networks, particularly those not subject to forest practice rules performance standards.
SoC-CCC-23.2.1.6	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	2	100	CalFire, PG&E, Santa Cruz County							
SoC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
SoC-CCC-23.2.2.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	1	20	CalFire, CalTrans, City of Capitola, NRCS, RWQCB, Santa Cruz County						TBD	Cost may vary significantly. However, a well designed road management plan should result in overall cost savings.
SoC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
SoC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary										
SoC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	3	100	CA Coastal Commission, City of Capitola, Santa Cruz County, Santa Cruz RCD						TBD	Cost accounted for in ESTUARY.
SoC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Implement water conservation strategies that provide for drought contingencies without relying on interception of surface flows or groundwater depletion.	2	100	IWRP, NRCS, Private Landowners, Santa Cruz County, Santa Cruz RCD							
SoC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	If predicted flows are below a level considered critical to maintain viable rearing habitat for salmonids, measures to reduce water consumption should be initiated by municipal water suppliers and other users in the watershed through conservation programs.	1	10	City of Capitola, IWRP, NRCS, SWRCB	36.00	36.00				72	Cost for stream flow model estimated at $71,825/project
SoC-CCC-24.1.2.3	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	3	100	City of Capitola, IWRP, Santa Cruz County, Santa Cruz RCD						In-Kind	
SoC-CCC-24.2	**Objective**	**Severe Weather Patterns**	**Address the inadequacy of existing regulatory mechanisms**										
SoC-CCC-24.2.1	Recovery Action	Severe Weather Patterns	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										
SoC-CCC-24.2.1.1	Action Step	Severe Weather Patterns	Work with local governments to incorporate protection of CCC coho salmon in any flood management activity (CDFG 2004).	2	100	City of Capitola, Santa Cruz County, USACE						In-Kind	
SoC-CCC-24.2.2	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-24.2.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	3	100	CalFire, City of Capitola, IWRP, Santa Cruz County, Santa Cruz RCD, USACE						TBD	Concentrated rainfall and extreme flood events could increase sediment input into Soquel Creek and tributaries from upslope locations. Much of the watershed is comprised of steep topography in erodible geology, which has led to frequent landslides. Accumulated fine sediment within the stream channel from upslope landslides has likely adversely impacted salmonid spawning and rearing habitats. Improved land-use practices will likely lower sediment yield rates following future flooding events. However, much of the watershed is considered impaired and additional flooding events could slow the recovery rate of instream habitat conditions. Erosion assessment cost accounted for in other action steps. Assessment should identify protective measures for high-risk shallow-seeded landslides.
SoC-CCC-24.2.3	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology.										
SoC-CCC-24.2.3.1	Action Step	Severe Weather Patterns	Agencies and landowners should develop contingencies for, drought conditions in a manner compatible with CCC coho salmon recovery needs.	2	10	Private Landowners, Santa Cruz County, Soquel Creek Water District, SWRCB						TBD	Due to the heavy over-drafting of water from Soquel Creek, the impact of a severe drought in conjunction with ongoing overdraft of the aquifer could be devastating to all lifestages of coho salmon and steelhead in the watershed. Although the watershed is Fully Appropriated and adjudicated, a water master is not appointed and there is no oversight of flow requirements. Required minimum bypass flows are not enforced for permitted surface water diversions and it is likely flows drop below mandated requirements in many stream reaches during the summer period. Additionally, even less oversight exists for ground water pumping in the watershed, which may impact baseflows more significantly than surface water diversions. Current demand for water exceeds the safe yield of local aquifers and is in danger of seawater contamination. Severe drought, particularly if occurring over a period of two or more years, would likely reduce flows significantly throughout the watershed, which would reduce overall salmonid abundance and compromise coho recovery goals for the Santa Cruz Mountains Diversity Stratum.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-24.2.3.2	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon during droughts.	3	20	CalFire, CDFG, Private Consultants, Private Landowners, RWQCB, SWRCB						In-Kind	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality.
SoC-CCC-24.2.3.3	Action Step	Severe Weather Patterns	Encourage SWRCB to bring illegal water diverters and out-of-compliance diverters into compliance with State law.	1	100	CDFG, SWRCB							
SoC-CCC-24.2.3.4	Action Step	Severe Weather Patterns	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	3	100	IWRP, NRCS, Santa Cruz RCD							
SoC-CCC-24.2.3.5	Action Step	Severe Weather Patterns	Improve coordination between agencies and others to address season of diversion, off-stream reservoirs, bypass flows protective of coho salmon and their habitats, and avoidance of adverse impacts caused by water diversion (CDFG 2004).	2	10	CDFG, City of Capitola, NMFS, RWQCB, Soquel Creek Water District, SWRCB							
SoC-CCC-24.3	**Objective**	**Severe Weather Patterns**	**Address the overutilization for commercial, recreational, scientific or educational purposes**										
SoC-CCC-24.3.1	Recovery Action	Severe Weather Patterns	Prevent reduced density, abundance, and diversity										
SoC-CCC-24.3.1.1	Action Step	Severe Weather Patterns	Increase enforcement patrols by CDFG and NMFS OLE in sensitive spawning and rearing areas.	1	10	CDFG Law Enforcement, NMFS OLE						In-Kind	Patrols should focus on the lower East Branch of Soquel where coho salmon were most recently spawned successfully.
SoC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
SoC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to the estuary (impaired quality and extent)										
SoC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Ensure current and future water diversions (surface and groundwater) do not further impair water quality conditions for rearing juvenile salmonids.	2	10	Private Landowners, RWQCB, SWRCB	7.50	7.50				15	Cost for continuous water quality monitoring estimated at $5,000/station. Assume minimum of 3 for lagoon. Cost does not account for maintenance or data management.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
SoC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Ensure water supply demands can be met without impacting flow either directly or indirectly through groundwater withdrawals and aquifer depletion.	2	100	City of Capitola, Santa Cruz County, SWRCB						TBD	Stream flow model should identify flow levels for coho salmon.
SoC-CCC-25.1.2.2	Action Step	Water Diversion/Impoundment	Develop water education programs to reduce water use directed at both municipal water users and those with riparian and appropriative water rights.	2	5	City of Capitola, Santa Cruz County, Santa Cruz RCD, Soquel Creek Water District, SWRCB	20.00					20	
SoC-CCC-25.1.2.3	Action Step	Water Diversion/Impoundment	Work with water diverters in the lower West Branch of Soquel to evaluate and modify diversions that may impact rearing habitat quality.	2	15	IWRP, NRCS, Santa Cruz RCD, SWRCB						In-Kind	
SoC-CCC-25.1.2.4	Action Step	Water Diversion/Impoundment	Coordinate timing of water diversions to minimize the likelihood of fish stranding and stream dewatering.	2	100	Private Consultants, Private Landowners, Santa Cruz RCD, Soquel Creek Water District, SWRCB						In-Kind	
SoC-CCC-25.1.2.5	Action Step	Water Diversion/Impoundment	Install passive flow bypass devices designed to allow diversion of water only when minimum streamflow requirements are exceeded.	2	20	CDFG, IWRP, Private Landowners, Santa Cruz RCD, SWRCB						In-Kind	CDFG should review diversions during period 1600 agreement updates and request installation of passive diversion devices where appropriate and feasible.
SoC-CCC-25.1.2.6	Action Step	Water Diversion/Impoundment	Encourage programs and entrepreneurial efforts by private organizations to purchase easements on water rights for maintenance of adequate surface flows.	2	20	IWRP, NRCS, Santa Cruz County, Santa Cruz County Land Trust, Soquel Creek Water District, SWRCB						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-25.1.2.7	Action Step	Water Diversion/Impoundment	Encourage riparian water users that were assigned Class 2 water rights at the time of the adjudication to lease their water right portion to the City of Capitola.	3	20	CDFG, City of Capitola, Private Landowners, SWRCB						In-Kind	Based on claimed or estimated use at the time of the Soquel adjudication, the SWRCB assigned four classes of water right. The right assignment describes the user's maximum daily use in each of the four classes. The water desired in each class of user must be fully satisfied before water may be apportioned to the next higher numbered class. Within the riparian use classes, Classes 1,2, and 4, water is to be simultaneously shared among all the users of that class in proportion to the user's allotment in that class. This implies that if there is insufficient water to satisfy everyone's right a determination must be made of how much water is available. Riparian users with a Class 2 water right could release their water right to Capitola for protection of fish per section 1707. This would protect fish habitat by protecting streamflow leading to the lagoon and inflow into the lagoon.
SoC-CCC-25.1.2.8	Action Step	Water Diversion/Impoundment	Evaluate recycling waste water as a supplemental supply for irrigation and possibly groundwater recharge.	2	10	City of Capitola, IWRP, Public, RWQCB, Soquel Creek Water District, SWRCB						TBD	Use and recharging of recycled waste water would lead to reduced groundwater pumping which in turn could result in increased base flows in Soquel Creek.
SoC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent impairment to passage and migration										
SoC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	3	10	CDFG, Private Landowners, SWRCB						In-Kind	All authorized surface water diverters should be notified of fish screen obligations. Notification should be followed by site visits within one year by DFG and SWRCB staff to ensure diversion are in compliance.
SoC-CCC-25.1.4	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (impaired instream temperature)										
SoC-CCC-25.1.4.1	Action Step	Water Diversion/Impoundment	Ensure water diversions do not impair water temperatures in Soquel Creek.	1	100	CDFG, Private Landowners, SWRCB						In-Kind	As part of future 1600 agreements, CDFG should require installation of temperature thermographs upstream and downstream of diversion. These results should be reviewed by CDFG for every subsequent 1600 agreement.
SoC-CCC-25.2	**Objective**	**Water Diversion/Impoundment**	**Address the inadequacy of existing regulatory mechanisms.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-25.2.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
SoC-CCC-25.2.1.1	Action Step	Water Diversion/Impoundment	Appoint and adequately fund a Water Master to carry out the adjudication of water rights on Soquel Creek.	1	5	Santa Cruz County, Private Landowners, Soquel Creek Water District, SWRCB	200.00					200	The watershed has been designated as a Fully Appropriated Stream by the California State Water Resources Control Board and placed under a statutory adjudication by court order in 1978. However, a water master to enforce the conditions of the adjudication has not occurred. The lack of oversight places the fishery at even greater risk. Surface water diversions and ground water pumping adversely impact almost all coho lifestages and are particularly deleterious during drought conditions. Water diversions result in excessively high water temperatures for coho salmon in Soquel Creek and loss of surface flow. Loss of surface flow has been documented in 1992, 1994, and 2008.
SoC-CCC-25.2.1.2	Action Step	Water Diversion/Impoundment	Establish a comprehensive stream flow evaluation program to determine instream flow needs for salmonids throughout the watershed.	1	5	CDFG, City of Capitola, IWRP, Santa Cruz County, Santa Cruz RCD, Soquel Creek Water District, SWRCB, USFWS							Diversions, from direct diversions and near stream wells, adversely impact the summer rearing lifestage and was determined to be the most significant threat to salmonids in the watershed. Water diversions and pumping of the alluvial aquifer reduce the quantity of water in the wetted stream channel, which increases diurnal temperature fluctuations and reduces available rearing habitat. A streamflow evaluation program should be developed in consultation with CDFG and NMFS. The program should develop rule curves, based on water year, that specifies flows necessary for salmonids to survive and thrive at all lifestages. Cost accounted for above.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-25.2.1.3	Action Step	Water Diversion/Impoundment	Install gauging devices to acquire hydrologic data on stream flows.	1	10	CDFG, IWRP, Soquel Creek Water District, SWRCB	12.00	12.00				24	Groundwater depletion is a limiting factor as well in the watershed and pieziometers will likely also be need to assess groundwater/surface water interactions. Gauging locations can be calibrated with the USGS gauge on Soquel Creek. Gauging sites should be located near areas with significant diversions and high value habitats. Likely locations include 1) lower Reach 1 immediately upstream of the lagoon, 2) upper Reach 1 downstream of Soquel Avenue near Walnut Street Park, 3) Reach 3 immediately downstream of the Bates Creek confluence, 4) in lower Reach 4 below the surface water diversion at the lower nursery, 5) in Reach 6 adjacent to the Mountain School, 6) Reach 9 below the Mill Pond diversion, Reach 13 of the West Branch near its mouth and below residential diversions. Other locations are likely necessary and should also be evaluated. Cost for stream flow gauges estimated at $1000/gauge. Cost does not account for maintenance or data management.
SoC-CCC-25.2.1.4	Action Step	Water Diversion/Impoundment	Request the SWRCB to conduct interagency consultation with the California Department of Fish and Game, and seek technical assistance from NMFS on the issuance, perfection, or changes to water rights permits.	1	100	CDFG, NMFS, SWRCB						In-Kind	
SoC-CCC-25.2.1.5	Action Step	Water Diversion/Impoundment	Identify and work with the SWRCB to address depletion of summer base flows from authorized and unauthorized water uses. Coordinated efforts by Federal, State, and County law enforcement agencies to remove illegal diversions from all streams in the Soquel Creek watershed.	1	10	CDFG, IWRP, NMFS, Private Landowners, State Water Resources Control Board						In-Kind	Request the SWRCB review and/or modify water use of permitted diversion to instream flows supportive of the freshwater life history requisites of steelhead and coho salmon.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-25.2.1.6	Action Step	Water Diversion/Impoundment	Prohibit new or increased surface water diversions, or groundwater pumping that depletes surface flows, for existing permit holders in Soquel Creek.	1	100	CDFG, NMFS, Private Landowners, Santa Cruz County, SWRCB						In-Kind	No additional water diversions should occur in Soquel Creek. Water diversions and ground water pumping, which have depleted the aquifer, coupled with degraded instream habitat conditions, significantly degrade juvenile rearing opportunities during the summer period. Many stream reaches go dry during the summer juvenile rearing period, and this drying is unambiguously not due to natural conditions. A notable decline in base flow has occurred in the watershed since the 1950s as measured at the USGS Soquel Creek gage during dry periods. Balance Hydrologics, Inc. (2003) reported that the decrease was characterized by a drop in baseflows of two to four cfs resulting in dry period baseflows of zero to two cfs. The most likely cause of the decreases in baseflow are surface diversions and near-stream groundwater pumping.
SoC-CCC-25.2.1.7	Action Step	Water Diversion/Impoundment	Evaluate and monitor 1600 program compliance related to all water diversions (CDFG 2004) in Soquel Creek.	1	100	CDFG						In-Kind	Initial focus for compliance should be directed at the East Branch of Soquel Creek upstream of areas where coho were detected in 2009.
SoC-CCC-25.2.1.8	Action Step	Water Diversion/Impoundment	Encourage SWRCB to bring illegal water diverters (those unpermitted and permitted but out-of-compliance with permit terms) into compliance with State law.	1	5	CDFG, NMFS, Public, Santa Cruz County, Soquel Creek Water District, SWRCB						In-Kind	Initial area of concentration should be directed at diversions in the East Branch of Soquel Creek where coho salmon juveniles were detected in 2008.
SoC-CCC-25.2.1.9	Action Step	Water Diversion/Impoundment	Evaluate major groundwater diversions for impacts to surface flow.	2	10	CDFG, Private Landowners, Public, Santa Cruz County, Soquel Creek Water District, SWRCB						TBD	Available information indicates the Soquel Creek Water District operates a deep-aquifer well near Main Street in Soquel Village and it draws underflow from Soquel Creek. This location and others should be assessed and if determined to impact surface flows, 1600 agreements and water rights should be reviewed and modified to ensure impacts to rearing habitats are minimized, particularly during the summer low flow period.
SoC-CCC-26.1	**Objective**	**Watershed Process**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
SoC-CCC-26.1.1	Recovery Action	Watershed Process	Reduce adverse impacts to watershed processes associated with urbanization.										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
SoC-CCC-26.1.1.1	Action Step	Watershed Process	Conserve open space in contiguous landscapes, protect floodplain areas and riparian corridors, and develop conservation easements.	1	100	CalFire, FEMA, Santa Cruz County, Santa Cruz County Land Trust, The Nature Conservancy						In-Kind	

Ten Mile River

Location	•Mendocino County
Watershed Area	• 120.0 Square Miles
Potential Habitat	•118.5 Stream Miles
Vegetation	•75% Coniferous •12% Riparian or Montane Forest
Erodability	•Moderate to High
Ownership Patterns	•99% Private
Dominant Land Uses	•Timber
Housing Density	•Low
TMDL Pollutants	•Sediment and Temperature

South Fork Ten Mile River. *Photo provided by KRIS Information System, and is used with permission.*

Ten Mile River Coho Salmon: Persistent – Low Abundance

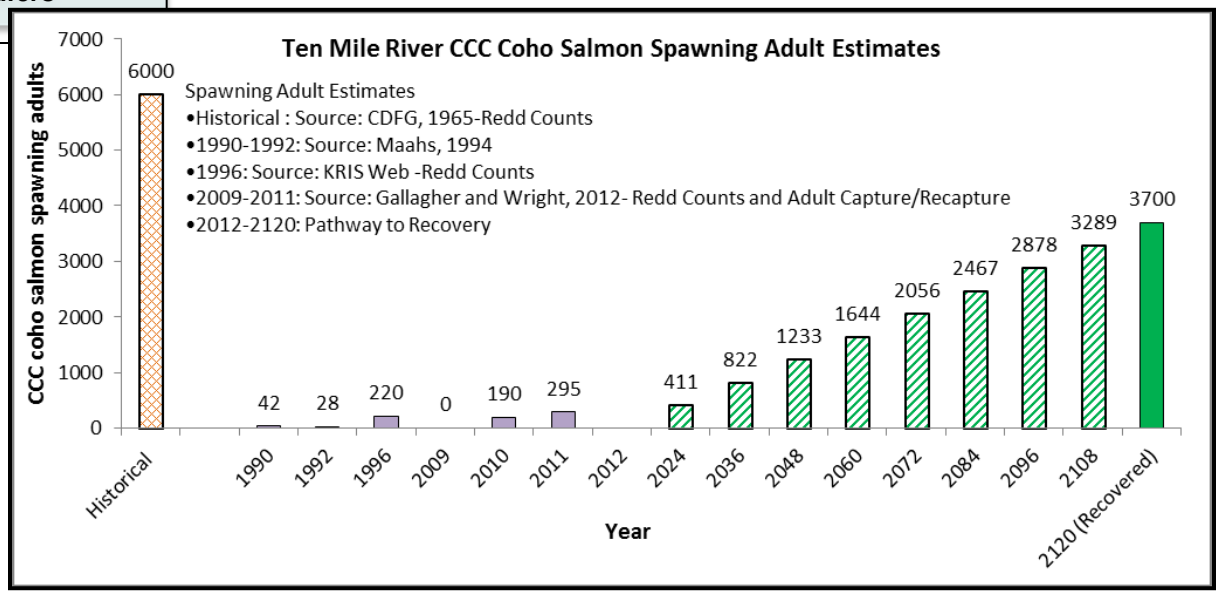
Recovery Goals

✓ Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed

Ten Mile River Creek Adult Spawner Targets

Downlisting to Threatened
1850

Recovery
3700



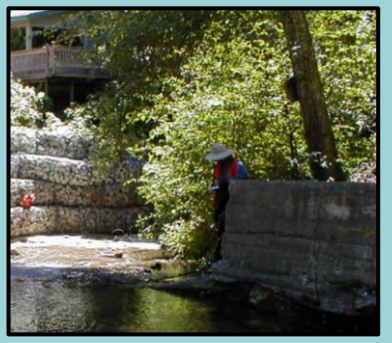
STEELHEAD: YES
CHINOOK SALMON: YES

Ten Mile River

Potential Habitat: 118.5 miles
Recovery Target: 3,700 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
GOOD	POOR	GOOD	VERY GOOD	POOR	POOR	FAIR	FAIR	FAIR	POOR	FAIR



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Promote restoration projects designed to create or restore complex habitat features
- Retain, recruit and actively input large wood into stream

Priority 2 & 3: Long-Term Restoration Actions

- Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors along the lower mainstem reaches
- Fully implement the Ten Mile River TMDL
- Establish a life cycle monitoring station in the Ten Mile River watershed

Recovery Partners

Blencowe Forestry

Photo courtesy from left to right: Campbell Timberland, Gualala River Watershed Council, Campbell Timberland, Morgan Bond, SWFSC and Kristen Kittleson, County of Santa Cruz

Ten Mile River

Potential Habitat: 118.5 miles
Recovery Target: 3,700 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	MEDIUM	MEDIUM	HIGH	LOW	NA	LOW	HIGH	MEDIUM	LOW	LOW	HIGH	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Minimize timber harvest on unstable slopes
- Discourage home building or other incompatible land use in areas identified as timber production zones
- Identify and hydrologically disconnect problematic legacy roads or landings within WLPZ's
- Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Conduct annual inspections of all roads and correct conditions that are likely to deliver sediment to streams

Priority 2 & 3: Long-Term Threat Abatement Actions

- Implement sediment reduction techniques in concert with prescribed fire or fire suppression techniques
- Avoid or minimize adverse impacts of timber harvest to off-channel habitats, floodplains, ponds, and oxbows
- Protect headwater channels with larger buffers and encourage tree retention to minimize sediment delivery
- Manage riparian areas for their site potential composition and structure
- Encourage wider riparian buffer zones in areas where stream are limiting
- Encourage low impact timber harvest techniques, and implementation of restoration projects as part of ongoing timber management practices

LWD on Ten Mile Creek
Photo Courtesy: Campbell Timberland Management

Conservation Highlights

- The Nature Conservancy is working with landowners in the lower watershed to assess and improve floodplain connectivity
- Campbell Timberland Management, Trout Unlimited, CDFG, and Blencowe Forestry have collaborated to restore habitat complexity through placement of large woody debris structures and sediment remediation projects.
- Problem roads have been decommissioned, reducing sediment inputs to streams.

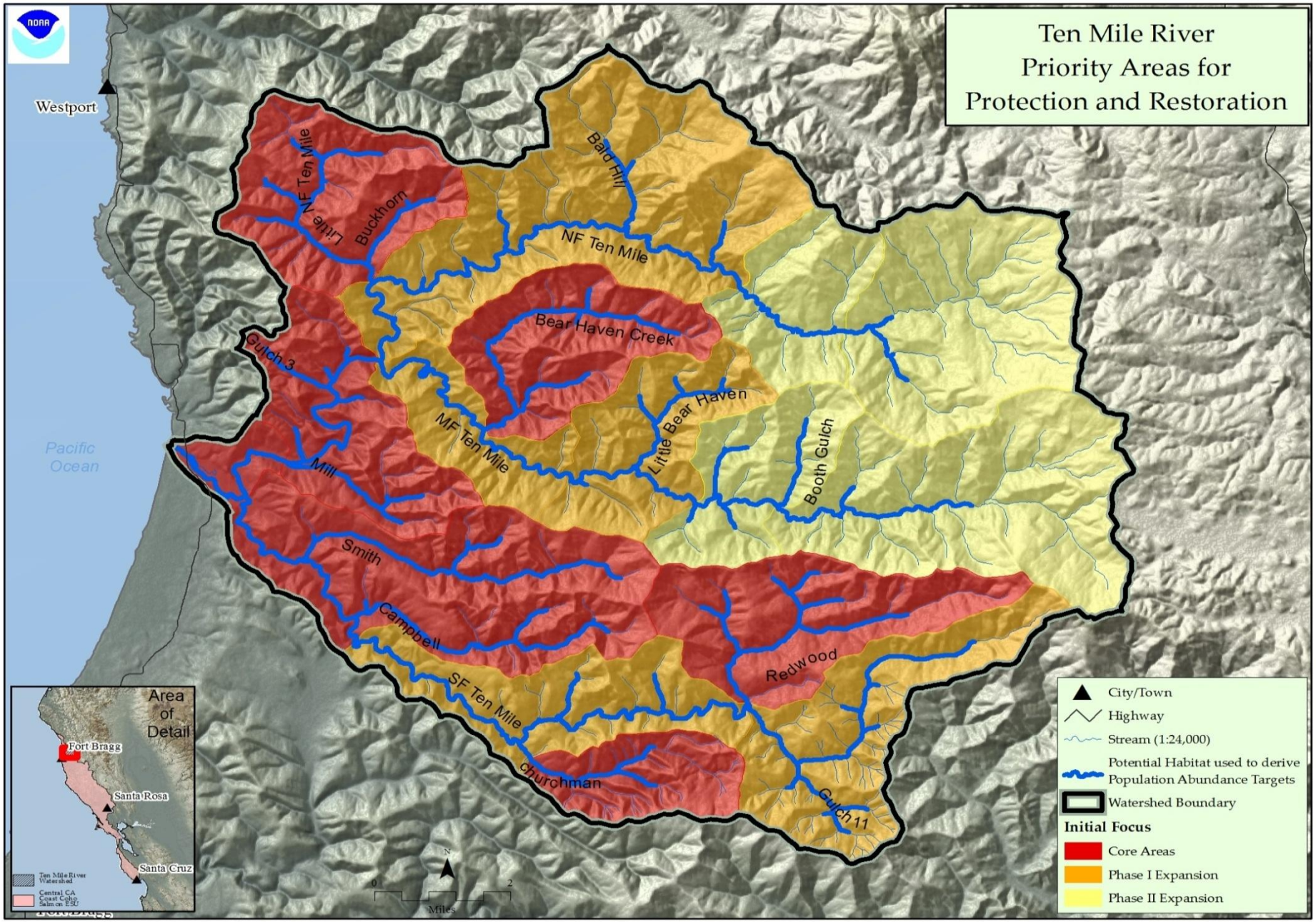


Figure 1: Map of Ten Mile River

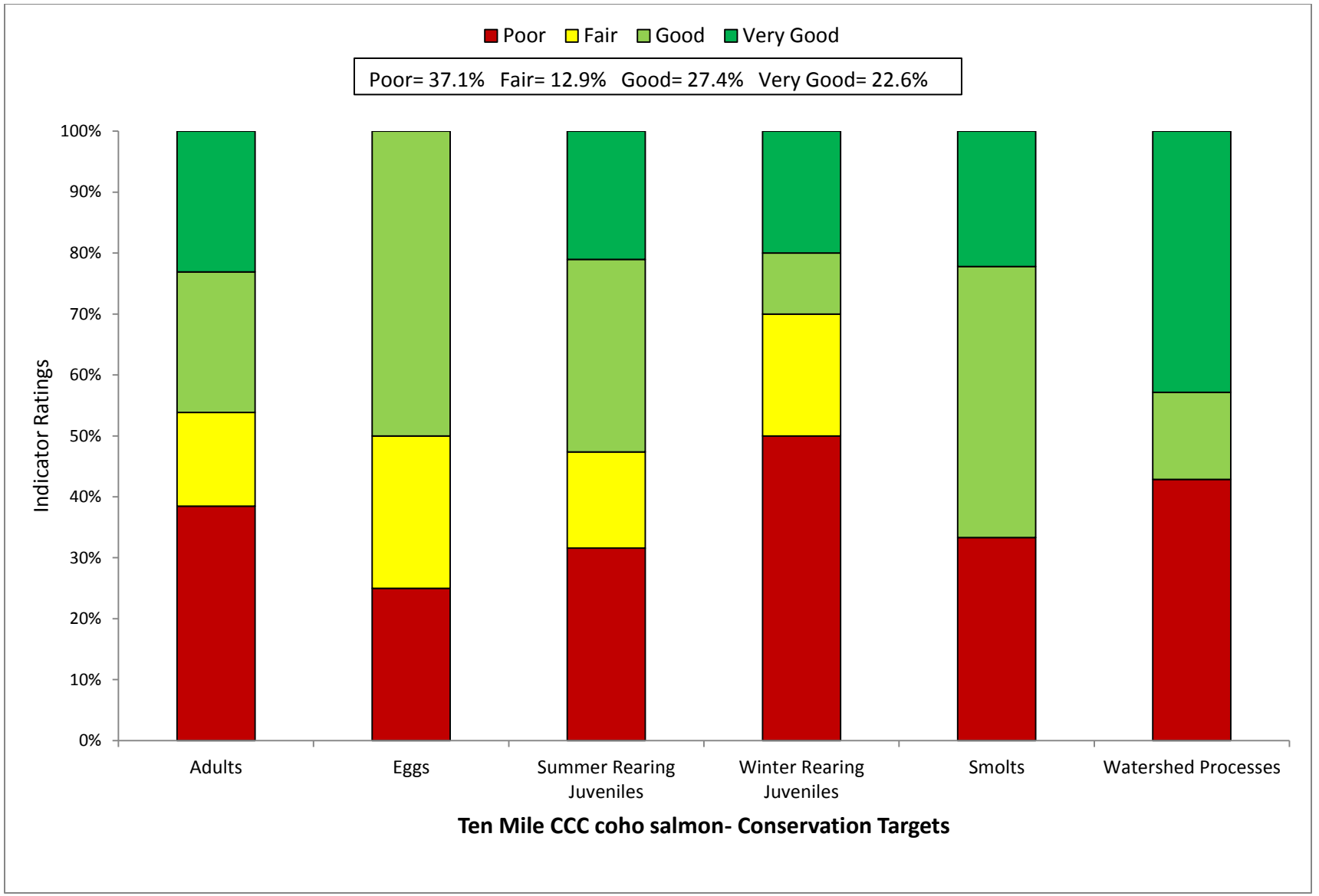


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Ten Mile River

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**0.45 LWD jams over 138403m.**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**90% of streams 97% IP-km (>30% Pools; >20% Riffles)**	Very Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**10% stream 2% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**35% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**3% streams 0% IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Properly Functioning Condition**	Good	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.45 LWD Jams over 138403m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**14% streams 32% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**90% streams 97% IP-km (>30% Pools; >20% Riffles)**	Very Good	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**10% stream 2% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**1 Diversion/23.9 km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**94% of streams/ IP-km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**35% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**3% streams 0% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50-74% IP km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**50-74% of Historical Range**	Fair	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**0.45 LWD Jams over 138403m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**90% streams 97% IP-km (>30% Pools; >20% Riffles)**	Very Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**10% stream 2% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**35% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**<50% of streams/ IP-Km (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50-80% Response Reach Connectivity**	Fair	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Properly Functioning Condition**	Good	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**10% stream 2% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**1 Diversion/23.9 km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =42**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**>90% IP-Km (>6 and <16 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.08% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**42% of Watershed in Timber Harvest**	Poor	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**5% 1unit/20ac. 95%<1unit/160ac.**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**51-74% Historical Species Composition**	Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**7.2 miles/square mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**6.2 miles/square mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Ten Mile River

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Medium	Low	Low	Medium
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	High	Medium	Medium	High
5	Fishing and Collecting	Low	-	Low	-	Low	-	Low
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Medium	Medium	High	Low	High	High
9	Mining	Low	Low	Medium	Medium	Low	Low	Medium
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	High	Medium	High	Low	High	High
13	Severe Weather Patterns	Medium	Medium	Medium	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Low	Low	Medium
Threat Status for Targets and Project		Medium	Medium	High	High	Medium	High	High

Central CA Coast Coho Salmon ~ Ten Mile River

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Improve the quality and extent of freshwater lagoon habitat

1.1.1.1. **Action Step:** Initiate estuary study to evaluate limiting factors in Ten Mile River estuary.

1.1.1.2. **Action Step:** Where feasible, remove structures and modify practices that degrade or reduce the historical estuarine extent or functions to benefit coho salmon and steelhead.

1.1.1.3. **Action Step:** Evaluate feasibility enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

2.1.1. **Recovery Action:** Increase and enhance velocity refuge

2.1.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.1.1.2. **Action Step:** Existing beaver habitat should be protected, and issues related to flooding resolved without the removal of beaver habitat (e.g. flow reduction devices, etc.)

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase LWD, primary pools and shelter ratings.

3.1.1.1. **Action Step:** Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.

3.1.1.2. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

3.1.1.3. **Action Step:** Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).

3.1.1.4. **Action Step:** Encourage retention and recruitment of large woody debris for all historical CCC coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

4. Restoration- Hydrology

No species-specific actions were developed.

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Reduce adverse impacts to watershed processes associated with road density

5.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

5.1.2. **Recovery Action:** Reduce adverse impacts to watershed processes associated with timber harvest

5.1.2.1. **Action Step:** Reduce the amount and rate of even aged management.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve tree diameter

8.1.1.1. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.

8.1.1.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Fully implement Ten Mile River TMDL.

9.1.1.2. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

9.1.1.3. **Action Step:** Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

9.1.2.2. **Action Step:** Stabilize the Miller Pond dam in Little North Fork Ten Mile to prevent catastrophic failure and massive sediment input into critical downstream spawning and rearing areas.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

10.1.1. **Recovery Action:** Refine assessment methods to more accurately identify and measure key habitat attributes.

10.1.1.1. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Establish a life cycle stations in the Ten Mile River watershed (Gallagher and Gallagher 2005). Consider placing a life cycle station on one key tributary (e.g., Little North Fork Ten Mile, Bear Haven, Campbell creeks) or, if possible, in each subwatershed (North Fork, Clark Fork, South Fork).

10.1.3. **Recovery Action:** Increase abundance

10.1.3.1. **Action Step:** Re-establish a naturally reproducing run of coho salmon.

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Plant native vegetation to promote streamside shade where otherwise deficient (i.e., lower reaches of North Fork and South Fork).

11.1.2. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.2.1. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

15.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.3.1. **Action Step:** Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to off-channel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion

19.1.3. **Recovery Action:** Allow trees in riparian areas to age, die, and recruit into the stream naturally.

19.1.3.1. **Action Step:** Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.

19.1.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.1.4.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.4.2. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.4.3. **Action Step:** For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.

19.1.4.4. **Action Step:** Minimize timber harvest on unstable slopes adjacent to Class 1 streams in the North Fork Ten Mile.

19.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

19.1.5.1. **Action Step:** Manage riparian areas for their site potential composition and structure.

19.1.5.2. **Action Step:** Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.

19.1.6. **Recovery Action:** Prevent increased landscape disturbance

19.1.6.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.1.7. **Recovery Action:** Prevent alterations to sediment transport (road condition/density, etc.)

19.1.7.1. **Action Step:** All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, by hydrologically disconnected to prevent sediment runoff and delivery to streams.

19.1.7.2. **Action Step:** Avoid new road construction in riparian zones

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.

19.2.1.2. **Action Step:** Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of coho salmon

19.2.1.3. **Action Step:** Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004) or "Short Term HCP Guidelines" (NMFS 1999).

19.2.1.4. **Action Step:** Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.

19.2.1.5. **Action Step:** Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.6. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.1.2. **Action Step:** Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.2.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2.2. **Action Step:** Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.

23.1.2.3. **Action Step:** Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.

23.1.2.4. **Action Step:** Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.

23.1.2.5. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.2.6. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.1.2.7. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.

23.1.2.8. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.2.9. **Action Step:** All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.

23.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.3.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.1.4. **Recovery Action:** Prevent impairment to passage and migration

23.1.4.1. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.

23.2.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.3.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.3.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

23.2.3.3. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to passage and migration

24.1.1.1. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

24.1.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.2.1. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

24.1.2.2. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

24.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.3.1. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Ten Mile River

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat										
TMR-CCC-1.1.1.1	Action Step	Estuary	Initiate estuary study to evaluate limiting factors in Ten Mile River estuary.	3	5	CDFG, RWQCB, The Nature Conservancy, Trout Unlimited	275.00					275	Estimate based on a three year study period and relative costs from other estuary studies. Development of a multi-disciplinary Technical Advisory Committee (TAC) to develop the scientific foundation for this study is recommended. The TAC should be familiar with other estuaries and estuary reaches within the Lost Coast Diversity Stratum as well as past and ongoing studies within the CCC ESU. Cost based on estuary use/residence timing at a cost of $273,487.
TMR-CCC-1.1.1.2	Action Step	Estuary	Where feasible, remove structures and modify practices that degrade or reduce the historical estuarine extent or functions to benefit coho salmon and steelhead.	3		Private Landowners, The Nature Conservancy, Trout Unlimited						TBD	Ten Mile Estuary is relatively intact and likely has few structures that have significantly modified the historical tidal prism and feeding and transition habitat. Costs are difficult to determine until after an evaluation is conducted outlines the extent of the habitat impairment.
TMR-CCC-1.1.1.3	Action Step	Estuary	Evaluate feasibility enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CDFG, Private Landowners, The Nature Conservancy	105.00	105.00				210	Targeting likely limiting factors such as over wintering and smolt transition habitats should be a high priority. Cost based on wetland restoration at a cost of $206,493.
TMR-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										
TMR-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	5	CalFire, Campbell Timberland Management, CDFG, Private Landowners	300.00					300	These actions should initially target habitat in Core areas and the lower portions of the three mainstems (North Fork, Clark Fork, and South Fork). Cost based on treating 8.3 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
TMR-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Existing beaver habitat should be protected, and issues related to flooding resolved without the removal of beaver habitat (e.g. flow reduction devices, etc.)	3	100	CalFire, Campbell Timberland Management, CDFG, Private Landowners						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase LWD, primary pools and shelter ratings.										
TMR-CCC-3.1.1.1	Action Step	Habitat Complexity	Identify historical habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	1	5	Campbell Timberland Management, CDFG, Private Landowners, The Nature Conservancy	250.00					250	In addition to projects that increase large wood volumes in the three major subwatersheds and their tributaries attention should also be focused in the lower floodplain areas along the lower South Fork Ten Mile and areas below the Clark Fork/North Fork confluence. Projects designed to increase winter refuge habitat in these floodplain areas should be considered a high priority for salmonid habitat recovery. In the past few years, Campbell Timberland Management has conducted significant effort to improve instream habitat complexity for salmonids through the addition of large woody material. Initial efforts were focused on the South Fork Ten Mile, and today the majority of the South Fork mainstem has been enhanced with LWD. LWD recruitment efforts are now focused on the North Fork Ten Mile and Clark Fork Ten Mile. In 2010 and 2011, approximately 15 miles of mainstem North Fork were enhanced with LWD. Campbell Timberland has indicated that these efforts will continue into the near future. Cost based on treating 10 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile. Additional features such as riparian vegetation and boulders will increase cost.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-3.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	1	10	Campbell Timberland Management, CDFG, Private Consultants, Private Landowners, The Nature Conservancy, Trout Unlimited							Campbell Timberlands has implemented numerous LWD projects at relatively low cost due their use of non-anchored material. This is significantly less expensive than engineered approaches. Data from DFG habitat inventories indicate shelter ratings throughout the Ten Mile River watershed are poor within all sampled reaches and this is a limiting factor for the summer rearing and smolt lifestages. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat according to shelter rating values. LWD was likely removed during past land management activities and well intentioned stream clearing practices. However, since these surveys were completed in the mid-1990's, extensive efforts to improve instream habitat conditions have been conducted in the mainstem portions of the South Fork, Clark Fork and North Fork using the Accelerated Recruitment approach. To date 18 miles (29 km) of the Ten Mile have been augmented with LWD and another 19 miles (30.5 km) are targeted in the near future by Campbell Timberland Management. While significant efforts have occurred, it is likely that instream habitat conditions overall (including some of the tributaries and properties not managed by CTM) are not at the viability targets for these attributes. Costs accounted for in "Identify Historical Habitat Lacking Complexity."
													To implement this recommendation, additional streamlining of the THP process for LWD input by regulatory agencies is necessary. This recommendation should be adopted as a reoccurring recommendation for all restoration projects by individuals, agencies, and organizations that fund restoration projects. In Ten Mile stream reaches where there is little immediate downstream infrastructure, properly sized trees could be felled into stream channels to create these structures. Coordinating instream large wood placement with future timber harvest activities in the watershed could result in substantial cost savings and serve as an opportunity for effective timber harvest plan mitigation. Costs may vary significantly due to stream access, varying paucity of large wood between sub-watersheds, and installation techniques. Ten Mile has been habitat typed

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-3.1.1.3	Action Step	Habitat Complexity	Encourage coordination of LWD placement in streams as part of logging operations and road upgrades to maximize size, quality, and efficiency of effort (CDFG 2004).	1	100	CalFire, Campbell Timberland Management, CDFG, Private Landowners, RCD, RWQCB						In-Kind	and thus the stream reaches lacking wood can be readily identified. Projects will occur as part of ongoing timber harvest actions and have lower overall costs, resulting in significant savings compared to restoration projects occurring without timber management equipment already nearby. Installing large woody material into a stream deficient in large wood should be considered a top restoration priority, particularly in Core and Priority 1 subwatersheds. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint. Cost accounted for in identify historical habitats lacking complexity.
TMR-CCC-3.1.1.4	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody debris for all historical CCC coho salmon streams to maintain and enhance current stream complexity, pool frequency, and depth. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	1	100	CalFire, CDFG, Private Landowners, RWQCB, USACE						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-5.1.1	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with road density										
TMR-CCC-5.1.1.1	Action Step	Landscape Patterns	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	3	10	CalFire, Campbell Timberland Management, Private Landowners	660	660				1,320	Costs may be significant and benefits should be weighed against additional upland disturbance and overall costs. This recommendation is more feasible within Ten Mile watershed because a large portion of it is owned by one landowner. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 110 miles of road network at a rate of $12,000/mile.
TMR-CCC-5.1.2	Recovery Action	Landscape Patterns	Reduce adverse impacts to watershed processes associated with timber harvest										
TMR-CCC-5.1.2.1	Action Step	Landscape Patterns	Reduce the amount and rate of even aged management.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-8.1.1	Recovery Action	Riparian	Improve tree diameter										
TMR-CCC-8.1.1.1	Action Step	Riparian	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to ameliorate instream temperature and provide a source of future large woody debris recruitment.	2	20	CalFire, Campbell Timberland Management, CDFG, Private Landowners	401.25	401.25	401.25	401.25		1,605	Most of these lands (inset floodplains and riparian corridors) are used for forest management and it is anticipated that most of this cost will be absorbed as part of on going forestry practices. Additional cost may be incurred in the lower watershed where other land management actions occur, including minimal farming and minimal grazing. Many of the areas historically used for agricultural purposes have been extensively cleared of all riparian vegetation. Targeting restoration in these areas may result in some lands no-longer being farmed for hay production, etc. Landowner outreach will likely be required in these areas. Cost based on treating 1 mile (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre.
TMR-CCC-8.1.1.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	10	CalFire, Campbell Timberland Management, Private Landowners	171.00	171.00				342	Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Analysis of WHR size classes for Ten Mile watershed suggests that riparian stands are relatively well stock, albeit at a much younger age and generally in smaller size classes. Loss of the original forest changed the rate of recruitment and the quality of instream habitat forming features (e.g., old growth redwoods can persist instream for hundreds of years as LWD, and due to their large size create significant habitat forming features). Tree recruitment into the stream channel is likely at a slower rate than under historical conditions, due, in part, to the much younger age of the extant riparian stands. Cost based on riparian thinning 3 miles (assume 80 acres/mile in 15% High IP) at a rate of $1,422/acre. Cost is expected to be minimal because most of the watershed is subject to active timber management. Additional cost may be incurred in the lower watershed where other land management actions occur.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
TMR-CCC-9.1.1.1	Action Step	Sediment	Fully implement Ten Mile River TMDL.	2	20	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						In-Kind	High levels of instream fine sediment and turbidity likely impair the egg, smolt, and winter rearing lifestages within many basins in Ten Mile River Watershed. Ten Mile River is considered impaired due to high instream sediment conditions (USEPA 2000). The source analysis in Ten Mile TMDL included an assessment of sediment sources historically and/or presently impacting water quality. Several management-related factors have contributed to the elevated sediment delivery rates throughout the watershed, primarily the high rate of timber harvest and associated road building. While overall rates have declined in the 67-year study period from 1933-1999, the USEPA (2000) determined that sediment generation from road surface erosion had increased. Current sediment delivery from all sources is estimated at 629 tons/mi2/yr., with about 50% of the total amount attributed to natural processes (i.e., background) and the rest management-related (USEPA 2000). Ten Mile River does not have time lines specified. Rapid implementation will result in greater cost, but it could result in significant benefits. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for coho protection. It is anticipated most cost will be included as part of upgrades associated with future timber harvest actions. Ten Mile River TMDL does not have time lines specified. Rapid implementation will result in greater cost, but it could result in significant benefits. The TMDL targets high priority areas for implementation that are similar to NMFS prioritization for coho protection. It is anticipated most cost will be included as part of upgrades associated with future timber harvest actions.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-9.1.1.2	Action Step	Sediment	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey, Campbell Timberland Management, Private Landowners, RWQCB	115.00	115.00				230	Identification of unstable areas will provide critical information for future THP planning and road construction and road decommissioning actions. Identification of high risk areas will provide important information for future road decommissioning grant funds by identifying areas for prioritization. Cost for erosion assessment estimated at $12/acre (assume 25% of total watershed acres)
TMR-CCC-9.1.1.3	Action Step	Sediment	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).	2	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						TBD	Minimal- difficult to estimate cost because assessments for the magnitude of the problem were not available. Additionally, many roads have been rocked - often through the timber harvest process - and these costs should be considered an ongoing operation expense.
TMR-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
TMR-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						TBD	Sediment basins must be maintained on a yearly basis. A limited number of areas may be suitable for sediment catchment basins, but where feasible, they should be used to retain or remove potentially chronic fine sediment sources that impact primary stream channels. Sties should be located on smaller tributaries or first order streams.
TMR-CCC-9.1.2.2	Action Step	Sediment	Stabilize the Miller Pond dam in Little North Fork Ten Mile to prevent catastrophic failure and massive sediment input into critical downstream spawning and rearing areas.	1	5	CDFG, Private Landowners, RWQCB						TBD	Little North Fork Ten Mile is one of the most important streams inTen Mile River watershed. Cost cannot be determined until a plan is developed to stabilize the dam. Cost likely to be minimal since the structure will not need to be replaced.
TMR-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms**										
TMR-CCC-10.1.1	Recovery Action	Viability	Refine assessment methods to more accurately identify and measure key habitat attributes.										
TMR-CCC-10.1.1.1	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	60	Campbell Timberland Management, CDFG, Private Landowners, RWQCB						TBD	The watershed has been habitat typed and has had extensive instream monitoring occur in the past.
TMR-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-10.1.2.1	Action Step	Viability	Establish a life cycle stations in the Ten Mile River watershed (Gallagher and Gallagher 2005). Consider placing a life cycle station on one key tributary (e.g., Little North Fork Ten Mile, Bear Haven, Campbell creeks) or, if possible, in each subwatershed (North Fork, Clark Fork, South Fork).	2	20	Campbell Timberland Management, CDFG, NMFS, NOAA RC, Private Landowners	235.00	235.00	235.00	235.00		940	Cost based on life cycle monitoring station at a cost of $234,600. Initial cost may vary depending on infrastructure (permanent vs. annual) used for the monitoring efforts. Monitoring in the Ten Mile watershed should be closely coordinated and complementary with other ongoing monitoring efforts in the Lost Coast Diversity Stratum. Due to the costs associated with monitoring and the difficultly in funding current ongoing monitoring, the short term implementation of this recommendation will be problematic.
TMR-CCC-10.1.3	Recovery Action	Viability	Increase abundance										
TMR-CCC-10.1.3.1	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon.	3	15	Campbell Timberland Management, CDFG, Private Landowners, RWQCB						In-Kind	
TMR-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
TMR-CCC-11.1.1.1	Action Step	Water Quality	Plant native vegetation to promote streamside shade where otherwise deficient (i.e., lower reaches of North Fork and South Fork).	2	20	CalFire, Campbell Timberland Management, Private Landowners, RWQCB							Costs may be higher in the lower watershed where significant areas of site 1 soils where extensive forests were removed. Historical logging practices effectively removed all of the original conifer overstory (principally redwood and Douglas-fir) throughout the basin. As a result, no old-growth riparian stands remain within the watershed. Conversion of the lower sections of the mainstem Ten Mile River from conifers to grassland for cattle grazing and agriculture has likely lowered riparian function and diversity adjacent to some of better rearing areas in the lower watershed. Reestablishing a functional riparian forest in these areas (provided landowners are willing) will likely require extensive oversight (watering, cattle exclusion) until the trees become established. Altered riparian conditions are common throughout Ten Mile River watershed, elevating summer water temperatures in some reaches and limiting LWD recruitment. Cost accounted for in RIPARIAN.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-11.1.2	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
TMR-CCC-11.1.2.1	Action Step	Water Quality	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions.	2	5	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						In-kind	
TMR-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										Past logging resulted in a conversion of the conifer-dominated overstory to an overstory dominated by hardwoods in many ridge top areas and in eastern portions of the watershed. The combination of younger conifer and hardwoods likely leaves these portions of Ten Mile watershed more vulnerable to wildfire than under historical conditions.
TMR-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered a standard practice.
TMR-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
TMR-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out.
TMR-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Standard business practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
TMR-CCC-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, we recommend CalFire Resource Advisors inform the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.	2	100	CalFire							Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations (e.g., picking up water from areas other than Ten Mile River lagoon). Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
TMR-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										
TMR-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire							Do not pull water from the lagoon during fire unless absolutely necessary.
TMR-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										
TMR-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
TMR-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	2	CalFire						In-Kind	
TMR-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
TMR-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to off-channel habitats, floodplains, ponds, and oxbows.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Timber harvest remains a threat to coho salmon habitat in Ten Mile River, but at diminished levels compared to historical practices. Timber harvest was listed as a threat for watershed processes due in large part to the high rate of harvest in many of the planning watersheds. Even with application of new California Forest Practice Rules this threat is anticipated to continue.
TMR-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										
TMR-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Road surface treatment options will vary widely on road use and geology.
TMR-CCC-19.1.3	Recovery Action	Logging	Allow trees in riparian areas to age, die, and recruit into the stream naturally.										
TMR-CCC-19.1.3.1	Action Step	Logging	Timber management should be designed to allow trees in riparian areas to age, die, and naturally recruit into the stream.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	The current Forest Practice Rules require retention of a proportion of the largest diameter trees adjacent to water courses. This practice should continue and potential expansion of the number left for future recruitment should be considered.
TMR-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCC-19.1.4.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.4.2	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.4.3	Action Step	Logging	For areas with high or very high erosion hazard, extend the monitoring period and upgrade road maintenance for timber operations.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation applies to all THPs located in the mixed lithology geomorphic units with steep slopes, and all sandstone geomorphic units (steep and gentle slopes).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-19.1.4.4	Action Step	Logging	Minimize timber harvest on unstable slopes adjacent to Class 1 streams in the North Fork Ten Mile.	1	30	CalFire, CDFG, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.5	Recovery Action	Logging	Prevent adverse alterations to riparian species composition and structure										
TMR-CCC-19.1.5.1	Action Step	Logging	Manage riparian areas for their site potential composition and structure.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.5.2	Action Step	Logging	Encourage wider riparian buffer zones in areas where stream temperatures or riparian canopy are found limiting.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.6	Recovery Action	Logging	Prevent increased landscape disturbance										
TMR-CCC-19.1.6.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.7	Recovery Action	Logging	Prevent alterations to sediment transport (road condition/density, etc.)										
TMR-CCC-19.1.7.1	Action Step	Logging	All roads, landings, and skid trails associated with timber operations should, to the maximum extent practicable, by hydrologically disconnected to prevent sediment runoff and delivery to streams.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-19.1.7.2	Action Step	Logging	Avoid new road construction in riparian zones	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Old roads should not be reopened unless for proper decommissioning purposes. Particular care should be directed at new road construction or reconstruction adjacent to Class 1 streams with high IP value habitat.
TMR-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms**										
TMR-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-19.2.1.1	Action Step	Logging	Establish greater oversight and post-harvest monitoring by the permitting agency for operations within Core, Phase I and Phase II CCC coho salmon areas.	3	20	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	
TMR-CCC-19.2.1.2	Action Step	Logging	Forest landowners should consider pooling resources for a watershed-wide HCP or GCP that could provide for incidental take authorization and promote survival and recovery of coho salmon	3	20	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	A watershed wide conservation effort could be used to help direct mitigation to areas where it would be most effective, rather than mitigation on a THP by THP basis. Pooling of resources could direct monitoring to areas where it would be most effective and minimize duplication of efforts. Other considerations could potentially covering timber harvest activities for multiple watersheds within Mendocino County. Cost is a rough estimate and may vary considerably depending on the number of species and activities covered. A multiple landowner HCP is preferable due to economy of scale and overall, similar land management actions across the watershed. The high cost of HCP development is considered a major impediment and disincentive for many landowners.
TMR-CCC-19.2.1.3	Action Step	Logging	Until no-take rules are developed or the State has a secured HCP or GCP, assign NMFS staff to conduct THP reviews and provide no-take recommendations by using revised "Guidelines for NMFS staff when Reviewing Timber Operations: Avoiding Take and Harm of Salmon and Steelhead" (NMFS 2004) or "Short Term HCP Guidelines" (NMFS 1999).	3		NMFS							The need for this action may change if the California Forest Practice Rules change and reach a no-take standard or the state receives incidental take authorization through the HCP process.
TMR-CCC-19.2.1.4	Action Step	Logging	Encourage timber landowners to implement restoration projects as part of their ongoing timber management practices in Core area stream reaches where large woody material is deficient.	2	100	CalFire, Campbell Timberland Management, Private Landowners							Installing large woody material into stream deficient in large wood should be considered a top restoration priority, particularly in Core and Priority 1 subwatersheds. Restoration during harvest activities provides a unique opportunity to access key areas that are relatively undisturbed in comparison to areas of the watershed with a large rural residential footprint.
TMR-CCC-19.2.1.5	Action Step	Logging	Discourage Mendocino County from rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CalFire, Mendocino County, Private Landowners						0	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-19.2.1.6	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CalFire, Mendocino County, Private Landowners						0	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
TMR-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
TMR-CCC-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	5	CalFire, Campbell Timberland Management, Private Landowners	225.00					225	All new and replacement culverts should be sized to accommodate a 100 year flow event. Cost based on treating 1 stream crossing (assume minor 2 lane road) at a rate of $223,051/unit.
TMR-CCC-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, Campbell Timberland Management, Private Landowners						TBD	These will likely be replaced as part of future timber harvest plans in Ten Mile watershed.
TMR-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCC-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2		CalFire, Campbell Timberland Management, Private Landowners						0	Legacy roads from past logging activity continue to impact Ten Mile watershed. Legacy roads from past logging activity continue to adversely impact habitat quality for salmonids in Ten Mile watershed. Road densities are high throughout the watershed and are estimated at 2.5 miles of road per square mile of watershed area, and at 3.7 miles per square mile of riparian area. Many of these roads were poorly situated and constructed, improperly maintained, and many have been abandoned and not properly decommissioned. Cost accounted for LANDSCAPE PATTERNS.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-23.1.2.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Many roads in the watershed have inside ditches. Cost should be considered part of road maintenance costs.
TMR-CCC-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input.
TMR-CCC-23.1.2.4	Action Step	Roads/Railroads	Install sediment traps for pretreatment, and a modified culvert system that can act as an efficient detention system.	3	100	CalFire, Campbell Timberland Management, Private Landowners						TBD	Sediment traps will require a significant maintenance commitment. Conduct inventory of culverts needing sediment traps.
TMR-CCC-23.1.2.5	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	CalFire, Campbell Timberland Management, Private Landowners						TBD	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Conduct inventory of culverts needing energy dissipaters.
TMR-CCC-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	2	5	CalFire, Campbell Timberland Management, Private Landowners						TBD	Assess the feasibility and extent of spoils storage site. Cost will be determined once an assessment is completed.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-23.1.2.7	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	CalFire, Campbell Timberland Management, Private Landowners	385.00	385.00				770	Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but a lot of work remains before this sediment source is thoroughly minimized. An effective road program should include a component that closes and remediates unnecessary roads and skid trails in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed. The potential for sediment (both through chronic input and large episodic events) is likely to continue. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules. Cost based on road assessment for 830 miles (assume 75% of road network) at a cost of $927/mile.
TMR-CCC-23.1.2.8	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	CalFire, Campbell Timberland Management, Private Landowners, Trout Unlimited	306.00	306.00				612	Costs may vary widely depending on number of riparian roads and the magnitude of the problem associated with the roads. Additionally, many roads in Core watersheds have been addressed and hydrologically disconnected - often through the timber harvest process - and these costs should be considered an ongoing operation expense. Focus initial efforts (and/or continue ongoing efforts) in Little North Fork Ten Mile, Bear Haven (DFG 2004), Mill, Campbell, and Smith Creeks. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on decommissioning 51 miles of riparian road network at a rate of $12,000/mile. TU has partnered with CTM and Pacific Watershed Associates to upgrade 3.4 miles of inner gorge roads in Little North Fork which should be considered a major priority considering the importance of the coho salmon population in the Little North Fork.
TMR-CCC-23.1.2.9	Action Step	Roads/Railroads	All harvest plans should identify problematic unused legacy roads or landings with WLPZ's and ensure these areas are hydrologically disconnected and revegetated with native species where practicable following completion of harvest activities.	1	100	CalFire, Campbell Timberland Management, Private Landowners, RWQCB						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
TMR-CCC-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
TMR-CCC-23.1.4.1	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
TMR-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
TMR-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
TMR-CCC-23.2.1.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFG, NRCS, RWQCB, USACE						In-Kind	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.
TMR-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
TMR-CCC-23.2.2.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	1	10	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	A well designed road management plan should result in overall cost savings due to lower maintenance costs.
TMR-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
TMR-CCC-23.2.3.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	1	100	CalFire, Campbell Timberland Management, Private Landowners						0	This action is part of ongoing road maintenance and should be directed at the entire road network.

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							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-23.2.3.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	CalFire, Campbell Timberland Management, Private Landowners						0	Cost should be considered part of land owner road management plans.
TMR-CCC-23.2.3.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	
TMR-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
TMR-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
TMR-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	3	20	CDFG, NOAA RC, Private Landowners, The Nature Conservancy, Trout Unlimited						TBD	Cost is unknown. The main benefit of this action is to improve flow conditions in the lower portion of the watershed where a few homes and limited agricultural use occurs.
TMR-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
TMR-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	2	100	Campbell Timberland Management, CDFG, Private Landowners						In-Kind	This recommendation should be considered standard practice.
TMR-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	1	10	CalFire, Campbell Timberland Management, Private Landowners, RWQCB, The Nature Conservancy	90.50	90.50				181	Little infrastructure exists on the floodplains aside from numerous roads. Creation and restoration of offchannel habitat features could be used as a demonstration project and reference point for future actions in regards to costs, feasibility, biological effectiveness, and appropriate construction techniques. Areas in the lower reaches of the Ten Mile River should be designed with consideration of providing high flow regufia. Cost based on treating 5 miles (assume 81 project/mile in 25% High IP) at a rate of $36,046/mile.
TMR-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
TMR-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, RWQCB, State Parks						TBD	Extreme rainfall events could result in major input of sediment from upslope locations, particularly from legacy roads. The high road density in the watershed increases the likelihood of major sediment input during wet weather periods. Targeting high risk roads for closure and appropriate restoration actions will reduce the magnitude of this threat. Assess extent of high-risk shallow-seeded landslide areas and develop rehabilitation plan.

Location	•Mendocino County
Watershed Area	• 24.5 Square Miles
Potential Habitat	•10.9 Stream Miles
Vegetation	•70% Coniferous •20% Riparian or Montane Forest
Erodability	•High
Ownership Patterns	•98% Private; 2% Public
Dominant Land Uses	•Timber
Housing Density	•Very low
TMDL Pollutants	•None

Usal Creek
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Usal Creek Coho Salmon: Nearly Extirpated

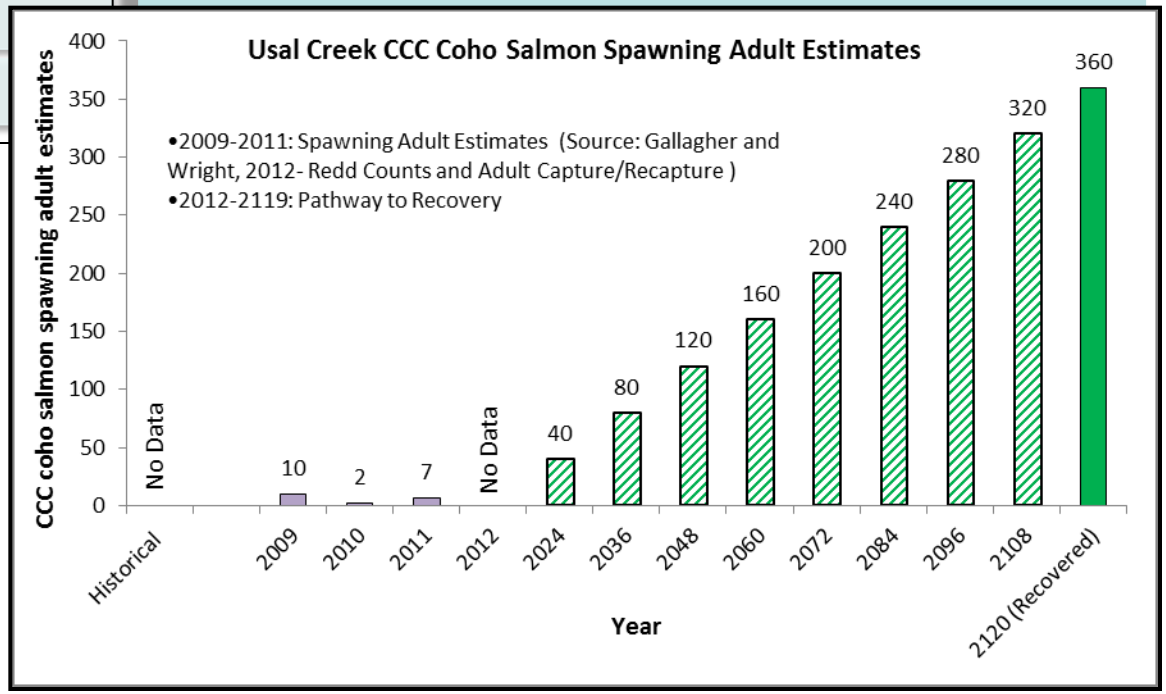
Recovery Goals

✓ Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed

Usal Creek
Adult Spawner Targets

Downlisting to Threatened
180

Recovery
360



STEELHEAD: YES
CHINOOK SALMON: NO

Usal Creek

Potential Habitat: 10.9 miles
Recovery Target: 360 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
POOR	POOR	GOOD	FAIR	FAIR	POOR	GOOD	GOOD	GOOD	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats
- Install large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth

Priority 2 & 3: Long-Term Restoration Actions

- Install LWD structures in the estuary, and consider sediment removal from lower mainstem and the estuary
- Conduct conifer release by thinning hardwoods, and replant floodplain with native overstory vegetation
- Encourage landowners to implement restoration projects as part of ongoing operations
- Improve passage conditions through the aggraded estuary, mainstem, and lower reaches

Recovery Partners

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Paola Bouley, SPAWN, Campbell Timberland and Morgan Bond, SWFSC

Usal Creek

Potential Habitat: 10.9 miles
Recovery Target: 360 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
NA	MEDIUM	MEDIUM	MEDIUM	MEDIUM	NA	NA	MEDIUM	LOW	LOW	NA	HIGH	HIGH	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Protect existing areas with floodplains or off channel habitats from future development

Priority 2 & 3: Long-Term Threat Abatement Actions

- Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure
- Use available best management practices for road construction, maintenance, management and decommissioning
- Encourage County of Mendocino to winterize and maintain the Usal County road
- Establish adequate spoils storage sites throughout the watershed
- Replace the existing county bridge in the Sinkyone State Parks Campground

Usal Creek (left) Soldier Creek confluence. *Photo provided by Redwood Forest Foundation, Inc., and is used with permission. All rights reserved.*

Conservation Highlights

- To improve aquatic habitat Campbell Timberland Management and Redwood Forest Foundation have collaborated on sediment remediation projects.

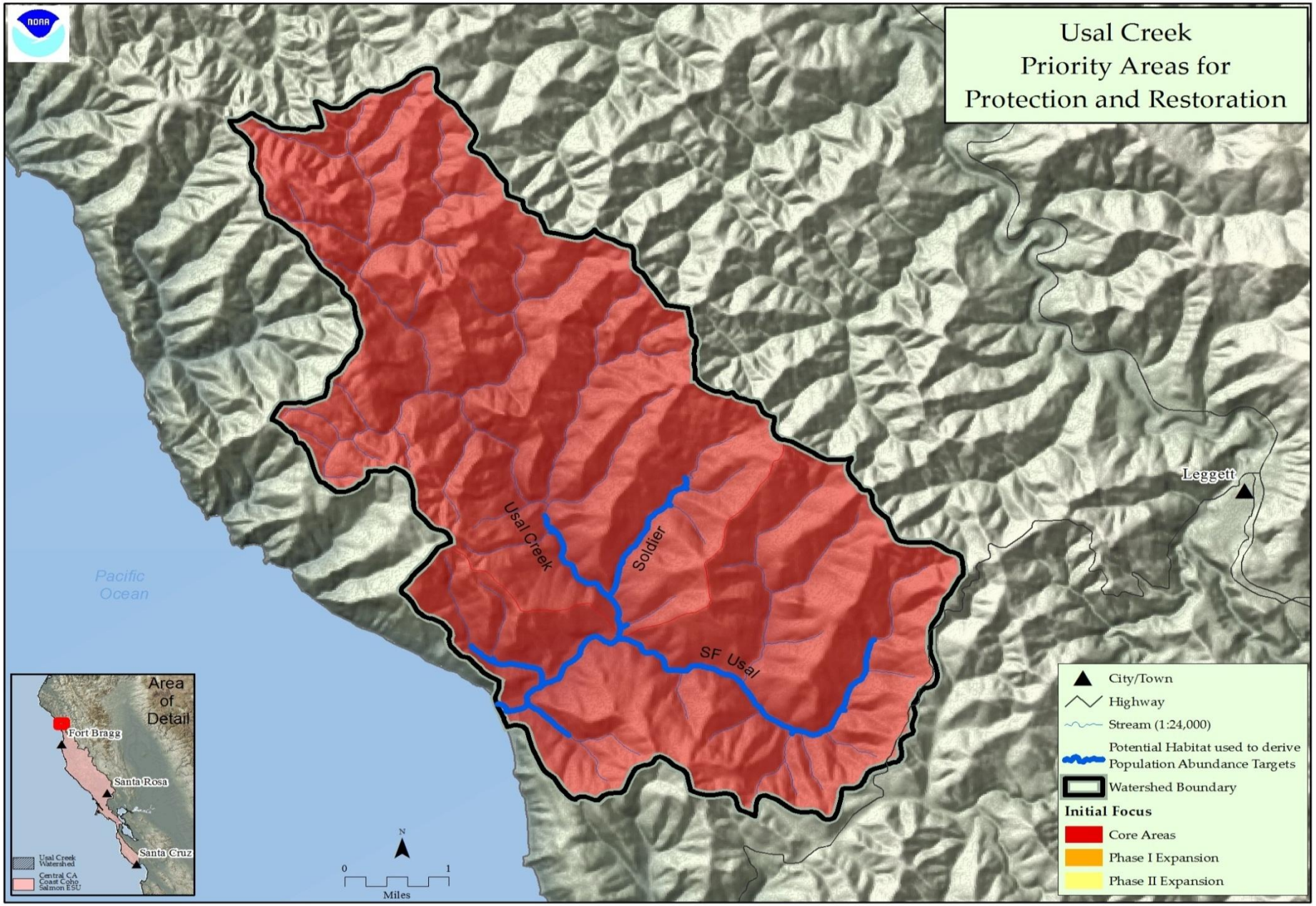


Figure 1: Map of Usal Creek

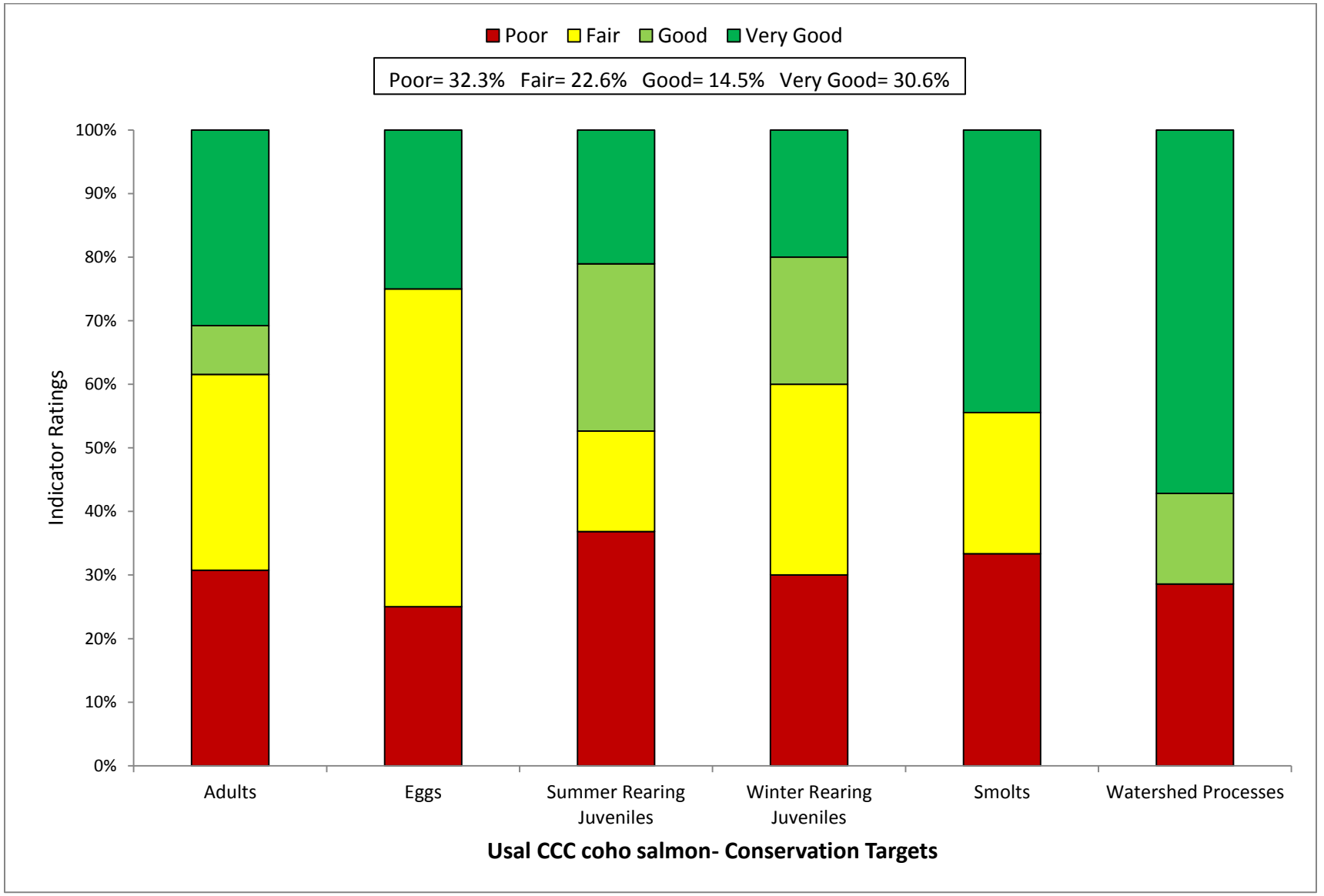


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Usal Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams 49% IP-km**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**30% by stream 12% by IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factore Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40% Class 5 & 6 across IP-km**	Fair	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No evidence of toxins or contaminants**	Very Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = <35**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =51-75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**70% streams 75% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired and not functioning**	Poor	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**30% stream 10% IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% streams 49% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**30% by stream 12% by IP (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =35-50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score = 41.6**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 Diversions**	Very Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**75% of IP-km to 90% of IP-km accessible**	Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**>90% of streams/ IP-Km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**70% streams 75% IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**75 to 89% IP-km (<16 C MWMT)**	Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No evidence of toxins or contaminants**	Very Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**80% by streams 49% by IP-km (>30% Pools; >20% Riffles)**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**30% by stream 12% by IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**40% Class 5 & 6 across IP-km**	Fair	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**70 by streams 75 by IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No evidence of toxins or contaminants**	Very Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50 to 74% of streams/ IP-Km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**30% by stream 12% by IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0 diversions**	Very Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score = <35**	Very Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**<50% of IP-km accessible**	Poor	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**>90% IP-km (>6 and <16 C)**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No evidence of toxins or contaminants**	Very Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50 to 74% of streams/ IP-Km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.117% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**18% of Watershed in Timber Harvest in last 15 years**	Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**0% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**>75% Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**3.5 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**4.3 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Usal Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	-	-	-	-	-	-	-
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Medium	High	Medium	Medium	Medium	Medium
5	Fishing and Collecting	Medium	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	-	-	-	-	-	-	-
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Low	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	-	-	-	-	-	-	-
12	Roads and Railroads	Medium	Medium	High	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	High	Medium	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
	Threat Status for Targets and Project	Medium	Medium	High	Medium	High	Medium	High

Central CA Coast Coho Salmon ~ Usal Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Improve the quality and extent of freshwater lagoon habitat

1.1.1.1. **Action Step:** Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.

1.1.1.2. **Action Step:** Evaluate and implement as appropriate, sediment removal from Usal lower mainstem and estuary. Sediment could be used as a rock source of the numerous unpaved roads in the watershed as well as for the Usal County Road.

1.1.2. **Recovery Action:** Improve the quality of each estuarine habitat zone

1.1.2.1. **Action Step:** Conduct conifer release by thinning hardwoods in lower reaches of South and North Fork Usal Creek. Conifers could serve as a source for future large woody debris recruitment into the estuary and aid in cooler water temperatures flowing into estuary.

1.1.2.2. **Action Step:** Initiate riparian planting of conifers within the riparian zones that are currently dominated by hardwoods and floodplain areas that are absent of conifers.

1.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.2.1. **Recovery Action:** Reduce frequency of artificial breaching events

1.2.1.1. **Action Step:** Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.

1.2.1.2. **Action Step:** Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to Usal lagoon.

1.2.1.3. **Action Step:** Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.

2.1.1. **Recovery Action:** Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest.

2.1.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.1.1.2. **Action Step:** Target habitat restoration and enhancement that will function between winter baseflow and flood stage.

2.1.1.3. **Action Step:** Promote restoration projects designed to create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats.

2.1.1.4. **Action Step:** Replant floodplain with native overstory vegetation.

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase large wood frequency and shelter rating

3.1.1.1. **Action Step:** Install Large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.1.2. **Action Step:** Mechanically recruit alder from floodplain surfaces into the stream channel.

3.1.1.3. **Action Step:** Identify historical CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.

3.1.1.4. **Action Step:** Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).

3.1.1.5. **Action Step:** Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.

3.1.1.6. **Action Step:** Encourage retention and recruitment of large woody material for all historical anadromous salmonid rearing habitats in Usal Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.

3.1.1.7. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.

3.1.1.8. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

3.1.2. **Recovery Action:** Increase frequency of primary pools

3.1.2.1. **Action Step:** Excavate sediment and build up channel bars.

4. Restoration- Hydrology

No species-specific actions were developed.

5. Restoration- Landscape Patterns

No species-specific actions were developed.

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Rehabilitate and enhance passage into tributaries (aggradation/degradation)

6.1.1.1. **Action Step:** Evaluate smolt (and juvenile rearing) outmigration constraints, particularly during drought year low flow conditions, through the aggraded estuary, mainstem Usal, and lower reaches of N Fk. Usal.

6.1.1.2. **Action Step:** Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season..

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.

10.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

10.2.1. **Recovery Action:** Increase spatial structure and diversity

10.2.1.1. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.2.2. **Recovery Action:** Increase spawner density

10.2.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

10.2.2.2. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while fire fighters and equipment are on site.

15.1.1.3. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.1.4. **Action Step:** Re-contour any new facility sites as soon as possible after site cleanup and fire.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by firefighting actions.

15.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.3.1. **Action Step:** Draft water from lakes, ponds, storage tanks, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.1.2. **Action Step:** Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.2.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.2.2. **Action Step:** Encourage County of Mendocino winterize the Usal County road using modern techniques to ensure sediment from roads does not enter North Fork Usal Creek.

23.1.2.3. **Action Step:** Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.

23.1.2.4. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.2.5. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.

23.1.2.6. **Action Step:** Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.

23.1.2.7. **Action Step:** Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.

23.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.3.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.1.4. **Recovery Action:** Prevent impairment to passage and migration

23.1.4.1. **Action Step:** Replace the existing bridge on Usal County Road located in the Sinkyone State Parks Campground.

23.1.4.2. **Action Step:** Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.

23.1.5. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

23.1.5.1. **Action Step:** Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

23.2.1. **Recovery Action:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.

23.2.1.1. **Action Step:** Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.

23.2.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.2.3.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.

23.2.3.2. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.

23.2.3.3. **Action Step:** Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.

23.2.3.4. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary (impaired quality and extent)

24.1.1.1. **Action Step:** Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).

24.1.2. **Recovery Action:** Prevent impairment to passage and migration

24.1.2.1. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.

24.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.3.1. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

24.1.4. **Recovery Action:** Reduce turbidity and suspended sediment

24.1.4.1. **Action Step:** Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.

24.1.4.2. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Usal Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UsC-CCC-1.1.1	Recovery Action	Estuary	Improve the quality and extent of freshwater lagoon habitat										
UsC-CCC-1.1.1.1	Action Step	Estuary	Identify key locations and install LWD structures targeting increased pool depth and shelter within the estuary.	2	10	CDFG, State Parks	275.00	275.00				550	Efforts should be directed at facilitating channel scour as well as providing summer refugia for rearing juvenile salmonids in the estuary and the lower mainstem. Available information obtained from historical photographs does not provide a clear image of the estuary's historical size and extent. Inferences, based on removal of old growth conifers from the floodplain and current rates of sediment input from the upper watershed, suggest historically the estuary may have provided more suitable rearing habitat for salmonids than under current conditions. Due to the importance estuaries play in the survival of salmonids, further assessment of the potential to enhance and restore estuarine quality and extent should be conducted. An immediate program of LWD supplementation to enhance habitat complexity will likely be necessary due to the long period of time it will likely take for LWD to naturally recruit from existing riparian zones. Cost based on treating 2 acres (assume 25% of estuarine habitat) at a rate of $272,120/acre.
UsC-CCC-1.1.1.2	Action Step	Estuary	Evaluate and implement as appropriate, sediment removal from Usal lower mainstem and estuary. Sediment could be used as a rock source of the numerous unpaved roads in the watershed as well as for the Usal County Road.	2	5	CA Coastal Commission, CDFG, Mendocino County Department of Public Works, RFFI, State Parks	30.00					30	The historical potential of Usal estuary is unknown; however, it is believed to be highly compromised due to aggradation from past land-management practices in the upper portion of the watershed. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Excess sediment could be used as a rock source for the numerous unpaved roads in the watershed and for Usal County Road. The rock would likely need to be crushed, once removed from the estuary in order to provide an adequate road base. Cost cannot be accurately determined without assessing the volume of sediment to be removed on an annual basis. Assume flat rate of $60,000/ mile for 0.5 miles.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-1.1.2	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										
UsC-CCC-1.1.2.1	Action Step	Estuary	Conduct conifer release by thinning hardwoods in lower reaches of South and North Fork Usal Creek. Conifers could serve as a source for future large woody debris recruitment into the estuary and aid in cooler water temperatures flowing into estuary.	2	5	RFFI	1.50					2	Cost would be almost completely for personnel. Little permitting costs anticipated. The lower reaches have a heavy alder overstory component that slows the growth of understory conifers and ultimately impedes the rate of future conifer recruitment to the wetted channel. Cost based on riparian thinning for 1 mile (assume 320 acres/mile in 25% High IP) at a rate of $1,422/mile.
UsC-CCC-1.1.2.2	Action Step	Estuary	Initiate riparian planting of conifers within the riparian zones that are currently dominated by hardwoods and floodplain areas that are absent of conifers.	2	5	Campbell Timberland Management, CDFG, State Parks							Initial efforts should focus on the alder dominated riparian areas along the mainstem and lower North and South Forks of Usal Creek. Historical photographs of the Usal floodplain indicate the presence of old growth conifers. Replanting the floodplain would likely facilitate LWD recruitment in the distant future. Cost accounted for in FLOODPLAIN CONNECTIVITY.
UsC-CCC-1.2	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**										
UsC-CCC-1.2.1	Recovery Action	Estuary	Reduce frequency of artificial breaching events										
UsC-CCC-1.2.1.1	Action Step	Estuary	Post durable and attractive interpretive signage at the beach to discourage casual breaching of the lagoon sandbar.	3	10	State Parks	1.50	1.50				3	Additional educational signage along the estuary should be included with this recommendation. Signage should explain estuarine function and its benefits to endangered species and water quality of a properly functioning estuary. Cost of signs can vary widely depending on materials. Average cost estimated to be $1,000/sign. Assume minimum of 3 signs located at key points along the estuary.
UsC-CCC-1.2.1.2	Action Step	Estuary	Post warning signs and provide financial rewards to individuals who identify persons who illegally breach the sandbar to Usal lagoon.	3	10	CDFG Law Enforcement, NMFS OLE, State Parks							Unauthorized breeching reported during smolt season. Cost for signs could be accounted for in post durable attractive signs.
UsC-CCC-1.2.1.3	Action Step	Estuary	Implement patrols by citizens groups, State Parks staff and law enforcement to ensure the sandbar is not illegally breached.	3	100	State Parks						In-Kind	Rough cost estimate for the 100 year period. Close coordination by all parties would likely comprise the majority of the costs.
UsC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Create flood refuge habitat, such as hydrologically connected floodplains with riparian forest.										
UsC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	2	CDFG, RFFI, State Parks	20.00					20	Assessments have already been conducted but additional site specific field checks and mapping are likely needed.
UsC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Target habitat restoration and enhancement that will function between winter baseflow and flood stage.	3	20	CDFG, NOAA RC, RFFI, State Parks						TBD	Difficult to estimate cost until an evaluation of habitat enhancement opportunities are conducted.
UsC-CCC-2.1.1.3	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcoves, backchannels, ephemeral tributaries, or seasonal pond habitats.	1	5	CDFG, RFFI, State Parks	45.00					45	Areas with perennial flow and high IP-km scores should be targeted first for this measure. Little infrastructure exists on the floodplain. Creation and restoration of off-channel habitat features could be used as a demonstration project and reference point for future actions in regards to costs, feasibility, biological effectiveness, and appropriate construction techniques. Areas in the lower reaches of Usal should be designed with consideration of providing high flow refugia. Cost based on treating 1.25 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
UsC-CCC-2.1.1.4	Action Step	Floodplain Connectivity	Replant floodplain with native overstory vegetation.	2	20	CDFG, RFFI, State Parks	503	503	503	503		2,010	Cost based on treating 1.25 miles (assume 80 acres/mile) at a rate of $20,057/acre.
UsC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UsC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency and shelter rating										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install Large woody material, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	1	5	CDFG, NMFS, Private Consultants, RFFI, State Parks	37.50					38	Usal Creek has approx. 5 km of High IP habitat. Data from CDFG habitat inventories indicate shelter ratings throughout the Usal Creek watershed are poor within all sampled reaches. Poor LWD ratings were documented within the watershed, due largely to a lack of functional instream habitat. Large portions of this functional instream structure were likely removed due to past land management and well-intentioned stream clearing practices. Initial efforts should be directed at the lower reaches where significant aggradation limits summer rearing habitat. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Costs can be reduced by using onsite materials and coordinating efforts and equipment associated with other land management actions. Unsecured LWD input is practical in Usal Creek because almost no downstream infrastructure is present other than the County bridge which is recommended in this plan for upgrades. Large woody material should be targeted to reach density and volume outlined in the Viability table in this document. These actions will improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility. Cost based on treating 1.5 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.
UsC-CCC-3.1.1.2	Action Step	Habitat Complexity	Mechanically recruit alder from floodplain surfaces into the stream channel.	2	5	, CDFG, RFFI, State Parks	15.00					15	Recruit alders at least 20 feet away from the stream banks to maintain bank integrity. Rather than felling trees by chainsaw, pull over with winches and place root balls in the channel. Recruit at a rate of one tree per channel width in the lower portions of North Fork and South Fork Usal and appropriate locations on the mainstem. This action should occur within the context of a larger overall large wood (conifer) enhancement effort throughout the watershed.
UsC-CCC-3.1.1.3	Action Step	Habitat Complexity	Identify historical CCC coho salmon habitats lacking in channel complexity, and promote restoration projects designed to create or restore complex habitat features that provide for localized pool scour, velocity refuge, and cover.	2	15	CDFG, NMFS, Private Consultants, RFFI, State Parks							Increasing channel confinement should be a priority in the lower portion of Usal Creek. A confined channel would more efficiently sort and process bed material and thus, facilitate development of resilient pool riffle structure.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-3.1.1.4	Action Step	Habitat Complexity	Incorporate large woody material into stream bank protection projects, where appropriate. Do not use aqua logs (cylindrical concrete rip rap).	3	100	CDFG, NMFS, Private Consultants, RFFI, State Parks							Little bank hardening is anticipated to be needed in Usal watershed. This recommendation should be a standard practice.
UsC-CCC-3.1.1.5	Action Step	Habitat Complexity	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	2	100	CDFG, Private Landowners						In-Kind	This recommendation should be adopted as a reoccurring recommendation for all timber harvest plans.
UsC-CCC-3.1.1.6	Action Step	Habitat Complexity	Encourage retention and recruitment of large woody material for all historical anadromous salmonid rearing habitats in Usal Creek. Consult a hydrologist and qualified fisheries biologist before removing wood from streams.	2	100	CDFG, NMFS, Private Landowners, State Parks						In-Kind	Manipulation of Large Woody Material should not occur until evaluated by a hydrologist and/or qualified biologist familiar with Lost Coast streams.
UsC-CCC-3.1.1.7	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts.	3	100	CDFG, RFFI, RWQCB, State Parks						In-Kind	Retention of wood could result in cost savings for future restoration projects. Significant oversight and evaluation should occur prior to removal of any large wood structure.
UsC-CCC-3.1.1.8	Action Step	Habitat Complexity	Conduct conifer release to promote growth of larger diameter trees where appropriate.	2	100	RFFI, State Parks						TBD	Conifer release must take a comprehensive approach and should only be initiated in stream reaches with adequate canopy cover and where increases in instream temperatures are unlikely. Conifer release will ultimately promote the natural recruitment of large wood into the tributaries and mainstem areas. Cost could be minimal if incorporated into ongoing timber harvest plans. The forest is in a period of recovery from past intensive harvest practices and the overstory has changed from a heavily dominated redwood overstory to a forest with young redwood and a significant hardwood and Douglas-fir overstory component. Conifer release will ultimately restore riparian processes by providing a source for future large wood recruitment into watercourses. Some cost for conifer release accounted for in ESTUARY recovery actions.
UsC-CCC-3.1.2	Recovery Action	Habitat Complexity	Increase frequency of primary pools										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-3.1.2.1	Action Step	Habitat Complexity	Excavate sediment and build up channel bars.	2	10	CDFG, RFFI, State Parks, USACE	37.50	37.50				75	Using an excavator/backhoe, remove sediment from incipient pools or adjacent to incipient bars, and place the sediment on incipient bars. Grade the placed sediment to contoured form and attach to banks, mimicking alternate bars in general shapes. Bars should confine the active channel approximately 50% in width. This rough design estimate should be refined by results from field survey and hydraulic model analysis. Place LWD and available coarse sediment on bar surfaces to increase resistance to erosion.
UsC-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UsC-CCC-6.1.1	Recovery Action	Passage	Rehabilitate and enhance passage into tributaries (aggradation/degradation)										
UsC-CCC-6.1.1.1	Action Step	Passage	Evaluate smolt (and juvenile rearing) outmigration constraints, particularly during drought year low flow conditions, through the aggraded estuary, mainstem Usal, and lower reaches of N Fk. Usal.	2	10	RFFI, State Parks	292.50	292.50				585	Evaluation should consider flow conditions and impacts to smolt outmigration under extreme drought conditions through the month of June. Cost for conducting study to determine adequate summer low flows needed to support rearing juveniles. Cost for stream flow model accounted for in SEVERE WEATHER PATTERNS. Cost for annual smolt outmigration surveys estimated at $58,404/year.
UsC-CCC-6.1.1.2	Action Step	Passage	Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season..	1	5	CDFG, NMFS, RFFI, State Parks	120.00					120	Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season. Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season. Install instream structures such as boulders, boulder clusters, LWD, and other appropriate materials to increase scour and maintain the wetted channel at appropriate depths during the outmigration season.
UsC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
UsC-CCC-9.1.1.1	Action Step	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.	3	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	The original forest of Usal Creek was almost completely removed. The removal occurred relatively recently compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to Usal Creek watercourses. The alteration of sediment transport will likely continue to affect multiple salmonid life stages in the watershed. The December 2006, Soldier Creek landslide will likely continue to contribute sediment into the lower watershed, and the transport of this sediment into the ocean will likely take many years under current conditions.
UsC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
UsC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.		30							TBD	Cost for this recovery action cannot be determined at this time. Assessment of feasibility and need for catchment basins will determine the extent of costs.
UsC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UsC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-10.1.1.1	Action Step	Viability	Work with existing permittees to rescue juvenile coho salmon that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG.	3	100	CDFG, NMFS, Private Consultants, RFFI, State Parks						In-Kind	The earliest known quantitative information on salmonids in Usal Creek was obtained from a report on fish rescue efforts initiated by DFG in 1940 (Brown et al. 1994). Available information from fish rescue efforts in 1945 (Shapovalov 1949) were directed at saving juveniles in response to stream dewatering during the late-summer/early-fall low flow period. In 1945 a total of 25,821 juvenile steelhead and 61,133 juvenile coho were rescued from mainstem Usal Creek and possibly the estuary (a maximum distance of only 1.7 miles). The lower section of Usal is highly aggraded and dries during the summer low flow period. If coho numbers successful rebound in Usal it is likely that juvenile fish will become stranded in the lower reach. An evaluation of the potential benefits of rescue should be considered and if implemented, suitable areas should be identified within the watershed.
UsC-CCC-10.2	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**										
UsC-CCC-10.2.1	Recovery Action	Viability	Increase spatial structure and diversity										
UsC-CCC-10.2.1.1	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	2	100	CDFG, NMFS, Private Consultants, RFFI, State Parks						In-Kind	
UsC-CCC-10.2.2	Recovery Action	Viability	Increase spawner density										
UsC-CCC-10.2.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	2	21	CDFG, NMFS, Private Consultants, RFFI, State Parks	83.33	83.33	83.33	83.33	16.67	350	Monitoring adult abundance in Usal Creek is not as high a priority as in other watersheds in the Lost Coast Diversity Stratum due to the watersheds designation as "Dependent" and the existing monitoring currently occurring in the stratum. Periodic monitoring should have sufficient funding to document size of all three cohorts and should occur concurrently with smolt monitoring to the maximum extent possible. Cost based on $1000/IP km for 5 km of High IP.
UsC-CCC-10.2.2.2	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts.	3	10	CDFG, NMFS, Private Consultants, RFFI, State Parks	56.00	56.00				112	Cost based on fish/habitat restoration effectiveness monitoring at a cost of $111,192.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UsC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
UsC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sedimentation reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire, RFFI							This recommendation should be considered a standard practice.
UsC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	2	100	CalFire, RFFI							This recommendation will result in a net cost savings. This recommendation should be considered a standard practice and no additional financial costs are anticipated.
UsC-CCC-15.1.1.3	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	3	100	CalFire, RFFI							Implementing erosion control measures when constructing firebreaks (if possible) or shortly thereafter will likely result in a net cost savings. It is much more financially efficient to implement these measures while the fire crews are present rather than months later after the fire is out.
UsC-CCC-15.1.1.4	Action Step	Fire/Fuel Management	Re-contour any new facility sites as soon as possible after site cleanup and fire.	3	100	CalFire, RFFI							Standard business practice.
UsC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
UsC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident. The resource agencies can provide guidance regarding critical resources in the area that may be affected by fire fighting actions.	2	100	CalFire						In-Kind	Guidance could include informing CalFire in regards to the presence of sensitive biological resources in the watershed as well as recommendations regarding watersource locations. Protocols, similar to those recommended here, are already in place between USFWS, NMFS, BLM, and USFS which could provide a template for CalFire.
UsC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, storage tanks, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source. Require all water trucks/tenders be fitted with CDFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lower stream flows during water drafting.	3	100	CalFire							Do not draft water from the lagoon during fire unless absolutely necessary.
UsC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										
UsC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality										
UsC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	2	2	CalFire						In-Kind	
UsC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
UsC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
UsC-CCC-23.1.1.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	385.00	385.00				770	All new and replacement culverts should be sized to accommodate a 100 year flow event. Cost based on upgrading 3 stream crossing (assume minor 2 lane rural road) at a rate $254,065/unit.
UsC-CCC-23.1.1.2	Action Step	Roads/Railroads	Stream crossings on THP parcels should be identified and mapped with the intention of replacement or removal if they cannot pass 100 year flow. Design should include fail safe measures to accommodate culvert overflow without causing massive road fill failures.	3	30	CalFire, RFFI							These will likely be replaced as part of future timber harvest plans in Usal watershed.
UsC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-23.1.2.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	Legacy roads from past logging activity continue to impact the Usal watershed. Road densities are high throughout the watershed and are estimated at 3.5 miles of road per square mile overall and at 4.5 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed, not properly maintained, and many have been abandoned. Cost associated with future implementation of THPs.
UsC-CCC-23.1.2.2	Action Step	Roads/Railroads	Encourage County of Mendocino winterize the Usal County road using modern techniques to ensure sediment from roads does not enter North Fork Usal Creek.	2	100	CDFG, Mendocino County Department of Public Works, RFFI						In-Kind	The Usal County Road should be properly winterized every year to ensure sediment from this dirt road does not enter Usal Creek or other anadromous streams in the area. Road closure during the winter period should be implemented if necessary to ensure integrity of road winterization efforts.
UsC-CCC-23.1.2.3	Action Step	Roads/Railroads	Conduct periodic training for road maintenance crews regarding modern sediment remediation techniques protective of salmonids.	2	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	This should be an ongoing program (approximately every three years), particularly for County road maintenance staff regarding sediment remediation on the Usal County Road. Existing material can likely be used and tailored to private landowners and agencies with road maintenance staff. Roads are likely the largest contributor of sediment in the watershed, and sediment was rated as the most significant factor limiting salmonid production in the watershed. Outreach is critical to minimize the high rates of sediment input.
UsC-CCC-23.1.2.4	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	20	Campbell Timberland Management, Mendocino County Department of Public Works, RFFI, State Parks	90.00	90.00	90.00	90.00		360	However, a longer duration is associated with the action due to the large road and skid trail network and low rate of timber harvest. North Fork Usal's mainline riparian road should be considered one of the top decommission priorities. Cost based on treating 30 miles of road (assume reduce road density to 2.0mi/mi square) at a rate of $12,000/mile.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-23.1.2.5	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity. The assessments should prioritize sites and outline implementation timelines of necessary actions.	2	10	Mendocino County Department of Public Works, RFFI, State Parks	39.50	39.50				79	Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but a lot of work remains before this significant sediment source is thoroughly addressed. Of particular note, the Usal County Road is poorly maintained by Mendocino County and is believed to contribute significant volumes of sediment into the North Fork. To the maximum extent practicable, problem roads and active erosion sites, such as the campground near Hotel Gulch on State Parks Property, should be prioritized and addressed as part of a comprehensive sediment reduction plan for the entire Usal basin. The program should include a component that closes and remediates unnecessary roads and skid trails and moves campsites away from watercourses in an effort to lower overall road density in the watershed. Road remediation for future timber harvest plans should be considered a top mitigation priority. The inventory should include all roads in the watershed, including abandoned roads. Many of these roads will likely not be addressed until timber harvest is resumed and, based on the low rate of projected harvest in the watershed, the potential for sediment (both through chronic input and large episodic events) is high. Road rehabilitation from locations identified as high risk should not be based solely on timber harvesting schedules. Cost based on assessment of 68 miles (assume 75% of total road network) at a rate of $1,150/mile.
UsC-CCC-23.1.2.6	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	2	5	Mendocino County Department of Public Works, RFFI, State Parks						TBD	An assessment of adequate spoils storage sites needs to be completed before determining costs.
UsC-CCC-23.1.2.7	Action Step	Roads/Railroads	Install and maintain adequate energy dissipaters for culverts and other drainage pipe outlets where needed.	3	20	Mendocino County Department of Public Works, RFFI, State Parks						TBD	Particular care should be directed to ensuring water outfalls avoid unstable slopes. Number of energy dissipaters will be identified from road assessment.
UsC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	
UsC-CCC-23.1.4	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										
UsC-CCC-23.1.4.1	Action Step	Roads/Railroads	Replace the existing bridge on Usal County Road located in the Sinkyone State Parks Campground.	2	5	Mendocino County, State Parks	250.00					250	Due to stream bed aggradation the current bridge likely cannot pass a 100 year flow event in Usal Creek. Protection of this inadequate crossing in a major concern that may preclude necessary instream LWD enhancement above the bridge. Since the road receives light use a replacement bridge could be constructed on railcars which would result in a significant cost savings over other types of bridges. Cost based on upgrading crossing with bottomless/open arch crossing at a rate of $248,141/unit
UsC-CCC-23.1.4.2	Action Step	Roads/Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	Adopt NMFS (2001) Guidelines for Salmonid Passage at Stream Crossings.
UsC-CCC-23.1.5	Recovery Action	Roads/Railroads	Prevent adverse alterations to riparian species composition and structure										
UsC-CCC-23.1.5.1	Action Step	Roads/Railroads	Discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	Many abandoned roads and active roadside areas have extensive infestations of pampas grass.
UsC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanisms**										
UsC-CCC-23.2.1	Recovery Action	Roads/Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
UsC-CCC-23.2.1.1	Action Step	Roads/Railroads	Permitting and funding agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	100	CalFire, CDFG, NRCS, RWQCB, USACE						In-Kind	This should be considered a standard business practice by regulatory agencies, however, due to staffing levels regulatory oversight is often inadequate.

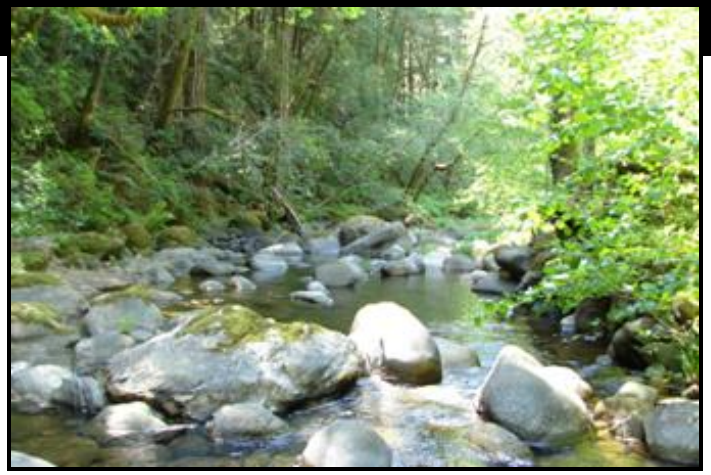
Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
UsC-CCC-23.2.2.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan, protective of salmonids and their habitat, is created and implemented.	1	10	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	Preservation of remaining migration zones are a high priority due to their importance for various salmonid life stages. Protection of these areas will potentially help facilitate future restoration actions.
UsC-CCC-23.2.3	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
UsC-CCC-23.2.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats.	2	20	Mendocino County Department of Public Works, RFFI, State Parks							This is a feasible recommendation for the Usal watershed due to the large number of abandoned and poorly maintained roads. Many of these roads are historical logging roads and skid trails that are no longer used. Decommissioning should evaluate potential impacts and benefits in terms of sediment mobilization between leaving road in current conditions and reopening for decommissioning purposes. Cost accounted for in address the present or threatened destruction of habitat.
UsC-CCC-23.2.3.2	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams.	2	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	Costs should be considered part of ongoing road maintenance.
UsC-CCC-23.2.3.3	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails to decrease fine sediment loads.	2	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	Cost should be considered part of land owner road management plans.
UsC-CCC-23.2.3.4	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	3	100	Mendocino County Department of Public Works, RFFI, State Parks						In-Kind	
UsC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary (impaired quality and extent)										
UsC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Monitor and evaluate existing subtidal resources and habitat types to track impacts of sea level rise to subtidal habitats that occur within and adjacent to selected tidal wetland restoration projects (California State Coastal Conservancy et al. 2010).	3	10	FEMA, Mendocino County, State Parks, USACE	120.00	120.00				240	Cost based on monitoring estuary use, residence timing at a rate of $273,217.
UsC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to passage and migration										
UsC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, Caltrans, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.	3	10	CalFire, CalTrans, CDFG, NMFS, RFFI, RWQCB, SWRCB	31.50	31.50				63	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality. Cost for stream flow model estimated at $63,005/project.
UsC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
UsC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	CDFG, RFFI, State Parks						In-Kind	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc.
UsC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Reduce turbidity and suspended sediment										
UsC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Patterns of water runoff, including surface and subsurface drainage, should match, to the greatest extent possible, the natural hydrologic pattern for the watershed in timing, quantity, and quality.	2	100	CalFire, RFFI, RWQCB, State Parks						In-Kind	Usal Creek watershed exhibits a Mediterranean-type climate, with an average rainfall between 45 and 75 inches that falls predominantly between the months of October and April. Although winter and spring seasons can be relatively wet (especially within higher elevations), the summer and fall can be warm; however, the maritime influence results in many days of prolonged fog which can moderate seasonal temperatures within the lower basin. Severe weather patterns, coupled with the existing road network, may exacerbate and accelerate future sediment delivery and land sliding.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
UsC-CCC-24.1.4.2	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, RFFI, RWQCB, State Parks						TBD	Assess and prioritize high-risk shallow-seeded landslide and develop plan to rehabilitate.

Waddell Creek

Location	•Santa Cruz County
Watershed Area	• 24.0 Square Miles
Potential Habitat	•8.0 Stream Miles
Vegetation	•85% Coniferous •14% Shrubland
Erodability	•Moderate to High
Ownership Patterns	•14% Private; 86% Public
Dominant Land Uses	•Recreation, Agricultural
Housing Density	•Low
TMDL Pollutants	•None



Waddell Creek
Photo by Jerry Smith, SJSU

Waddell Creek Coho Salmon: Nearly Extirpated

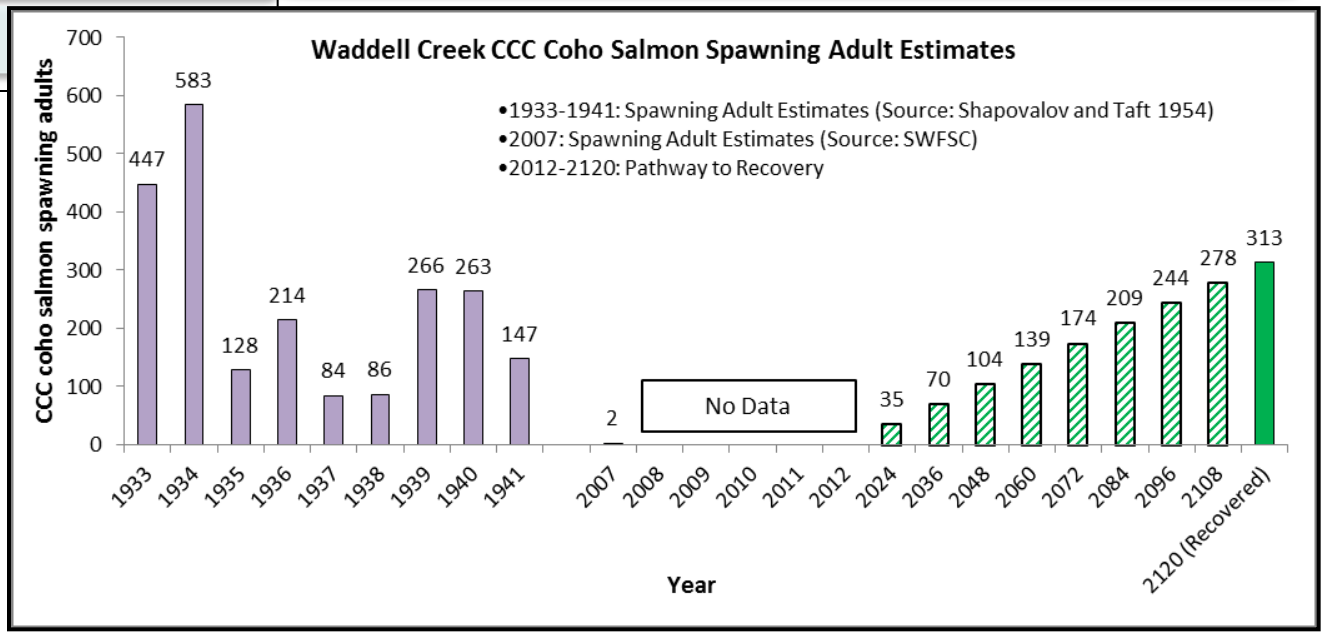
Recovery Goals
- ✓ Eliminate fish kills in upper watershed
- ✓ Conduct surveys to determine occupancy in watershed

Waddell Creek
Adult Spawner Targets

Downlisting to Threatened
157

Recovery
313

STEELHEAD: YES
CHINOOK SALMON: NO

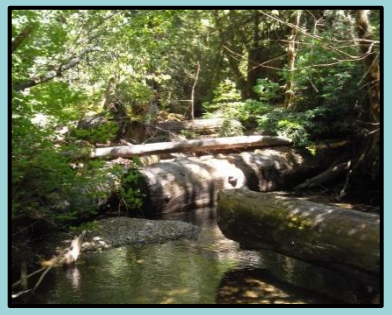


Waddell Creek

Potential Habitat: 8.0 miles
Recovery Target: 313 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	VERY GOOD	FAIR	FAIR	FAIR	GOOD	POOR	POOR	VERY GOOD



Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Identify source of ongoing fish kills in East Branch Waddell Creek and implement appropriate remediation and restoration actions
- Continue annual, standardized juvenile surveys in the watershed

Priority 2 & 3: Long-Term Restoration Actions

- Promote and evaluate alternatives to the proposed Highway One bridge replacement to improve estuary function
- Implement changes to restore natural function to river mouth dynamics
- Retain LWD for instream enhancement projects
- Place instream structures to improve gravel retention and habitat complexity
- Decommission or upgrade roads

Recovery Partners

California State Parks;
Waddell Creek Association

Photo Courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Gualala River Watershed Council, City of Santa Rosa and Morgan Bond, SWFSC

Waddell Creek

Potential Habitat: 8.0 miles
Recovery Target: 313 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM	NA	LOW	MEDIUM	NA	MEDIUM	LOW	HIGH	HIGH	MEDIUM

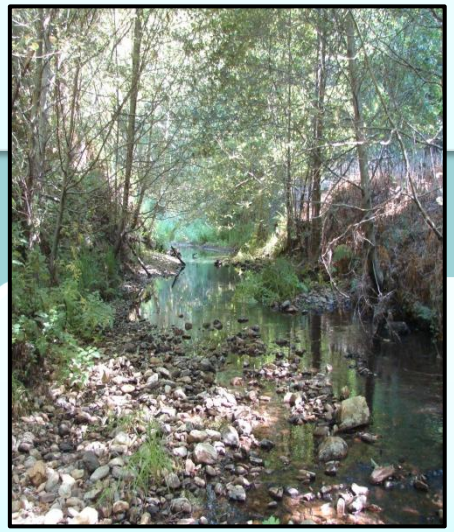
Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Immediately implement appropriate sediment control measures following completion of fire suppression
- Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value
- Existing areas with floodplains or off channel habitats should be protected from future development of any kind

Priority 2 & 3: Long-Term Threat Abatement Actions

- Conduct annual inspections of all roads prior to winter and correct conditions that are likely to deliver sediment to streams
- Limit winter use of unsurfaced roads and recreational trails
- Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques
- Ensure adequate water temperatures are maintained during droughts
- Protect sources of cool water input from future diversions
- Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion



Waddell Creek
Photo by Jerry Smith, SJSU

Conservation Highlights

- Seminal work on the life history of coho salmon and steelhead occurred in Waddell Creek from 1933 to 1942 (Shapavolof and Taft 1954).
- Annual juvenile abundance surveys conducted by San Jose State University faculty and students provides important population data on coho salmon in the Waddell Creek watershed.

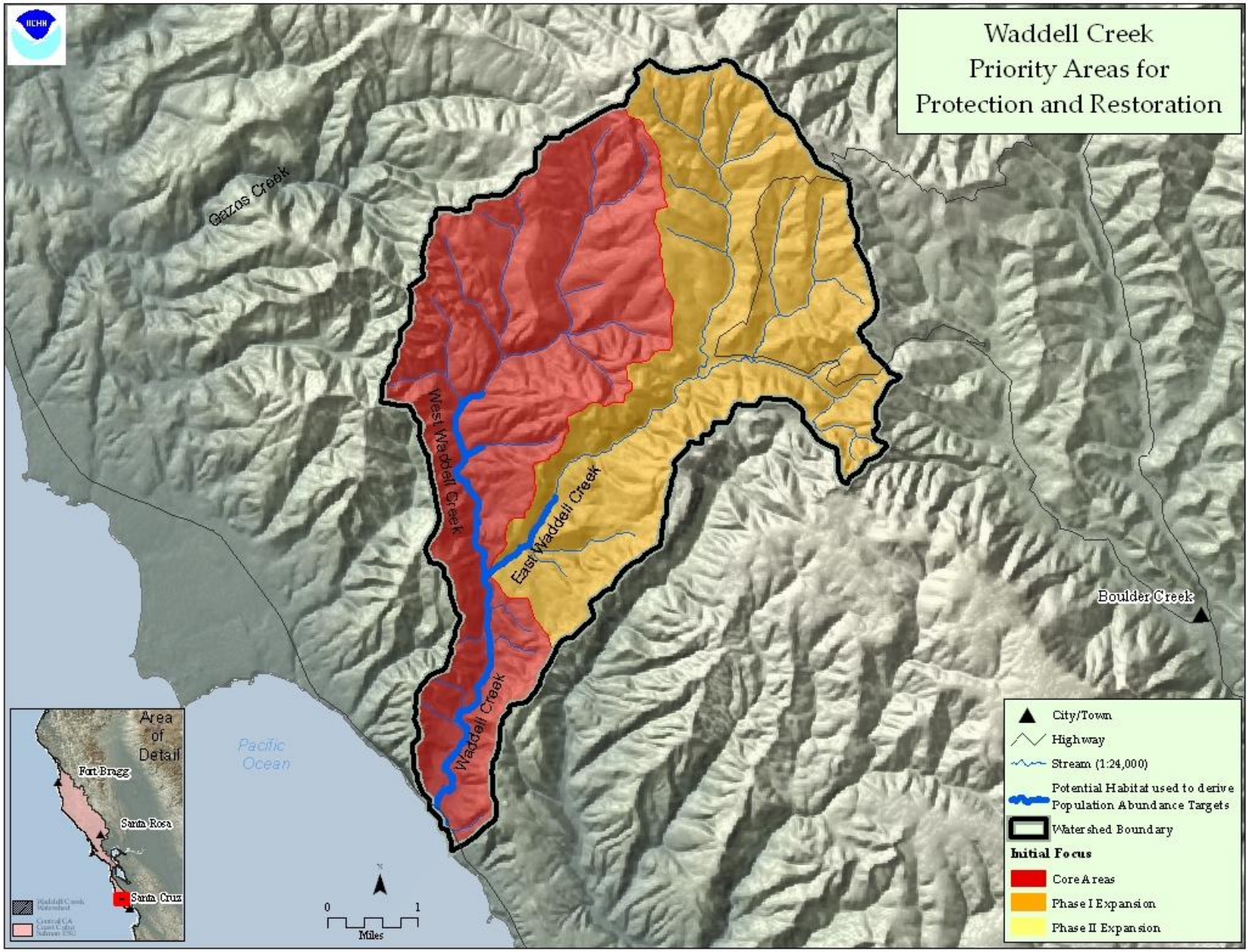


Figure 1: Map of Waddell Creek

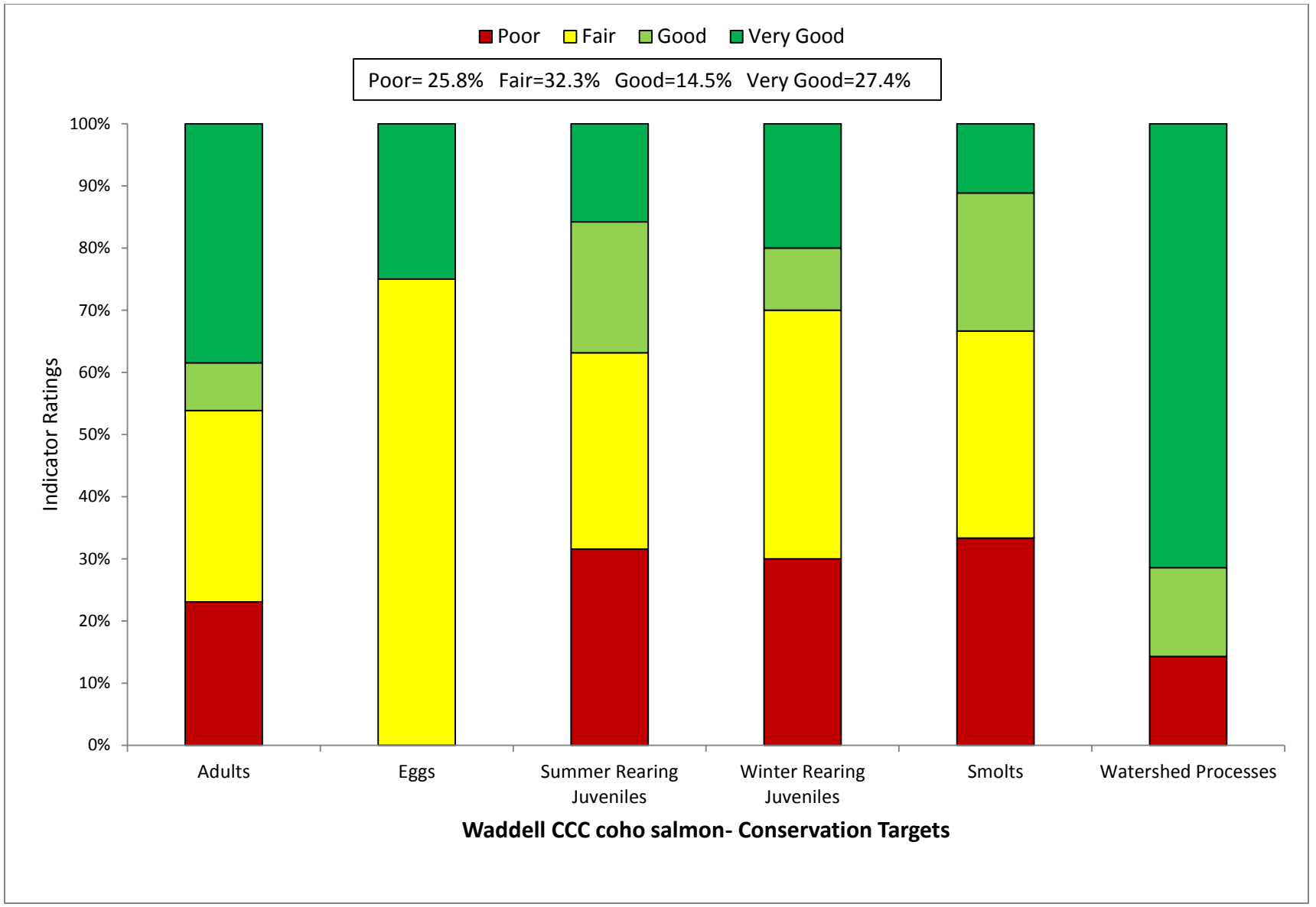


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Waddell Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**8.8 Key Pieces/100m**	Very Good	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**40% streams 51% IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**14% streams 1% IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =33**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =25**	Very Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =75**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**15-17% (0.85mm) and <30% (6.4mm)**	Fair	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**60% streams 52% IP-km (>50% stream average scores of 1 & 2)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**8.8 Key Pieces/100m**	Very Good	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**40% streams 51% IP**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**40% streams 51% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**14% streams 1% IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =42**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score 35-50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.17 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**86% streams 79% IP-km (>85% average stream canopy)**	Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**60% streams 52% IP**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**50 to 74% IP km (<16 C MWMT)**	Fair	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Acute**	Poor	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**<50-74% of Historical Range**	Poor	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**4 to 6 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**8.8 Key Pieces/100m**	Very Good	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**40% streams 51% IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**14% streams 1% IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**NA**	0	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**70-79% Density rating "D" across IP-km**	Fair	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**60% streams 52% IP**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Acute**	Poor	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**14% streams 1% IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**2.17 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**75-90% IP-km (>6 and <14 C)**	Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Acute**	Poor	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.17% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0.317% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**<15% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**1% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**>75% Intact Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**2.0 Miles/Square Mile**	Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**2.3 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Waddell Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Medium	Medium	Medium	Medium	Low	Medium
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Medium	-	High	Low	Medium	Low	Medium
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	Medium	Medium	High	High	High
5	Fishing and Collecting	Medium	-	Medium	-	Low	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Medium	Low	Medium
9	Mining	-	-	-	-	-	-	-
10	Recreational Areas and Activities	Low	Medium	Medium	Low	Medium	Medium	Medium
11	Residential and Commercial Development	Low	Low	Medium	Low	Low	Low	Low
12	Roads and Railroads	Medium	High	High	High	High	High	High
13	Severe Weather Patterns	Medium	Medium	High	Medium	High	High	High
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
	Threat Status for Targets and Project	Medium	Medium	High	Medium	High	High	High

Central CA Coast Coho Salmon ~ Waddell Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

1.1.1. **Recovery Action:** Rehabilitate natural river mouth dynamics

1.1.1.1. **Action Step:** Promote and evaluate alternatives to the current Highway One bridge to improve estuary function.

1.1.1.2. **Action Step:** Evaluate alterations to river mouth dynamics and implement changes to restore natural function

1.1.2. **Recovery Action:** Increase and enhance estuarine habitat complexity features

1.1.2.1. **Action Step:** Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity.

2.1.1.1. **Action Step:** Address channel incision issues and reduced stream complexity between the Highway one bridge (stream mile 0) and the footbridge (stream mile 8).

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Increase large wood frequency

3.1.1.1. **Action Step:** Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.

3.1.2. **Recovery Action:** Improve shelter rating

3.1.2.1. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem Waddell Creek.

3.1.2.2. **Action Step:** If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts. Create winter velocity refuge between stream mile 4 and 8 (footbridge). Create winter velocity refuge in stream above and below tramway springs.

4. **Restoration- Hydrology**

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

No species-specific actions were developed.

6. Restoration- Passage

No species-specific actions were developed.

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

No species-specific actions were developed.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

9.1.1. **Recovery Action:** Improve instream gravel quality

9.1.1.1. **Action Step:** Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations

9.1.1.2. **Action Step:** Place instream structures to improve gravel retention and habitat complexity.

9.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

9.1.1.4. **Action Step:** Remediate slides and gullies delivering sediment to stream channels.

9.1.1.5. **Action Step:** Remediate near stream sediment sources such as streamside landings, roads, and failing banks using appropriate techniques.

9.1.1.6. **Action Step:** Establish and/or maintain continuous and properly functioning native riparian buffers.

10. Restoration- Viability

10.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

10.1.1. **Recovery Action:** Increase spatial structure and diversity

10.1.1.1. **Action Step:** Establish life cycle station in the Waddell Creek watershed, and utilize it to compare productivity with existing historical data for the watershed (Gallagher and Gallagher 2005).

10.1.1.2. **Action Step:** Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.

10.1.2. **Recovery Action:** Increase spawner density

10.1.2.1. **Action Step:** Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.

11. Restoration- Water Quality

11.1. **Objective:** Address the inadequacy of existing regulatory mechanisms.

11.1.1. **Recovery Action:** Reduce toxicity and pollutants.

11.1.1.1. **Action Step:** Identify source of ongoing low fish abundance in upper East Waddell Creek and implement appropriate remediation and restoration actions.

11.1.1.2. **Action Step:** Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals or other associated practices into East Branch Waddell.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

14.1. **Objective:** Address disease or predation

14.1.1. **Recovery Action:** Prevent reduced density, abundance, and diversity

14.1.1.1. **Action Step:** Evaluate impacts of striped bass predation in the Waddell estuary to juvenile and smolting salmonids and implement abatement strategies if appropriate.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

15.1.1. **Recovery Action:** Prevent impairment to hydrology

15.1.1.1. **Action Step:** Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.

15.1.3. **Recovery Action:** Prevent impairment to instream substrate

15.1.3.1. **Action Step:** Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.

15.2. **Objective:** Address the inadequacies of regulatory mechanisms.

15.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

15.2.1.1. **Action Step:** Avoid use of aerial fire retardants and foams with 300 feet of riparian areas. To the maximum extent feasible, orient air drops so that the drop lands perpendicular to streams.

15.2.1.2. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.

15.2.1.3. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

No species-specific actions were developed.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.1.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.

23.1.1.2. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.2.1. **Action Step:** Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.

23.1.2.2. **Action Step:** Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.

23.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.1.3.1. **Action Step:** Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanism

23.2.1. **Recovery Action:** Prevent impairment to instream substrate

23.2.1.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.

23.2.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.

23.2.1.3. **Action Step:** Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to the estuary

24.1.1.1. **Action Step:** Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.

24.1.2. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.1.2.1. **Action Step:** Ensure adequate water temperatures are maintained during drought periods.

24.1.2.2. **Action Step:** Protect sources of cool water input from future diversions.

24.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.3.1. **Action Step:** Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical coho watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.

24.1.4. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

24.1.4.1. **Action Step:** Develop and implement critical flow levels for stream reaches impacted by water diversions. Critical flow values during droughts should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.

24.1.5. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

24.1.5.1. **Action Step:** Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.5.2. **Action Step:** Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

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Table 3: Implementation Schedule ~ Waddell Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WadC-CCC-1.1.1	Recovery Action	Estuary	Rehabilitate natural river mouth dynamics										
WadC-CCC-1.1.1.1	Action Step	Estuary	Promote and evaluate alternatives to the current Highway One bridge to improve estuary function.	2	10	CalTrans, CDFG, State Parks, USACE, USFWS	156.00	156.00				312	The current bridge is planned for a rebuild by Caltrans. A new bridge should account for sandbar formation and likely impacts to lagoon function. A new structure should be constructed to have minimal influence on sandbar opening and closing during all potential water years. Cost could not be determined at this time due to unknown financial considerations being evaluated by Caltrans for bridge design and reconstruction. The bridge location may have resulted in some channel incision which isolates the channel from the marsh and results in a lack of backwater habitat in the estuary. Cost for estuary use estimated at $311,467/project.
WadC-CCC-1.1.1.2	Action Step	Estuary	Evaluate alterations to river mouth dynamics and implement changes to restore natural function	2	10	CalTrans, State Parks						TBD	The current bridge and parking lot configuration should be closely evaluated and adverse impacts remediated to improve sand bar dynamics. A proposed rebuild of the Waddell Highway 1 bridge provides a rare opportunity within the range of CCC coho salmon to reclaim historical estuary dynamics. The sandbar closure frequency has changed, and these changes impact estuary productivity for rearing juvenile. Shapovalov and Taft (1954) documented that the sandbar closed the lagoon in eight of nine years during their study in the 1930s/early 1940s, while Smith (2010) documented that since at least 1995 the sandbar only formed in 2008 and 2009. This change in closure frequency has likely reduced the overall salmonid carrying capacity in Waddell Creek . Reasons for the change in closure frequency are not entirely clear, but Smith (2010) provided possible reasons, including changes to beach sand dynamics that may include possible interactions with the confined channel at the Highway 1 Bridge and/or Highway 1 berm and the State Park parking lot, and increases in the frequency of illegal breachings. Determining and correcting the reasons behind the changes to sandbar closure would provide essential information to guide future restoration and threat abatement measures. As at nearby Scott Creek, the California Department of Transportation is evaluating bridge replacement over US Route 1. If the bridge and/or parking lot are affecting sandbar closure dynamics, the problem should be considered and corrected during future bridge reconstruction.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-1.1.2	Recovery Action	Estuary	Increase and enhance estuarine habitat complexity features										
WadC-CCC-1.1.2.1	Action Step	Estuary	Install structures designed to enhance scour to increase residual pool depth and shelter for smolt transition and feeding during the spring.	2	10	CDFG, IWRP, Santa Cruz RCD, State Parks	310.00	310.00				620	Costs may vary depending on the total number of structures and necessary engineering. Due to the lack of instream infrastructure (after the Highway 1 bridge is replaced) it is likely that relatively little engineering will be necessary. Permitting costs are anticipated to be negligible to likely use of programmatic permits. Cost for treating 2 acres (assume 5% of total estuarine acres) at a rate of $310,216/acre.
WadC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
WadC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Prevent impairment to floodplain connectivity.										
WadC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Address channel incision issues and reduced stream complexity between the Highway one bridge (stream mile 0) and the footbridge (stream mile 8).	2	10		278.50	278.50				557	Costs are based on $28,500/mile for stream complexity actions and $41,092/mile for floodplain projects because the projects will work in concert with each other over the 8 mile section.
WadC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WadC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase large wood frequency										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-3.1.1.1	Action Step	Habitat Complexity	Install LWD, boulders, and other instream features to increase habitat complexity and improve pool frequency and depth.	3	10	IWRP, State Parks	71.25	71.25				143	Despite fair LWD ratings for Waddell Creek, only one percent of the instream shelter values measured scored >80 and (thus rated Poor). This may suggest instream shelter is compromised due to high sediment loading (embeddedness values also rated Poor) which may reduce the function and capacity of instream wood to create adequate shelter habitat. To improve shelter rating, LWD input should be evaluated in specific stream reaches where improvements are anticipated to result in benefits such as reaches with softer banks, and reaches where LWD rated below Very Good. Cost estimate based on DFG 2004, at approximately $28,500/mile, and assuming approximately 5 miles would be treated. Costs will be higher if engineered large wood placement approaches are used. Significant cost savings (and ecological benefits) would likely be realized if unsecured woody material (sized at 1.5 to 2 times bankfull) is used. Large woody debris should be targeted to reach density and volume outlined in the Viability table in this document. Cost for treating 5 miles with large wood placement is $142,500 and $576,384 for Engineered Log Jams, respectively.
WadC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve shelter rating										
WadC-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in mainstem Waddell Creek.	2	10		100.00	100.00				200	Cost based on $28,500/mile for 7 miles of mainstem Waddell Creek. Cost of improving shelter rating could be part of increasing large wood frequency.
WadC-CCC-3.1.2.2	Action Step	Habitat Complexity	If log jams are modified for fish passage, retain LWD for instream enhancement projects that address poor shelter rating for juveniles and smolts. Create winter velocity refuge between stream mile 4 and 8 (footbridge). Create winter velocity refuge in stream above and below tramway springs.	2	100	CDFG, IWRP, State Parks						TBD	Cost accounted for in above action steps.
WadC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WadC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality										
WadC-CCC-9.1.1.1	Action Step	Sediment	Conduct sediment source surveys in remaining portion of the watershed to identify existing sources of high sediment yield using accepted protocols and implement recommendations	3	10	CDFG, IWRP, State Parks	27.00	27.00				54	Cost for erosion assessment estimated at $13.90/acre (assume 25% of total watershed acres).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-9.1.1.2	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	10	CDFG, IWRP, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	642	642				1,284	DFG estimated LWD structures cost approximately $25,680/mile each (DFG 2004). Assumed 50 structures would be needed. However, cost saving could be realized if existing sources of large wood are used. Wood in Waddell Creek is clumped into a few areas and has the potential to act as migration barriers. Redistribution of wood into key stream reaches could improve overall gravel quality and reduce the potential threat of temporal migration barriers.
WadC-CCC-9.1.1.3	Action Step	Sediment	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	2	10	California Coastal Conservancy, CalTrans, Private Landowners, Santa Cruz County, Santa Cruz RCD, State Parks	15.73	15.73				31	Cost based on $13,680/mile for 2.3 miles of riparian road.
WadC-CCC-9.1.1.4	Action Step	Sediment	Remediate slides and gullies delivering sediment to stream channels.	3	20	IWRP, State Parks							
WadC-CCC-9.1.1.5	Action Step	Sediment	Remediate near stream sediment sources such as streamside landings, roads, and failing banks using appropriate techniques.	2	30	IWRP, State Parks						TBD	
WadC-CCC-9.1.1.6	Action Step	Sediment	Establish and/or maintain continuous and properly functioning native riparian buffers.	3	100	State Parks							Riparian buffers adjacent to agricultural field in the lower watershed should be carefully monitored over time. Any encroachment into the existing riparian buffer should be discouraged.
WadC-CCC-10.1	**Objective**	**Viability**	**Address the inadequacy of existing regulatory mechanisms.**										
WadC-CCC-10.1.1	Recovery Action	Viability	Increase spatial structure and diversity										
WadC-CCC-10.1.1.1	Action Step	Viability	Establish life cycle station in the Waddell Creek watershed, and utilize it to compare productivity with existing historical data for the watershed (Gallagher and Gallagher 2005).	3	6	CDFG, NOAA SWFSC, Private Landowners, State Parks	1,338	268				1,605	Although Waddell is rated as a Dependent watershed and other monitoring is occurring in an adjacent Dependent watershed (Scott Cr), Waddell is of particular historical importance to assessing long term trends of coastal salmonids due to the past work of Shapovalov and Taft (1954) during the 1930's. However, due to the ongoing effort in nearby Scott Creek, a lifecycle station in Waddell was rated as a lower priority. Cost for life cycle monitoring station estimated at $267,444.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-10.1.1.2	Action Step	Viability	Conduct periodic, standardized juvenile surveys in the watershed. Surveys should include all three cohorts.	1	20	NOAA SWFSC, Private Consultants, State Parks	94.00	94.00	94.00	94.00		376	Juvenile monitoring has been ongoing in Waddell Creek since 1988 and provides one of the longest continuous monitoring datasets in the CCC ESU. Monitoring should continue. Cost for annual juvenile distribution survey estimated at $18,823/year for Santa Cruz Mtns. Diversity Stratum.
WadC-CCC-10.1.2	Recovery Action	Viability	Increase spawner density										
WadC-CCC-10.1.2.1	Action Step	Viability	Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed. Surveys should include all three cohorts.	3	20		28.00	28.00	28.00	28.00		112	Standardized surveys should not occur until a small sustained run of CCC coho salmon is re-established in the watershed. Other monitoring efforts are occurring in the Santa Cruz Mtns Diversity Stratum. Redd monitoring using (GTRS sampling design) may be less expensive than establishing life cycle station to count migrating adults and smolts. All assessments should use standardized methods. Methods should be consistent across the ESU or at a minimum the Santa Cruz Mtns Diversity Stratum. Cost for spawner surveys are estimated at $56,470/year.
WadC-CCC-11.1	**Objective**	**Water Quality**	**Address the inadequacy of existing regulatory mechanisms.**										
WadC-CCC-11.1.1	Recovery Action	Water Quality	Reduce toxicity and pollutants.										
WadC-CCC-11.1.1.1	Action Step	Water Quality	Identify source of ongoing low fish abundance in upper East Waddell Creek and implement appropriate remediation and restoration actions.	1	3	CDFG, NMFS OLE, State Parks	50.00					50	Installation of continuous monitoring water quality gauges should begin as soon as possible. Relatively few threats exist in the watershed and habitat quality is better than many streams in the Santa Cruz Mountains. Nonetheless, fish density is very low compared to historical conditions and coho are nearly extirpated. Dr. Jerry Smith has sampled the watershed since 1988 and believes the low density is due to episodic dumping of toxic chemicals or other substance that has severely degraded water quality conditions for successful juvenile rearing in East Waddell Creek. NMFS OLE special agents and DFG game wardens investigated the watershed in 2008 but failed to detect potential toxin sources. Other habitat alterations (such as major landslides) have also been evaluated, but to date no other apparent causes leading to low juvenile densities have been detected. Cost for continuous water quality stations estimated at $5,000/station. Assume a minimum of 10. Cost does not account for maintenance or data management.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-11.1.1.2	Action Step	Water Quality	Coordinate with local law enforcement agencies to post reward for information leading to the identification and conviction of entities disposing of toxic chemicals or other associated practices into East Branch Waddell.	1	5	CDFG, NMFS OLE, Private Landowners, RWQCB, State Parks						TBD	
WadC-CCC-14.1	**Objective**	**Disease/Predation/Competition**	**Address disease or predation**										
WadC-CCC-14.1.1	Recovery Action	Disease/Predation/Competition	Prevent reduced density, abundance, and diversity										
WadC-CCC-14.1.1.1	Action Step	Disease/Predation/Competition	Evaluate impacts of striped bass predation in the Waddell estuary to juvenile and smolting salmonids and implement abatement strategies if appropriate.	3	10	CDFG, IWRP, Private Consultants, State Parks	65.00	65.00				130	Final reports should include a series of recommendations and the feasibility of implementing these recommendations. Accurate implementation cost cannot be determined until all potential control methods are evaluated and total magnitude of the impact of anadromous salmonids ascertained. Some researchers believe striped bass are not a major constraint. Total duration of predator control efforts may be longer depending on recommendations of plan. Cost for abundance/distribution surveys estimated at $129,391/project.
WadC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WadC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to hydrology										
WadC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Draft water from ponds, lakes, and reservoirs not occupied by listed salmonids when possible. In fish bearing waters excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, State Parks							Require all water truck/tenders be fitted with DFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Avoid significantly lowering stream flows during water drafting.
WadC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
WadC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	Establish fire contingency plan developed by experts from CalFire, local fire districts, Santa Cruz RCD, and regulatory agencies with expertise in fisheries issues.	3	5	CalFire, CDFG, Santa Cruz County, Santa Cruz RCD, USFWS							
WadC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Immediately implement appropriate sediment control measures following completion of fire suppression while firefighters and equipment are on site.	1	100	CalFire							This should be considered a standard practice by firefighting organizations
WadC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacies of regulatory mechanisms.**										
WadC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WadC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Avoid use of aerial fire retardants and foams with 300 feet of riparian areas. To the maximum extent feasible, orient air drops so that the drop lands perpendicular to streams.	2	100	CalFire							
WadC-CCC-15.2.1.2	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants to local firefighting agencies and CalFire.	3	5	CalFire, State Parks							
WadC-CCC-15.2.1.3	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	1	100	CalFire, CDFG, NMFS, USFWS							The resource agencies can provide guidance regarding critical resources in areas that may be affected by firefighting actions.
WadC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WadC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										
WadC-CCC-23.1.1.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.	2	10		28.04	28.04				56	Road densities are high throughout the watershed and are estimated at 2.0 miles of road per square mile of watershed area, and at 2.3 miles per square mile of riparian area. However, although road densities are high, they are generally lower than most target watershed in the Santa Cruz Mountains. Roads parallel many of the waterways within Waddell Creek and restrict channel migration and other fluvial processes. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery. Cost based on $13,680/mile for decommissioning 4.1 miles of road (10% of 41 miles of road network).
WadC-CCC-23.1.1.2	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	20		89.78	89.78	89.78	89.78		359	Cost based on $71,820/unit with 5 of the 11 crossings being treated. The complexity of the crossings could result in each unit costing $1,152,540, resulting in an estimate of $5,762,700.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WadC-CCC-23.1.2.1	Action Step	Roads/Railroads	Close unauthorized (pioneer) trails and conduct appropriate decommissioning practices. Hydrologically disconnect trails from associated waterways.	3	100	CalFire, State Parks							
WadC-CCC-23.1.2.2	Action Step	Roads/Railroads	Conduct road and sediment reduction assessments to identify sediment-related and runoff-related problems and determine level of hydrologic connectivity.	2	10	IWRP, Santa Cruz RCD, State Parks	43.50	43.50				87	Cost accounted for erosion assessment. Cost for road inventory estimated at $1,056/mile.
WadC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WadC-CCC-23.1.3.1	Action Step	Roads/Railroads	Design new roads to avoid unstable slopes, wetlands, floodplains and other areas of high habitat value.	1	100	CalFire, NRCS, Private Landowners, State Parks							
WadC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										
WadC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
WadC-CCC-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads where appropriate.	2	100	CalFire, Santa Cruz County, State Parks							Hydrologically disconnect roads where appropriate.
WadC-CCC-23.2.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.	2	100	State Parks							
WadC-CCC-23.2.1.3	Action Step	Roads/Railroads	Encourage appropriate restrictions for winter use of unsurfaced roads along rural utility easements; and establish best management practices for clearance within riparian corridors.	3	100	CalFire, PG&E, Santa Cruz County							
WadC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WadC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to the estuary										
WadC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Design estuary restoration projects to include subtidal habitats and natural bioengineering techniques that buffer wave action and increase sediment deposition to minimize shoreline and wetland erosion.	2	100								New bridges and upgrades to parking lots should evaluate future impacts associated with sea level rise. Cost accounted for in ESTUARY.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WadC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
WadC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Ensure adequate water temperatures are maintained during drought periods.	2	100	IWRP, Private Landowners, SWRCB							
WadC-CCC-24.1.2.2	Action Step	Severe Weather Patterns	Protect sources of cool water input from future diversions.	2	100	CDFG, State Parks, SWRCB							Sources of cool water input should not be diverted, particularly during drought periods.
WadC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WadC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Where existing infrastructure exists within historical floodplains or offchannel habitats in any historical coho watersheds, and restoration is found feasible, encourage willing landowners to restore these areas through conservation easements, etc.	3	20		136.71	136.71	136.71	136.71		547	Cost based on increasing from <50% to >80% of 186 acres of floodplain (=56 acres). Waddell Creek is low urban impact, therefore assume the lower cost of recovery of $9,765/acre for 56 acres.
WadC-CCC-24.1.4	Recovery Action	Severe Weather Patterns	Prevent impairment to stream hydrology (impaired water flow)										
WadC-CCC-24.1.4.1	Action Step	Severe Weather Patterns	Develop and implement critical flow levels for stream reaches impacted by water diversions. Critical flow values during droughts should include minimum bypass flow requirements to support upstream adult migration during winter months and juvenile rearing in the summer and fall months.	3	10	CDFG, NMFS HCD, State Parks, SWRCB	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project.
WadC-CCC-24.1.5	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WadC-CCC-24.1.5.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seated landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	California Geological Survey, Santa Cruz County, State Parks							Heavy rainfall and extreme flood events could result in major erosion in upslope locations. Much of the watershed is comprised of steep topography in erodible geology. High instream sediment concentration can fill pools, smother spawning gravel, and generally simplify instream habitat complexity.
WadC-CCC-24.1.5.2	Action Step	Severe Weather Patterns	Existing areas with floodplains or off channel habitats should be protected from future urban development of any kind.	1	100	California Geological Survey, CalTrans, Private Landowners, Santa Cruz County, USACE						In-Kind	Protecting these areas from impacts of development may be costly due to concerns of reverse condemnation, etc. Cost cannot be determined at this time due to a lack of information regarding where these existing habitats remain in juxtaposition to future development.

Wages Creek

Location	•Mendocino County
Watershed Area	• 13.0 Square Miles
Potential Habitat	•9.8 Stream Miles
Vegetation	•79% Coniferous •13% Riparian or Montane Forest
Erodability	•Moderately High
Ownership Patterns	•99% Private
Dominant Land Uses	•Timber
Housing Density	•Moderately Low
TMDL Pollutants	•None

Wages Creek estuary and campground.
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Wages Creek Coho Salmon: Nearly Extirpated

Recovery Goals

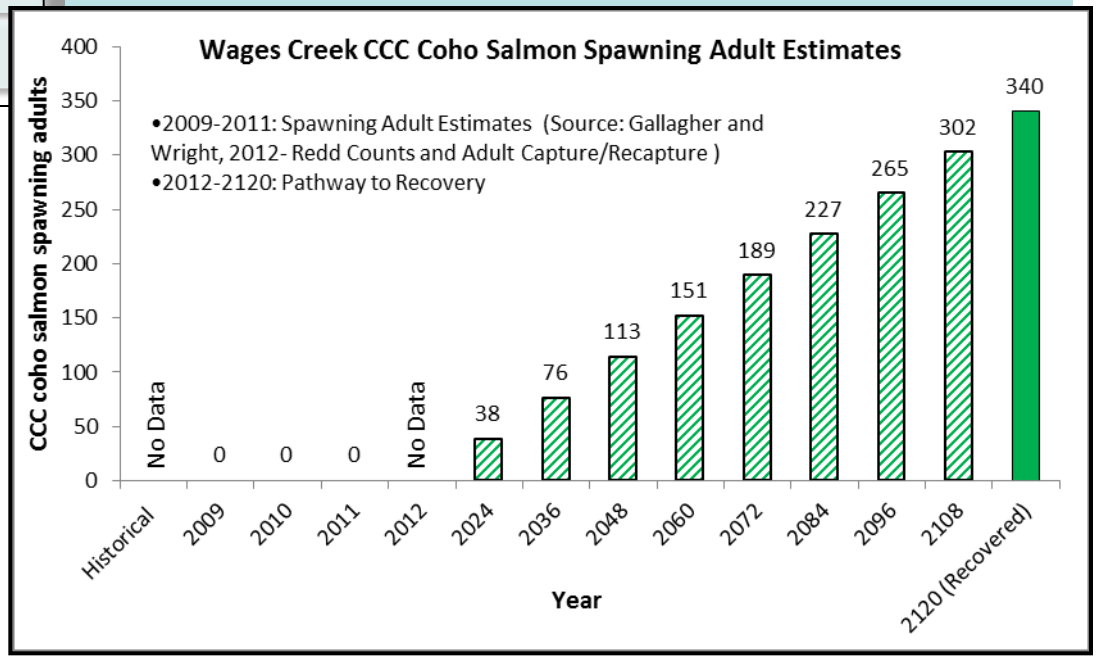
✓ Conduct periodic, standardized spawning surveys to estimate adult abundance in the watershed

Wages Creek Adult Spawner Targets

Downlisting to Threatened
170

Recovery
340

STEELHEAD: YES
CHINOOK SALMON: NO



Wages Creek

Potential Habitat: 9.8 miles
Recovery Target: 340 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	GOOD	VERY GOOD	FAIR	POOR	VERY GOOD	GOOD	GOOD	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth

Priority 2 & 3: Long-Term Restoration Actions

- Promote restoration projects designed to create or restore off channel habitat
- Restore and expand riparian buffers to increase riparian canopy cover
- Allow trees in riparian areas to age, die, and recruit into the stream naturally

Campbell TIMBERLAND MANAGEMENT LLC

Recovery Partners

Westport Water District.
Board of Forestry Monitoring Study Group,
Ballard Forestry

RESOURCES AGENCY CALIFORNIA DEPARTMENT FISH & GAME

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Gualala River Watershed Council, Campbell Timberland and Morgan Bond, SWFSC

Wages Creek

Potential Habitat: 9.8 miles
Recovery Target: 340 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
LOW	MEDIUM	LOW	HIGH	MEDIUM	NA	LOW	MEDIUM	LOW	LOW	MEDIUM	HIGH	MEDIUM	MEDIUM

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Discourage home building or other incompatible land use in areas identified as timber production zones
- Discourage forest-to-vineyard land or rural residential conversions
- Design new development to allow streams to meander in historical patterns
- Use available best management practices for road construction, maintenance, management and decommissioning

Priority 2 & 3: Long-Term Threat Abatement Actions

- Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography
- Decommission or upgrade roads
- Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure
- Fully maintain all roads with inside ditches unless these roads have been properly decommissioned
- Adopt a policy of "managed retreat" for areas highly susceptible to or previously damaged from flooding

South Fork Wages Creek Cooperative Instream Monitoring Project
Photo Courtsey: Cal Fire

Conservation Highlights

- Campbell Timberland Management has undertaken sediment remediation projects.
- The Wages Creek Monitoring Study Group, a collaborative effort, is conducting effectiveness monitoring to assess current conditions and long term trends in channel conditions.

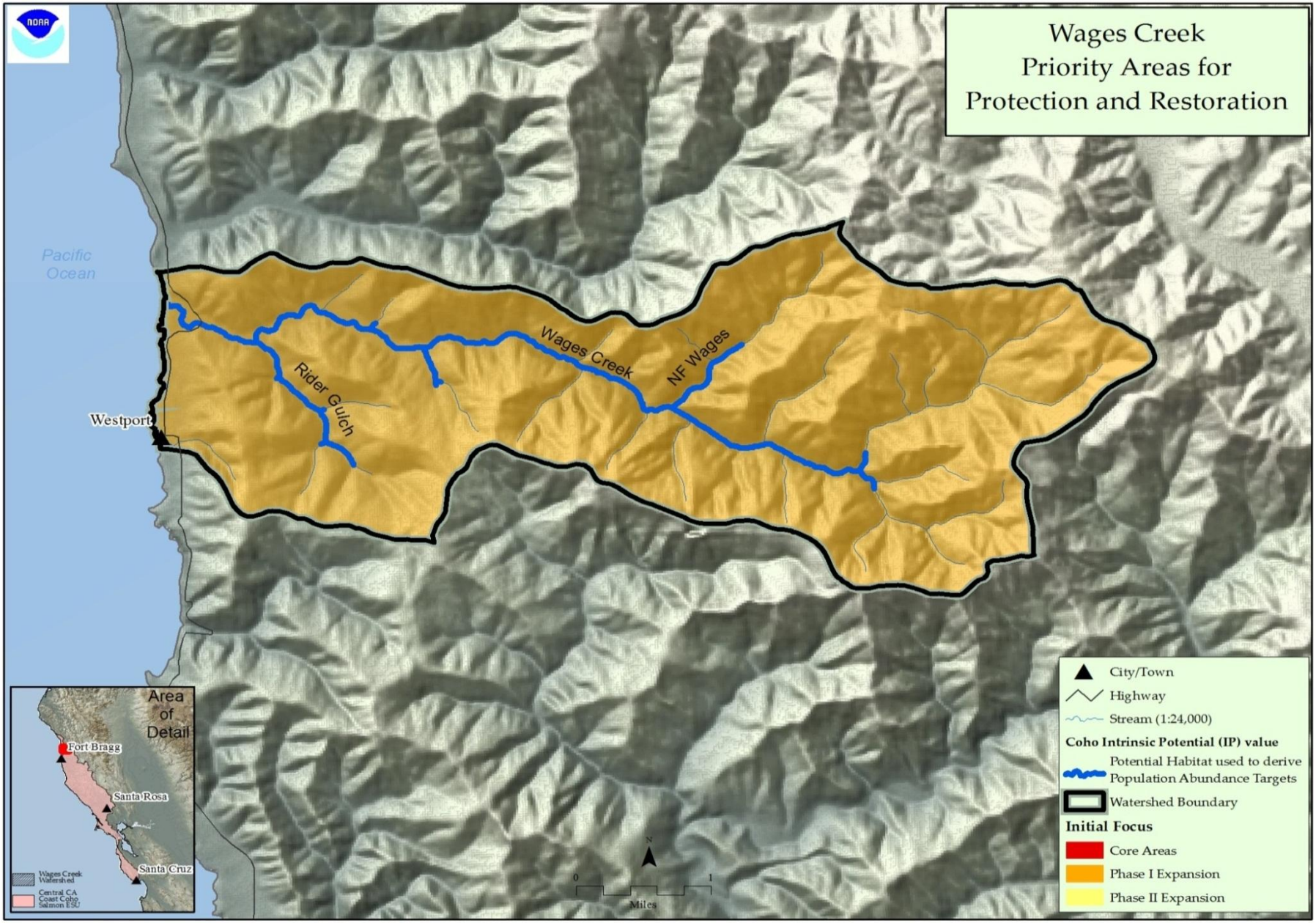


Figure 1: Map of Wages Creek

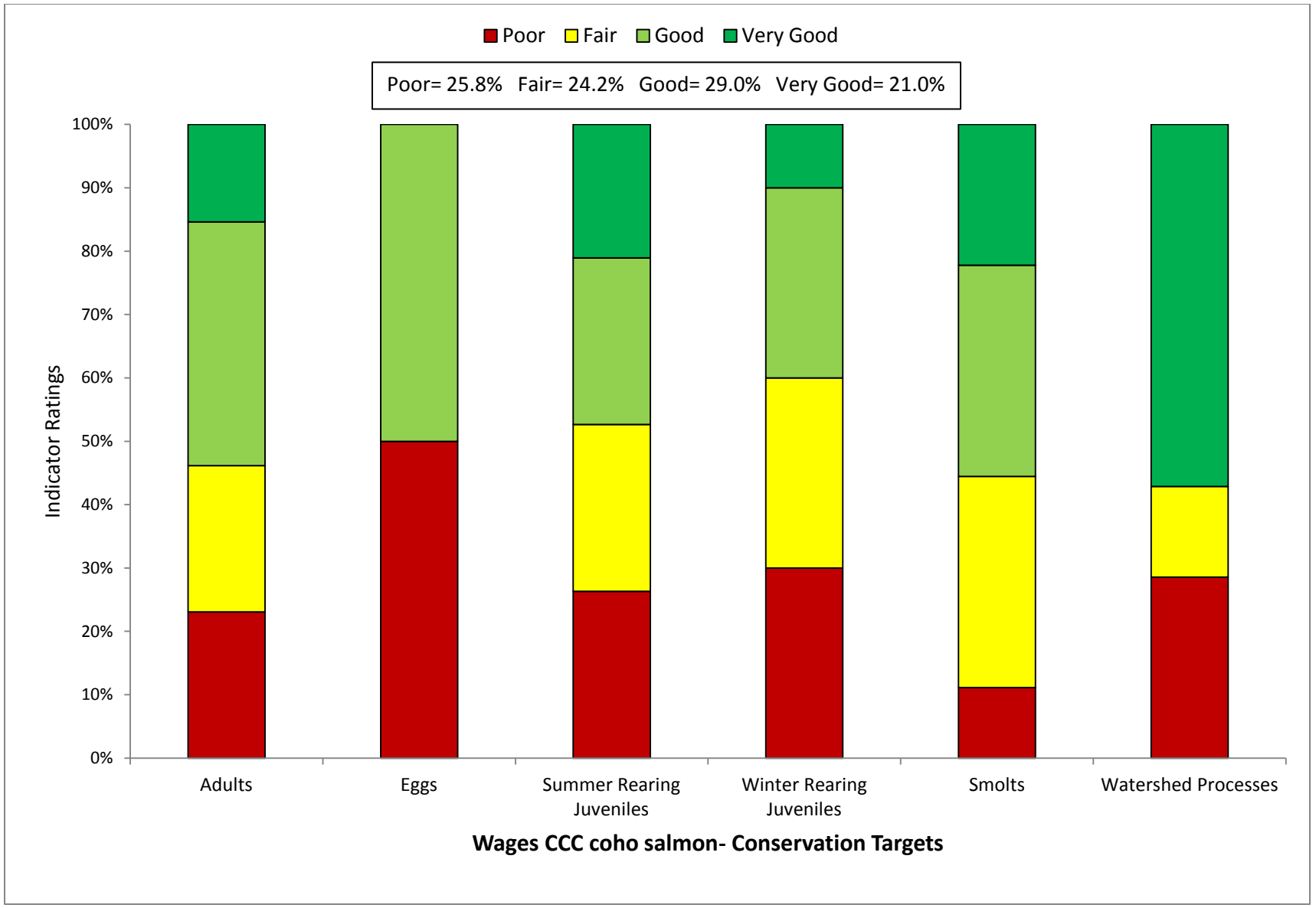


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Wages Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**<4 key pcs/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% by streams; 79% by IP-km (>30% Pools; >20% Riffles)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**50% streams; 79% IP-km (>80 stream average)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score = 35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**36% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**75% of IP-km to 90% of IP-km accessible**	Good	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**No Acute or Chronic**	Good	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score 35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score 35-50**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**0% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 key pcs/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**0% streams/ IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams; 79% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**50% streams; 79% IP-km (>80 stream average)**	Fair	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score 35-50**	Good	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score 35-50**	Good	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.02 Diversions/10 IP-km**	Fair	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**>90% of streams/ IP-km (>85% average stream canopy)**	Very Good	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**36% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**0% streams; 0% IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**>90% IP km (<16 C MWMT)**	Very Good	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**75-90% of Historical Range**	Good	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**<4 key pcs/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 to 1.3 Key Pieces/100m**	Fair	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**50% streams; 79% IP-km (>30% Pools; >20% Riffles)**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**50% streams; 79% IP-km (>80 stream average)**	Fair	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**100% of IP-km accessible**	Very Good	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**36% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**0% streams/IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**>80% Response Reach Connectivity**	Good	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**No Acute or Chronic**	Good	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**50% streams; 79% IP-km (>80 stream average)**	Fair	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**3.02 Diversions/10 IP-km**	Fair	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**NMFS Flow Protocol: Risk Factor Score 35-50**	Good	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**>90% of IP-km accessible**	Very Good	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**NMFS Flow Protocol: Risk Factor Score 35-50**	Very Good	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**No Acute or Chronic**	Good	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**75% to 90% of streams/ IP-km maintains severity score of 3 or lower**	Good	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.197% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**0% of Watershed in Agriculture**	Very Good	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**29% of Watershed in Timber Harvest**	Fair	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**<8% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**>75% Historical Species Composition**	Very Good	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**5.9 Miles/Square Mile**	Poor	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**5.7 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Wages Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	Low	Low	Medium	Low	Low	Low	Low
2	Channel Modification	Medium	Low	Medium	Low	Low	Low	Medium
3	Disease, Predation and Competition	Low	-	Medium	Low	Low	Low	Low
4	Fire, Fuel Management and Fire Suppression	Medium	Medium	High	Medium	Medium	Medium	High
5	Fishing and Collecting	Medium	-	Medium	-	Medium	-	Medium
6	Hatcheries and Aquaculture	-	-	-	-	-	-	-
7	Livestock Farming and Ranching	Low	Low	Medium	Low	Low	Low	Low
8	Logging and Wood Harvesting	Medium	Low	High	Medium	Medium	Medium	Medium
9	Mining	Low	Low	Medium	Low	Low	Low	Low
10	Recreational Areas and Activities	Low	Low	Medium	Low	Low	Low	Low
11	Residential and Commercial Development	Medium	Low	Medium	Low	Medium	Medium	Medium
12	Roads and Railroads	Medium	Medium	High	Medium	Medium	High	High
13	Severe Weather Patterns	Medium	Low	High	Medium	Medium	Medium	Medium
14	Water Diversion and Impoundments	Medium	Low	Medium	Low	Medium	Low	Medium
Threat Status for Targets and Project		Medium	Medium	High	Medium	Medium	High	High

Central CA Coast Coho Salmon ~ Wages Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

1.1.1. **Recovery Action:** Enhance and restore estuary function by improving complex habitat features.

1.1.1.1. **Action Step:** Evaluate feasibility of enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

2.1.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.1.1.1. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.1.1.2. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

3. **Restoration- Habitat Complexity**

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

3.1.1. **Recovery Action:** Increase LWD, primary pools and shelter ratings.

3.1.1.1. **Action Step:** Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.

3.1.1.2. **Action Step:** Install properly sized large woody debris to appropriate viability table targets.

3.1.1.3. **Action Step:** Allow trees in riparian areas to age, die, and recruit into the stream naturally.

4. **Restoration- Hydrology**

No species-specific actions were developed.

5. **Restoration- Landscape Patterns**

No species-specific actions were developed.

6. **Restoration- Passage**

No species-specific actions were developed.

7. **Restoration- Pool Habitat**

No species-specific actions were developed. See Habitat Complexity.

8. **Restoration- Riparian**

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Restore and expand riparian buffers to increase riparian canopy cover.

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Plant native vegetation in lower Wages and Rider Gulch to promote streamside shade.

8.1.2.2. **Action Step:** Conduct conifer release to promote growth of larger diameter trees where appropriate.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Reduce turbidity and suspended sediment

9.1.1.1. **Action Step:** Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).

9.1.2. **Recovery Action:** Improve instream gravel quality

9.1.2.1. **Action Step:** Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Re-establish a naturally reproducing run of coho salmon.

10.1.2. **Recovery Action:** Measure or estimate the condition of key attributes across the watershed.

10.1.2.1. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.1.3. **Recovery Action:** Measure or estimate response of key habitat attributes to recovery efforts across the watershed.

10.1.3.1. **Action Step:** Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.

10.2. **Objective:** Address other natural or manmade factors affecting the species' continued existence

10.2.1. **Recovery Action:** Increase spawner density

10.2.1.1. **Action Step:** Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.

11. Restoration- Water Quality

No species-specific actions were developed.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

No species-specific actions were developed.

13. Threat- Channel Modification

No species-specific actions were developed.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

15.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

15.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

15.1.1.1. **Action Step:** Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.

15.1.1.2. **Action Step:** Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.

15.1.2. **Recovery Action:** Prevent increased landscape disturbance

15.1.2.1. **Action Step:** In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.

15.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

15.1.3.1. **Action Step:** Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.

15.2. **Objective:** Address the inadequacy of existing regulatory mechanisms

15.2.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

15.2.1.1. **Action Step:** Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

No species-specific actions were developed.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

19.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

19.1.1.1. **Action Step:** Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.

19.1.2. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

19.1.2.1. **Action Step:** Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.

19.1.3. **Recovery Action:** Prevent impairment to instream substrate/food productivity (gravel quality and quantity)

19.1.3.1. **Action Step:** Protect headwater channels with larger buffers to minimize sediment delivery downstream.

19.1.3.2. **Action Step:** Wet weather and/or winter operations should be discouraged in areas with high erosion potential.

19.1.3.3. **Action Step:** Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.

19.1.4. **Recovery Action:** Prevent impairment to riparian

19.1.4.1. **Action Step:** Conserve and manage forestlands for older forest stages.

19.1.5. **Recovery Action:** Prevent increased landscape disturbance

19.1.5.1. **Action Step:** Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).

19.1.6. **Recovery Action:** Prevent future impairment to instream habitat complexity (reduced large wood and/or shelter)

19.1.6.1. **Action Step:** Allow trees in riparian areas to age, die, and recruit into the stream naturally.

19.2. **Objective:** Address the inadequacy of existing regulatory mechanisms.

19.2.1. **Recovery Action:** Prevent increased landscape disturbance

19.2.1.1. **Action Step:** Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).

19.2.1.2. **Action Step:** Discourage rezoning forestlands to rural residential or other land uses (e.g., vineyards).

19.2.1.3. **Action Step:** Reduce the amount and rate of even aged management.

19.2.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

19.2.2.1. **Action Step:** Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.

19.2.2.2. **Action Step:** Extend the monitoring period and upgrade THP road maintenance after harvest.

19.2.2.3. **Action Step:** Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

No species-specific actions were developed.

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate

23.1.1.1. **Action Step:** Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.2. **Action Step:** Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.

23.1.1.3. **Action Step:** Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).

23.1.1.4. **Action Step:** Establish adequate spoils storage sites throughout the watershed so materials from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

23.1.2.1. **Action Step:** Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.

23.1.3. **Recovery Action:** Prevent increased landscape disturbance

23.1.3.1. **Action Step:** Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas.

23.2. **Objective:** Address the inadequacy of existing regulatory mechanism

23.2.1. **Recovery Action:** Prevent impairment to instream substrate

23.2.1.1. **Action Step:** Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.

23.2.1.2. **Action Step:** Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.

23.2.1.3. **Action Step:** Licensed engineering geologists should review and approve grading on inner gorge slopes.

23.2.2. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

23.2.2.1. **Action Step:** Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to hydrology

24.1.1.1. **Action Step:** Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.

24.1.1.2. **Action Step:** CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.

24.1.1.3. **Action Step:** Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).

24.1.2. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

24.1.2.1. **Action Step:** Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.

24.1.3. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

24.1.3.1. **Action Step:** Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.

24.1.3.2. **Action Step:** Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.

25. Threat- Water Diversion/Impoundment

No species-specific actions were developed.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Wages Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-1.1	**Objective**	**Estuary**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
WagC-CCC-1.1.1	Recovery Action	Estuary	Enhance and restore estuary function by improving complex habitat features.										
WagC-CCC-1.1.1.1	Action Step	Estuary	Evaluate feasibility of enhancing the estuary with physical habitat improvement. Implement project if feasible and if determined to result in benefits to salmonid survival.	3	10	CA Coastal Commission, CDFG, Private Consultants, Private Landowners	136.50	136.50				273	The historical potential of the Wages Creek estuary to provide high quality rearing habitat is unknown. Due to the importance of estuaries for juvenile rearing (Bond et al. 2008), a thorough evaluation of the intrinsic potential of the estuary to provide necessary attributes for salmonid survival should occur to evaluate whether conditions could be improved. Due to various constraints, the overall habitat potential is likely relatively small. Cost based on evaluating estuarine habitat at a cost of $273,217/project..
WagC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
WagC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
WagC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	5	CDFG, Private Landowners, Trout Unlimited	112.00					112	Cost based on fish/habitat restoration monitoring at a cost of $111,192.
WagC-CCC-2.1.1.2	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	CDFG, Private Landowners, Trout Unlimited							Cost accounted for in delineate reaches possessing both winter rearing habitat and floodplain areas.
WagC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WagC-CCC-3.1.1	Recovery Action	Habitat Complexity	Increase LWD, primary pools and shelter ratings.										
WagC-CCC-3.1.1.1	Action Step	Habitat Complexity	Maintain current LWD, boulders, and other structure-providing features to maintain current stream complexity, pool frequency, and depth.	1	100	CalFire, CalTrans, Campbell Timberland Management, CDFG, Mendocino County, Private Landowners, RWQCB, USACE						In-Kind	Some landowners in the lower portions of Wages Creek may be concerned about potential property impacts associated with large wood materials adjacent to their infrastructure. This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-3.1.1.2	Action Step	Habitat Complexity	Install properly sized large woody debris to appropriate viability table targets.	2	10	CalFire, Campbell Timberland Management, CDFG, Private Landowners	50.00	50.00				100	Costs may be higher in Wages Creek than in some of the other watersheds in the Lost Coast Diversity Stratum due to the presence of rural residences in the lower portion of the watershed. Due to the presence of these structures, additional engineering may be required. Low gradient floodplain areas should be initially target for restoration. Cost based on treating 4 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile. If ELJ used in replacement of placing LWD, cost would be $404,480.
WagC-CCC-3.1.1.3	Action Step	Habitat Complexity	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, PG&E, Private Landowners, RPFs						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WagC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
WagC-CCC-8.1.1.1	Action Step	Riparian	Restore and expand riparian buffers to increase riparian canopy cover.	2	10	CalFire, Campbell Timberland Management, Private Landowners							Most of the Wages Creek watershed would benefit from improved riparian composition and structure, which would increase future LWD recruitment. General practices to improve riparian condition include initiating a conifer release program to promote existing conifer growth, and working with small landowners in the floodplain to increase riparian buffer widths and initiating planting of native vegetation. An immediate LWD supplementation program to enhance habitat complexity will likely be necessary due to the long period of time it may take for LWD to naturally recruit from existing riparian zones. Cost accounted for in other recovery actions.
WagC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
WagC-CCC-8.1.2.1	Action Step	Riparian	Plant native vegetation in lower Wages and Rider Gulch to promote streamside shade.	3	20	CDFG, NRCS, RWQCB	402.50	402.50	402.50	402.50		1,610	Cost based on planting 1 mile (assume 80 acres/mile in 5% High IP with 1 mile minimum) at a rate of $20,057/acre.
WagC-CCC-8.1.2.2	Action Step	Riparian	Conduct conifer release to promote growth of larger diameter trees where appropriate.	3	10	CalFire, Campbell Timberland Management, Private Landowners	57.00	57.00				114	Cost to treat 1 mile (assume 80 acres/mile in 15% High IP with a 1 mile minimum) at a rate of $1,422/acre.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WagC-CCC-9.1.1	Recovery Action	Sediment	Reduce turbidity and suspended sediment										
WagC-CCC-9.1.1.1	Action Step	Sediment	Where restricting winter access to unpaved roads is not feasible, encourage measures such as rocking to prevent sediment from reaching coho salmon streams (CDFG 2004).	3	10	CalFire, Campbell Timberland Management, Private Landowners, RWQCB							Minimal- difficult to estimate cost because assessments for the magnitude of the problem were not available. Additionally, many roads have been rocked - often through the timber harvest process - and these costs should be considered an ongoing operation expense.
WagC-CCC-9.1.2	Recovery Action	Sediment	Improve instream gravel quality										
WagC-CCC-9.1.2.1	Action Step	Sediment	Locations for sediment catchment basins should be identified, developed and maintained, where appropriate.	3	10	CalFire, Campbell Timberland Management, Private Landowners	50.00	50.00				100	This estimate was taken from the Ten Mile Creek watershed. Ongoing maintenance will likely occur as part of a yearly evaluation prior to the winter period. Maintenance costs were estimated at $10,000/yr.
WagC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WagC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
WagC-CCC-10.1.1.1	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon.	3	15	CDFG, Private Landowners						TBD	An effort to re-establish coho salmon in Wages Creek was attempted in the mid-1990's with juvenile planting in the early fall. Most of these fish were released in one or two locations in the lower watershed. No attempt was made to restore habitat conditions as part of this re-establishment effort. Limiting habitat conditions must be addressed prior to initiating future attempts at re-establishment. Fish should be released throughout the watershed and not just one or two locations.
WagC-CCC-10.1.2	Recovery Action	Viability	Measure or estimate the condition of key attributes across the watershed.										
WagC-CCC-10.1.2.1	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	15	CalFire, Campbell Timberland Management, CDFG, Private Landowners						In-Kind	A large proportion of the watershed has likely been habitat typed by Campbell Timberland Mgt. New habitat assessment methods may have future (unknown) costs.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-10.1.3	Recovery Action	Viability	Measure or estimate response of key habitat attributes to recovery efforts across the watershed.										
WagC-CCC-10.1.3.1	Action Step	Viability	Implement a monitoring program to evaluate the performance of recovery efforts. Core areas should have the highest priority for a site-based assessment; adapt the strategies for restoration and threat abatement to address site-based issues identified by the watershed assessments.	3	10	CalFire, Campbell Timberland Management, CDFG, Private Landowners	56.00	56.00				112	Cost based on fish/habitat restoration effectiveness monitoring estimated at $111,195/project..
WagC-CCC-10.2	**Objective**	**Viability**	**Address other natural or manmade factors affecting the species' continued existence**										
WagC-CCC-10.2.1	Recovery Action	Viability	Increase spawner density										
WagC-CCC-10.2.1.1	Action Step	Viability	Establish release imprinting stations, and other smolt release streams, so that smolts can be held for a minimum two week period prior to release. The holding period should allow for imprinting to occur on the parent release stream, increasing the potential for returns as adults which spawn naturally.	3	15	CDFG, Private Landowners						TBD	Identify suitable imprinting stations and annual availability of smolts.
WagC-CCC-15.1	**Objective**	**Fire/Fuel Management**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WagC-CCC-15.1.1	Recovery Action	Fire/Fuel Management	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WagC-CCC-15.1.1.1	Action Step	Fire/Fuel Management	Implement sediment reduction techniques in concert with prescribed fire techniques to minimize sediment impacts to various coho salmon life stages.	2	100	CalFire, Campbell Timberland Management						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-15.1.1.2	Action Step	Fire/Fuel Management	Reduce erosion from fire prevention or suppression activities by maintaining existing natural topography to the extent possible.	2	100	CalFire, Campbell Timberland Management						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-15.1.2	Recovery Action	Fire/Fuel Management	Prevent increased landscape disturbance										
WagC-CCC-15.1.2.1	Action Step	Fire/Fuel Management	In the event of a wildfire, CalFire Resource Advisors should contact the resource agencies for ESA consultation (or technical assistance) about the incident.	3	100	CalFire, CDFG, NMFS, USFWS						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-15.1.3	Recovery Action	Fire/Fuel Management	Prevent impairment to stream hydrology (impaired water flow)										
WagC-CCC-15.1.3.1	Action Step	Fire/Fuel Management	Draft water from lakes, ponds, and reservoirs not occupied by listed salmonids when possible. In fish-bearing streams, excavate active channel areas outside of wetted width to create off-stream pools for water source.	3	100	CalFire, Campbell Timberland Management						In-Kind	Require all water truck/tenders be fitted with DFG and NMFS approved fish screens when water is acquired at fish bearing streams. Put up a silt fence or other erosion controls around the water extraction locations. Attempt to avoid significantly lowering stream flows during water drafting.
WagC-CCC-15.2	**Objective**	**Fire/Fuel Management**	**Address the inadequacy of existing regulatory mechanisms**										
WagC-CCC-15.2.1	Recovery Action	Fire/Fuel Management	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WagC-CCC-15.2.1.1	Action Step	Fire/Fuel Management	Disseminate NMFS' October 9, 2007, jeopardy biological opinion on the use of fire retardants and its impacts to salmonids, to local firefighting agencies and CalFire.	2	1	CalFire, NMFS							
WagC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WagC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WagC-CCC-19.1.1.1	Action Step	Logging	Timber harvest planning should evaluate and avoid or minimize adverse impacts to offchannel habitats, floodplains, ponds, and oxbows.	1	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to stream hydrology (impaired water flow)										
WagC-CCC-19.1.2.1	Action Step	Logging	Evaluate road surface treatment options to halt or minimize impacts from water drafting and diversion during droughts and summer low flow periods.	3	10	CalFire, Campbell Timberland Management, CDFG, RWQCB							Cost cannot be determined until the feasibility of road surface treatments account for number of miles to be treated.
WagC-CCC-19.1.3	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (gravel quality and quantity)										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-19.1.3.1	Action Step	Logging	Protect headwater channels with larger buffers to minimize sediment delivery downstream.	2	100	CalFire, California Geological Survey, Campbell Timberland Management, Private Landowners						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-19.1.3.2	Action Step	Logging	Wet weather and/or winter operations should be discouraged in areas with high erosion potential.	2	100	CalFire, CDFG, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-19.1.3.3	Action Step	Logging	Encourage tree retention on the axis of headwall swales. Any deviations should be reviewed and receive written approval by a licensed engineering geologist.	3	100	CalFire, Campbell Timberland Management, CDFG, Private Landowners, RPFs, RWQCB						In-Kind	
WagC-CCC-19.1.4	Recovery Action	Logging	Prevent impairment to riparian										
WagC-CCC-19.1.4.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	
WagC-CCC-19.1.5	Recovery Action	Logging	Prevent increased landscape disturbance										
WagC-CCC-19.1.5.1	Action Step	Logging	Encourage low impact timber harvest techniques such as full-suspension cable yarding (to improve canopy cover; reduce sediment input, etc.).	2	25	CalFire, Campbell Timberland Management, CDFG, Private Landowners, RPFs, RWQCB						In-Kind	This recommendation should be considered standard practice.
WagC-CCC-19.1.6	Recovery Action	Logging	Prevent future impairment to instream habitat complexity (reduced large wood and/or shelter)										
WagC-CCC-19.1.6.1	Action Step	Logging	Allow trees in riparian areas to age, die, and recruit into the stream naturally.	2	100	CalFire, Campbell Timberland Management, Private Landowners						In-Kind	
WagC-CCC-19.2	**Objective**	**Logging**	**Address the inadequacy of existing regulatory mechanisms.**										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-19.2.1	Recovery Action	Logging	Prevent increased landscape disturbance										
WagC-CCC-19.2.1.1	Action Step	Logging	Discourage home building or other incompatible land use in areas identified as timber production zones (TPZ).	1	100	CalFire, Campbell Timberland Management, Mendocino County, Private Landowners						In-Kind	Illegal marijuana cultivation may occur in some areas and have the potential to severely degrade juvenile rearing conditions by diverting water and introducing toxic quantities of fertilizers and pesticides into the stream environment. Increased anthropogenic interface with forested lands will likely lead to increases in these activities.
WagC-CCC-19.2.1.2	Action Step	Logging	Discourage rezoning forestlands to rural residential or other land uses (e.g., vineyards).	1	100	CalFire, Mendocino County, Private Landowners						In-Kind	
WagC-CCC-19.2.1.3	Action Step	Logging	Reduce the amount and rate of even aged management.	2	40	CalFire, Campbell Timberland Management, CDFG, Private Landowners, RPFs, RWQCB							
WagC-CCC-19.2.2	Recovery Action	Logging	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WagC-CCC-19.2.2.1	Action Step	Logging	Map unstable soils and use that information to guide land use decisions, road design, THPs, and other activities that can promote erosion.	2	10	CalFire, California Geological Survey, Campbell Timberland Management, RPFs	35.00	35.00				70	Cost based on sediment assessment for 6,438 acres (assume 75% of total watershed acres) at a cost of $10.70/acre. Cost may be lower if incorporated into other recover action recommendations.
WagC-CCC-19.2.2.2	Action Step	Logging	Extend the monitoring period and upgrade THP road maintenance after harvest.	3	20	CalFire, Campbell Timberland Management, CDFG, Private Landowners, RPFs, RWQCB							
WagC-CCC-19.2.2.3	Action Step	Logging	Discourage all activities (e.g., roads, harvest, yarding, etc.) in unstable areas (e.g., steep slopes, headwall swales, inner gorges, streambanks, etc.) unless a detailed geological assessment is performed by a certified engineering geologist that shows there is no potential for increased sediment delivery to a watercourse.	2	100	CalFire, California Geological Survey, Campbell Timberland Management, CDFG, Private Landowners, RPFs, RWQCB						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WagC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
WagC-CCC-23.1.1.1	Action Step	Roads/Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	2	100	Campbell Timberland Management, Mendocino County, Private Landowners						TBD	Legacy roads from past logging activity continue to impact the Wages watershed. Road densities are high throughout the watershed and are estimated at 4.1 miles of road per square mile overall and at 5.3 miles per square mile in riparian areas. Many of these roads were poorly situated and constructed , not properly maintained, and many have been abandoned.
WagC-CCC-23.1.1.2	Action Step	Roads/Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized individuals and impacting uses to decrease fine sediment loads.	3	100	CalFire, Campbell Timberland Management, Private Landowners							
WagC-CCC-23.1.1.3	Action Step	Roads/Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (CDFG 2004).	3	20	CalFire, Campbell Timberland Management, RWQCB							Abandoned riparian roads in the upper portion of mainstem Wages should be closely evaluated for decommissioning. The original old growth forest of Wages Creek has been completely removed, aside from some scattered residual trees. The final removal occurred relatively recently, compared to many of the other watersheds in coastal Mendocino County (largely between the late 1950s and early 1980s). The mechanized removal practices left an extensive and inadequately maintained road network that continues to contribute sediment to the watercourses. The alteration of sediment transport will likely continue to affect multiple life stages of CCC coho salmon in the watershed. Cost accounted for in other recovery actions.
WagC-CCC-23.1.1.4	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so materials from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3	10	CalFire, Campbell Timberland Management, Private Landowners, RWQCB							
WagC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to watershed hydrology										

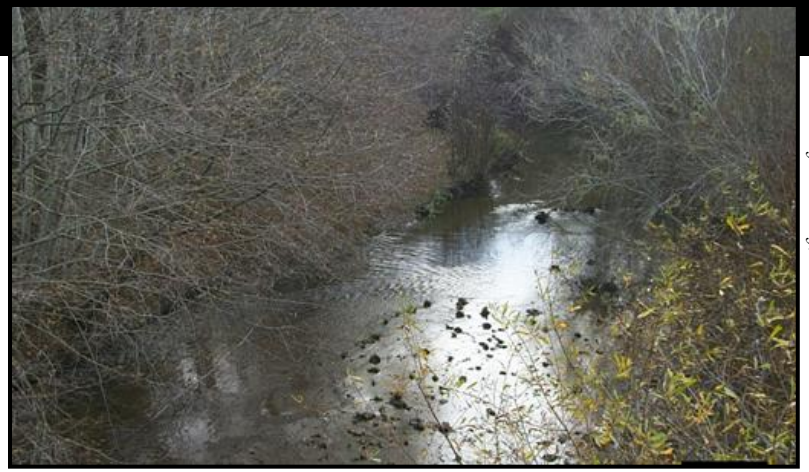
Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-23.1.2.1	Action Step	Roads/Railroads	Size culverts to accommodate flashy, debris-laden flows and maintain trash racks to prevent culvert plugging and subsequent road failure.	2	25	CalFire, Campbell Timberland Management, Private Landowners							
WagC-CCC-23.1.3	Recovery Action	Roads/Railroads	Prevent increased landscape disturbance										
WagC-CCC-23.1.3.1	Action Step	Roads/Railroads	Reduce road densities by 10 percent over the next 20 years, prioritizing high risk areas.	3	40	CalFire, Campbell Timberland Management, CDFG, Private Landowners						TBD	Initial focus should be directed in steeper portions of the upper watershed. Active and abandoned logging roads and skid trials exist throughout the basin and likely contribute large volumes of sediment. Many logging roads have been upgraded to modern standards, but substantial work remains before this significant sediment source is thoroughly addressed. Chronic sediment input from roads is likely a major limiting factor to overall habitat quality. This is a feasible recommendation for the Wages Creek watershed due to the fact most of the watershed is in timber management and owned by only a few landowners. The program should include a component that closes and remediates unnecessary roads and skid trails, lowering the overall road density in the watershed. Including road remediation within future timber harvest plans should be considered a top mitigation priority. Indiscriminate road density reduction should be avoided so as not to preclude inhibiting future road realignments that could also effectively reduce sediment delivery.
WagC-CCC-23.2	**Objective**	**Roads/Railroads**	**Address the inadequacy of existing regulatory mechanism**										
WagC-CCC-23.2.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate										
WagC-CCC-23.2.1.1	Action Step	Roads/Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	2	100	CalFire, Campbell Timberland Management, Private Landowners							This is part of ongoing maintenance requirements. Correct conditions that are likely to deliver sediment to streams, otherwise roads will be hydrologically closed/disconnected (fills and culverts removed, natural hydrology of hillslope largely restored).
WagC-CCC-23.2.1.2	Action Step	Roads/Railroads	Fully maintain all roads with inside ditches unless these roads have been properly decommissioned. All roads with inside ditches should be evaluated, and problems addressed, prior to the winter season.	2	100	CalFire, Campbell Timberland Management, Private Landowners							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-23.2.1.3	Action Step	Roads/Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	100	CalFire, California Geological Survey, Campbell Timberland Management, Private Landowners							
WagC-CCC-23.2.2	Recovery Action	Roads/Railroads	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WagC-CCC-23.2.2.1	Action Step	Roads/Railroads	Avoid new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	2	20	CalFire, California Geological Survey, Campbell Timberland Management, CDFG, Mendocino County, RWQCB							
WagC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WagC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to hydrology										
WagC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Identify and work with water users to minimize depletion of summer base flows from unauthorized water uses.	1	20	CDFG, Private Landowners, SWRCB							
WagC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	CDFG, SWRCB, RWQCB, CalFire, and other agencies and landowners, in cooperation with NMFS, should evaluate the rate and volume of water drafting for dust control in streams or tributaries and where appropriate, minimize water withdrawals that could impact coho salmon.	3	10	CalFire, Campbell Timberland Management, CDFG, Private Landowners, RWQCB, SWRCB						In-Kind	These agencies should consider existing regulations or other mechanisms when evaluating alternatives to water as a dust palliative (including EPA-certified compounds) that are consistent with maintaining or improving water quality. This recommendation should be considered standard practice.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WagC-CCC-24.1.1.3	Action Step	Severe Weather Patterns	Pursue opportunities to acquire or lease water, or acquire water rights from willing sellers, for coho salmon recovery purposes. Develop incentives for water right holders to dedicate instream flows for the protection of coho salmon (CDFG 2004)(Water Code § 1707).	3	20	CDFG, NOAA RC, Private Landowners						TBD	The price at which water is sold on environmental markets is determined by negotiations between landowners and purchasing entity. Cost will vary depending on water availability and landowner participation. It is unknown if this program will gain widespread acceptance in the watershed and therefore costs cannot be estimated. It is recommended that the equations used in the State Coho Plan for socioeconomic cost be utilized when more information regarding landowner participation is gathered.
WagC-CCC-24.1.2	Recovery Action	Severe Weather Patterns	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WagC-CCC-24.1.2.1	Action Step	Severe Weather Patterns	Protect high-risk shallow-seeded landslide areas and surfaces prone to erosion from being mobilized by intense storm events.	2	100	CalFire, California Geological Survey, Campbell Timberland Management, RWQCB							These areas should be identified and efforts should be made to minimize disturbance leading to increased risk of mobilization. An inventory of high-risk shallow-seeded landslide areas needs to be conducted to prioritize and develop costs for treatment.
WagC-CCC-24.1.3	Recovery Action	Severe Weather Patterns	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WagC-CCC-24.1.3.1	Action Step	Severe Weather Patterns	Adopt a policy of "managed retreat" (removal of problematic infrastructure and replacement with native vegetation or flood tolerant land uses) for areas highly susceptible to, or previously damaged from, flooding.	2	30	CalFire, Campbell Timberland Management, FEMA, Mendocino County						In-Kind	
WagC-CCC-24.1.3.2	Action Step	Severe Weather Patterns	Design new development to allow streams to meander in historical patterns. Protecting riparian zones and their floodplains or channel migration zones averts the need for bank erosion control in most situations.	1	100	CalFire, Campbell Timberland Management, Mendocino County, Private Landowners						In-Kind	This recommendation should be considered standard practice.

Walker Creek

Location	•Sonoma County
Watershed Area	•75.0 Square Miles
Potential Habitat	•67.6 Stream Miles
Vegetation	•24% Riparian or Montane Forest, 61% Grassland
Erodability	•Low to Moderate
Ownership Patterns	•96% Private, 4% Public
Dominant Land Uses	•Livestock
Housing Density	•Low
TMDL Pollutants	•Sediment, Nutrients, Pathogens, Metals



Walker Creek
Photo by Bob Coey, NMFS

Walker Creek Coho Salmon: Nearly Extirpated

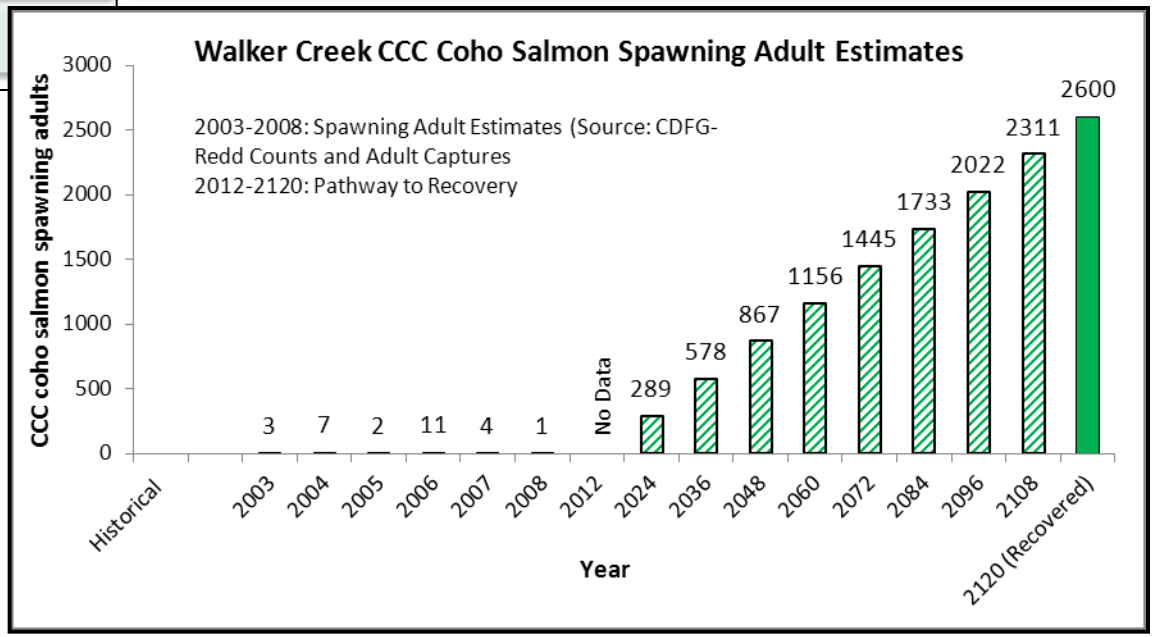
Recovery Goals

- ✓ Continue operation of the Captive Broodstock Program, including use of rescued fish
- ✓ Expand fish and habitat monitoring programs

Walker Creek Adult Spawner Targets

Downlisting to Threatened
1,300

Recovery
2,600



STEELHEAD: YES
CHINOOK SALMON: NO

Walker Creek

Potential Habitat: 67.6 miles
Recovery Target: 2,600 Spawning Adult Coho Salmon

Current Instream, Watershed and Population Conditions

Estuary/Lagoon	Habitat Complexity	Hydrology	Passage & Migration	Riparian Vegetation	Sediment	Stream Temperature	Velocity Refuge	Water Quality	Viability	Landscape Patterns
FAIR	POOR	FAIR	FAIR	POOR	POOR	POOR	POOR	POOR	POOR	GOOD

Preventing Extinction & Improving Conditions

Priority 1: Immediate Restoration Actions

- Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds
- Implement exclusion fencing and replant native riparian species and native conifers/hardwoods throughout riparian zones
- Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock for Russian River, Walker and Salmon Creeks.
- Minimize departure from the genetic profile that historically existed in the population

Priority 2 & 3: Long-Term Restoration Actions

- Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay
- Restore estuarine wetlands and sloughs, replant native riparian vegetation
- Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats, and complex habitat features
- Conduct instream and upslope sediment source surveys to identify and remediate existing sources of high sediment yield
- Identify and provide solutions for point and non-point sources contributing to toxicity and turbidity

Recovery Partners

Photo courtesy from left to right: Josh Fuller, NMFS, Campbell Timberland, Gualala River Watershed Council, Eli Asarian and Morgan Bond, SWFSC

Walker Creek

Potential Habitat: 67.6 miles
Recovery Target: 2,600 Spawning Adult Coho Salmon

Future Threats

Agriculture	Channel Modification	Disease & Predation	Fire & Fuel Management	Fishing & Collecting	Hatcheries & Aquaculture	Livestock & Ranching	Logging	Mining	Recreation	Urban Development	Roads & Railroads	Severe Weather	Diversions & Impoundment
VERY HIGH	MEDIUM	MEDIUM	LOW	LOW	LOW	VERY HIGH	LOW	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	HIGH

Reducing Future Threats

Priority 1: Immediate Threat Abatement Actions

- Promote off-channel storage to reduce impacts of water diversion
- Develop off-channel watering facilities for livestock
- Minimize impacts to riparian habitat and water quality from livestock
- Ensure livestock crossings avoid streams

Priority 2 & 3: Long-Term Threat Abatement Actions

- Ensure adequate "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) are available prior to diverting stream flows
- Upgrade existing crossings (bridges, culverts, fills, and other crossings) to accommodate 100-year flood flows
- Identify and remediate upstream pollution sources contributing to poor water quality conditions in the estuary
- Adequately screen water diversions to prevent juvenile salmonid mortalities

Streambank restoration on Walker Creek
Photo by Bob Coey, NMFS

Conservation Highlights

- Coho salmon from broodstock programs were released into the watershed
- Erosion control efforts are taking place to control sediment in the watershed
- Dairy and farming Best Management Practices have been developed and implemented in the Walker Creek Watershed

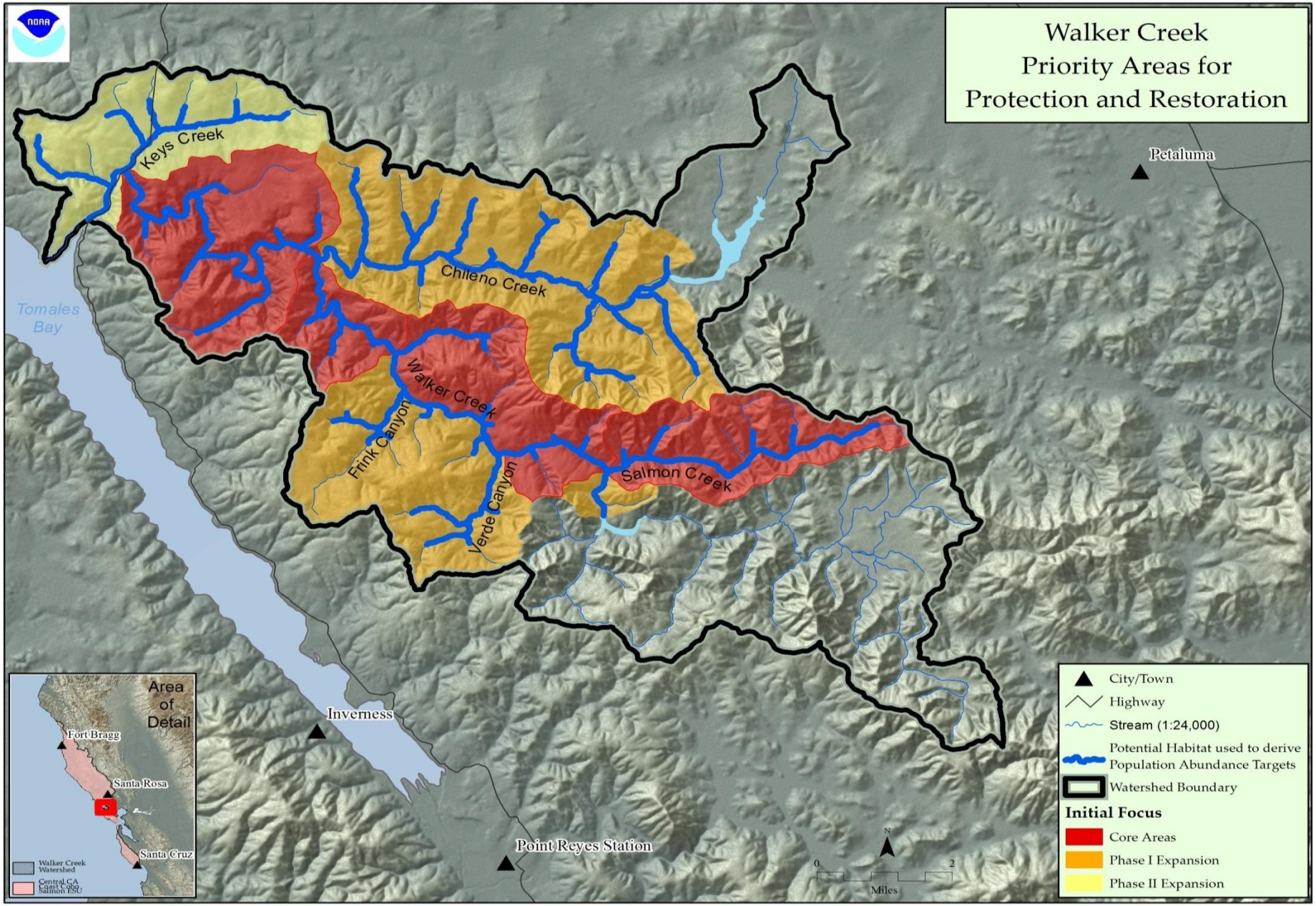


Figure 1: Map of Walker Creek

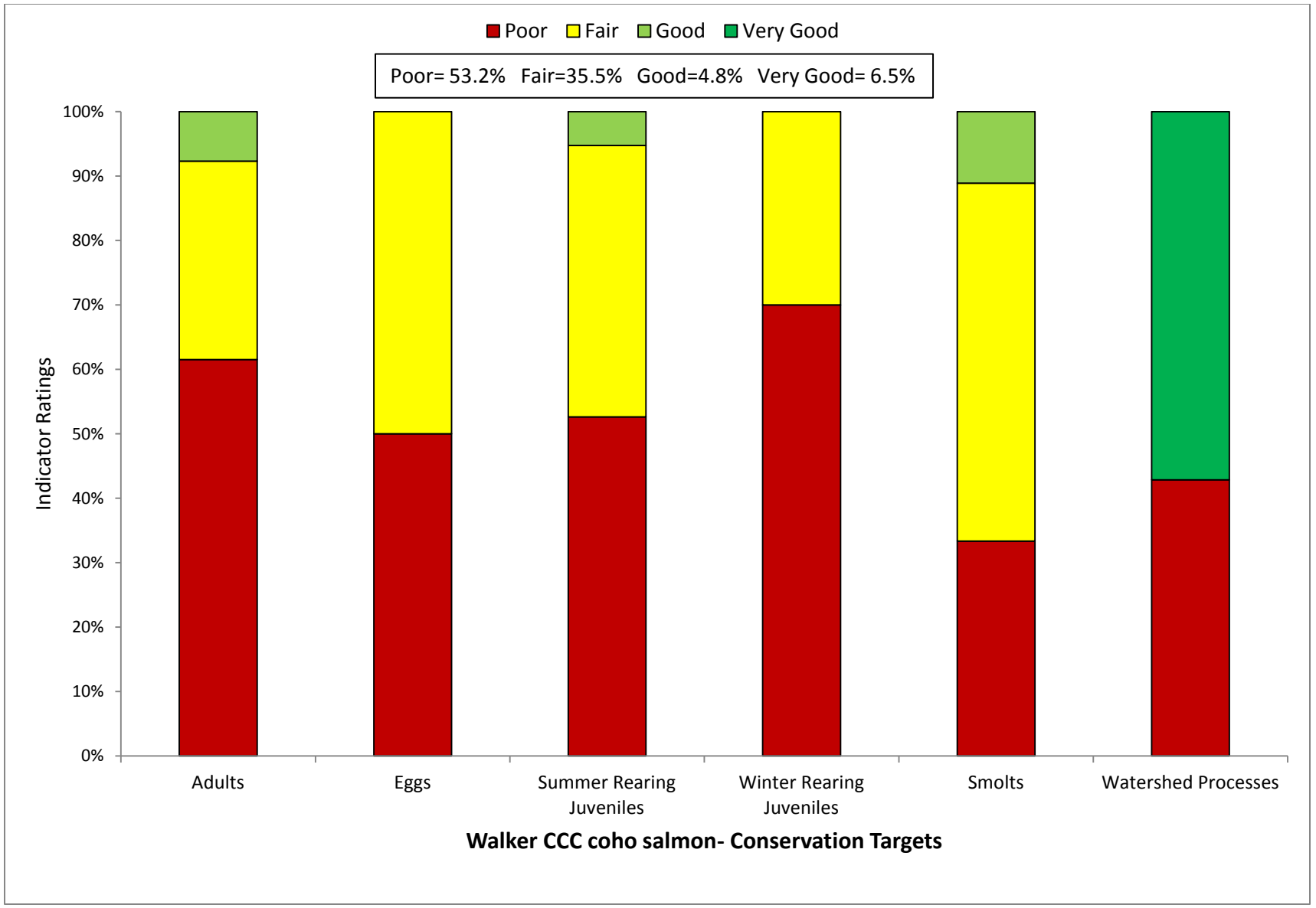


Figure 2: Viability Results by Lifestage

Table 1: CAP Viability Results ~ Walker Creek

Target	Attribute	Indicator	Result	Rating	Method	Desired Criteria
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	**0.2 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	6 to 11 key pcs/100m
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Expert Estuary/Lagoon Panel	1.3 to 4 Key Pieces/100 meters
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**0% streams 0 % IP-km (>30% Pools; >20% Riffles)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Adults	Habitat Complexity	Shelter Rating	**0% streams 0 % IP-km (>80 stream average)**	Poor	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>80 stream average)
Adults	Hydrology	Passage Flows	**Risk Factor Score =42**	Good	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Adults	Passage/Migration	Passage at Mouth or Confluence	**70% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Passage/Migration	Physical Barriers	**70% of IP-km accessible**	Fair	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	SEC Analysis/CDFG Data	55 - 69% Class 5 & 6 across IP-km
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Adults	Sediment	Quantity & Distribution of Spawning Gravels	**<50% of IP-km accessible**	Poor	SEC Analysis/CDFG Data	75% of IP-Km to 90% of IP-km
Adults	Velocity Refuge	Floodplain Connectivity	**50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Adults	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	SEC Analysis/CDFG Data	No Acute or Chronic
Adults	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Adults	Viability	Density	**<1 spawner per IP-km**	Poor	SEC Analysis/CDFG Data	low risk spawner density per Spence (2008)
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50
Eggs	Hydrology	Redd Scour	**Risk Factor Score =58**	Fair	SEC Analysis/CDFG Data	NMFS Flow Protocol: Risk Factor Score 35-50

Eggs	Sediment	Gravel Quality (Bulk)	**>17% (0.85mm) and >30% (6.4mm)**	Poor	NMFS Instream Flow Analysis	12-14% (0.85mm) and <30% (6.4mm)
Eggs	Sediment	Gravel Quality (Embeddedness)	**0% streams 0 % IP-km (>50% stream average scores of 1 & 2)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	NMFS Instream Flow Analysis	Properly Functioning Condition
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.2 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	6 to 11 key pcs/100m
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Instream Flow Analysis	1.3 to 4 Key Pieces/100 meters
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	**<50% of streams/ IP-km (>49% of pools are primary pools)**	Poor	NMFS Instream Flow Analysis	75% to 89% of streams/ IP-Km (>49% of pools are primary pools)
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**0% streams 0 % IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams 0 % IP-km (>80 stream average)**	Poor	NMFS Instream Flow Analysis	75% to 90% of streams/ IP-Km (>80 stream average)
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	**Risk Factor Score =83**	Poor	NMFS Instream Flow Analysis	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	**Risk Factor Score =58**	Fair	NMFS Watershed Characterization	NMFS Flow Protocol: Risk Factor Score 35-50
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.58 Diversions/10 IP-km**	Good	NMFS Watershed Characterization	0.01 - 1 Diversions/10 IP km
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	NMFS Watershed Characterization	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	**70% of IP-km accessible**	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	**67% of IP-km (>85% average stream canopy)**	Fair	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>85% average stream canopy)
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC or PAD/CDFG Data	≥80% Density rating "D" across IP-km
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**0% streams 0 % IP-km (>50% stream average scores of 1 & 2)**	Poor	SEC or PAD/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)

Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	**40% IP-km (<16 C MWMT)**	Poor	Population Profile/BPJ	75 to 89% IP km (<16 C MWMT)
Summer Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization/CWHR	No Acute or Chronic
Summer Rearing Juveniles	Water Quality	Turbidity	**50% to 74% of streams/ IP-km maintains severity score of 3 or lower**	Fair	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Summer Rearing Juveniles	Viability	Density	**<0.2 fish/meter^2**	Poor	SEC Analysis/CDFG Data	0.5 - 1.0 fish/meter^2
Summer Rearing Juveniles	Viability	Spatial Structure	**72% of Historical Range**	Fair	NMFS Watershed Characterization/CWHR	75-90% of Historical Range
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	**0.2 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	6 to 11 key pcs/100m
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	**<1 Key Pieces/100m**	Poor	NMFS Watershed Characterization/CWHR	1.3 to 4 Key Pieces/100 meters
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	**0% streams 0 % IP-km (>30% Pools; >20% Riffles)**	Poor	NMFS Watershed Characterization/CWHR	75% to 90% of streams/ IP-Km (>30% Pools; >20% Riffles)
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	**0% streams 0 % IP-km (>80 stream average)**	Poor	CDF Vegetation Maps/BPJ	75% to 90% of streams/ IP-Km (>80 stream average)
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	**70% of IP-km accessible**	Fair	Population Profile/BPJ	75% of IP-Km to 90% of IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	**0% Class 5 & 6 across IP-km**	Poor	Population Profile/BPJ	55 - 69% Class 5 & 6 across IP-km
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	**NA**	0	SEC Analysis/CDFG Data	≥80% Density rating "D" across IP-km
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	**50% to 74% of streams/ IP-km (>50% stream average scores of 1 & 2)**	Fair	SEC Analysis/CDFG Data	75% to 90% of streams/ IP-Km (>50% stream average scores of 1 & 2)
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	**50% Response Reach Connectivity**	Poor	SEC Analysis/CDFG Data	>80% Response Reach Connectivity
Winter Rearing Juveniles	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	NMFS Watershed Characterization	No Acute or Chronic
Winter Rearing Juveniles	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	NMFS Watershed Characterization	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower

Smolts	Estuary/Lagoon	Quality & Extent	**Impaired but functioning**	Fair	SEC Analysis/CDFG Data	Properly Functioning Condition
Smolts	Habitat Complexity	Shelter Rating	**0% streams 0 % IP-km (>80 stream average)**	Poor	Population Profile	75% to 90% of streams/ IP-Km (>80 stream average)
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	**0.58 Diversions/10 IP-km**	Good	Population Profile	0.01 - 1 Diversions/10 IP km
Smolts	Hydrology	Passage Flows	**Risk Factor Score =58**	Fair	TRT Spence (2008)	NMFS Flow Protocol: Risk Factor Score 35-50
Smolts	Passage/Migration	Passage at Mouth or Confluence	**50% of IP-km to 74% of IP-km accessible**	Fair	TRT Spence (2008)	75% of IP-Km to 90% of IP-km
Smolts	Smoltification	Temperature	**50-74% IP-km (>6 and <16 C)**	Fair	TRT Spence (2008)	75-90% IP-Km (>6 and <16 C)
Smolts	Water Quality	Toxicity	**Sublethal or Chronic**	Fair	TRT Spence (2008)	No Acute or Chronic
Smolts	Water Quality	Turbidity	**<50% of streams/ IP-km maintains severity score of 3 or lower**	Poor	EPA/RWQCB/NMFS Criteria	75% to 90% of streams/ IP-Km maintains severity score of 3 or lower
Smolts	Viability	Abundance	**Abundance leading to high risk spawner density = 0**	Poor	Newcombe and Jensen 2003	Smolt abundance to produce low risk spawner density per Spence (2008)
Watershed Processes	Hydrology	Impervious Surfaces	**0.16% of Watershed in Impervious Surfaces**	Very Good	SEC Analysis	3-6% of Watershed in Impervious Surfaces
Watershed Processes	Landscape Patterns	Agriculture	**>30% of Watershed in Agriculture**	Poor	EPA/RWQCB/NMFS Criteria	10-19% of Watershed in Agriculture
Watershed Processes	Landscape Patterns	Timber Harvest	**<15% of Watershed in Timber Harvest**	Very Good	Newcombe and Jensen 2003	25-15% of Watershed in Timber Harvest
Watershed Processes	Landscape Patterns	Urbanization	**1% of watershed >1 unit/20 acres**	Very Good	EPA/RWQCB/NMFS Criteria	8-11% of watershed >1 unit/20 acres
Watershed Processes	Riparian Vegetation	Species Composition	**<25% Historical Species Composition**	Poor	Newcombe and Jensen 2003	51-74% Intact Historical Species Composition
Watershed Processes	Sediment Transport	Road Density	**1.3 Miles/Square Mile**	Very Good	EPA/RWQCB/NMFS Criteria	1.6 to 2.4 Miles/Square Mile
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	**3 Miles/Square Mile**	Poor	Newcombe and Jensen 2003	0.1 to 0.4 Miles/Square Mile

Table 2: CAP Threats Results ~ Walker Creek

Threats Across Targets		Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Watershed Processes	Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	
1	Agriculture	High	High	Very High	High	High	High	Very High
2	Channel Modification	Medium	Medium	Medium	Medium	Medium	Medium	Medium
3	Disease, Predation and Competition	Medium	-	Medium	Low	Medium	Medium	Medium
4	Fire, Fuel Management and Fire Suppression	Low	Low	Low	Low	Low	Medium	Low
5	Fishing and Collecting	Medium	-	-	-	-	-	Low
6	Hatcheries and Aquaculture	Medium	-	-	-	-	-	Low
7	Livestock Farming and Ranching	High	Very High	Very High	High	High	High	Very High
8	Logging and Wood Harvesting	Low	Low	Medium	Low	Low	Low	Low
9	Mining	Medium	Medium	Medium	Low	Medium	Medium	Medium
10	Recreational Areas and Activities	Medium	Medium	Medium	Low	Low	Medium	Medium
11	Residential and Commercial Development	High	High	High	Medium	High	High	High
12	Roads and Railroads	High	High	Medium	High	Medium	High	High
13	Severe Weather Patterns	Medium	High	High	High	High	High	High
14	Water Diversion and Impoundments	High	Medium	High	Medium	High	Medium	High
Threat Status for Targets and Project		Very High	Very High	Very High	High	High	Very High	Very High

Central CA Coast Coho Salmon ~ Walker Creek

ACTIONS FOR RESTORING HABITATS

1. **Restoration- Estuary**

1.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

1.1.1. **Recovery Action:** Implement estuary protection and enhancement measures to restore estuary to properly functioning conditions.

1.1.1.1. **Action Step:** Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary

1.1.1.2. **Action Step:** Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements

1.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

1.2.1. **Recovery Action:** Increase the extent of estuarine habitat

1.2.1.1. **Action Step:** Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay (CDFG 2004).

1.2.1.2. **Action Step:** Per a completed limiting factors assessment, and utilizing adaptive management guidelines, develop restoration projects in areas which have high value physical and chemical properties for rearing salmonids

1.2.1.3. **Action Step:** Evaluate alterations to river mouth dynamics and implement changes to restore natural function

1.2.2. **Recovery Action:** Improve the quality of each estuarine habitat zone

1.2.2.1. **Action Step:** Restore estuarine wetlands and sloughs, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.

1.2.3. **Recovery Action:** Improve the quality of each estuarine habitat zones (see WQ parameters)

1.2.3.1. **Action Step:** Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary

1.2.3.2. **Action Step:** Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen)

2. **Restoration- Floodplain Connectivity**

2.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

2.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity.

2.1.1.1. **Action Step:** Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.

2.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

2.2.1. **Recovery Action:** Rehabilitate and enhance floodplain connectivity

2.2.1.1. **Action Step:** Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.

2.2.2. **Recovery Action:** Increase and enhance velocity refuge

2.2.2.1. **Action Step:** Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).

2.2.2.2. **Action Step:** Delineate reaches possessing both potential winter rearing habitat and floodplain areas.

2.2.2.3. **Action Step:** Identify areas where floodplain connectivity can be re-established in low gradient response reaches of Walker Creek. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats.

2.2.2.4. **Action Step:** Support landowners and the Marin RCD in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).

3. Restoration- Habitat Complexity

3.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

3.1.1. **Recovery Action:** Improve habitat complexity

3.1.1.1. **Action Step:** Conduct habitat assessment in Keys Creek

3.1.1.2. **Action Step:** Utilize recommendations to prioritize reaches for habitat improvement

3.1.2. **Recovery Action:** Improve pool:riffle:flatwater ratio

3.1.2.1. **Action Step:** Increase the frequencies of riffles in 55% of the streams within the watershed

3.1.2.2. **Action Step:** Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Chilen, Salmon and Walker Creek

3.1.3. **Recovery Action:** Improve large wood frequency

3.1.3.1. **Action Step:** Increase large wood frequency in 75% of streams within the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.1.3.2. **Action Step:** Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in middle and upper reaches of Walker Creek

3.1.3.3. **Action Step:** Modify MMWD's multi-agency MOU for Large Woody Debris to include Walker Creek.

3.1.3.4. **Action Step:** Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in all reaches of Chileno, Salmon and Verde Canyon

3.1.3.5. **Action Step:** Modify MMWD's multi-agency MOU for Large Woody Debris to include Walker Creek.

3.1.4. **Recovery Action:** Improve frequency of primary pools

3.1.4.1. **Action Step:** Increase primary pool frequency in 75% of streams within the watershed to improve conditions for adults, and summer/winter juveniles

3.1.4.2. **Action Step:** Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in all reaches of Chileno, Verde Canyon, and Walker Creek

3.1.5. **Recovery Action:** Improve shelter rating

3.1.5.1. **Action Step:** Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles

3.1.5.2. **Action Step:** Increase shelter ratings to optimal conditions (>80 pool shelter value) in all reaches of Chileno, Salmon, Verde Canyon and Walker Creeks

4. Restoration- Hydrology

4.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

4.1.1. **Recovery Action:** Improve flow conditions (baseflow conditions)

4.1.1.1. **Action Step:** Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).

4.1.1.2. **Action Step:** Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.

4.1.1.3. **Action Step:** To improve connectivity of surface flows with groundwater reduce aggradation and overall sediment load at the watershed scale by treating roads and sources of mass wasting.

4.1.1.4. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).

4.1.1.5. **Action Step:** Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).

4.1.2. **Recovery Action:** Improve passage flows

4.1.2.1. **Action Step:** Continue to assess the release of water from Soulejule Reservoir to develop the optimum flow release for coho salmon (CDFG 2004).

4.1.2.2. **Action Step:** Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).

5. Restoration- Landscape Patterns

5.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

5.1.1. **Recovery Action:** Improve sediment transport

5.1.1.1. **Action Step:** Implement DS level actions for treating watershed road networks

5.1.2. **Recovery Action:** Improve watershed hydrology

5.1.2.1. **Action Step:** Implement DS level recommendations to improve baseflows, and hydrologic connectivity

5.1.3. **Recovery Action:** Prevent landscape disturbance

5.1.3.1. **Action Step:** Implement Best Management Practices from DS level actions to prevent impairment due to Agriculture, Livestock and Residential Development.

5.1.3.2. **Action Step:** Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements

6. Restoration- Passage

6.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

6.1.1. **Recovery Action:** Improve access of spawning adults and juveniles

6.1.1.1. **Action Step:** Evaluate the feasibility of bypassing large dams (CDFG 2004) in the watershed.

6.1.1.2. **Action Step:** Evaluate the potential for Laguna Lake to serve as rearing habitat, and the potential passage, and outmigration challenges and issues

7. Restoration- Pool Habitat

No species-specific actions were developed. See Habitat Complexity.

8. Restoration- Riparian

8.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

8.1.1. **Recovery Action:** Improve canopy cover

8.1.1.1. **Action Step:** Assess riparian canopy, extent of exotic vegetation (e.g., Arundo donax, etc.), and prioritize, develop and implement riparian habitat projects using native vegetation

8.1.1.2. **Action Step:** Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.

8.1.1.3. **Action Step:** Increase the width of riparian corridors to 150' to allow multi-age stands of native trees and shrubs, and eventual recruitment of LWD

8.1.1.4. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).

8.1.2. **Recovery Action:** Improve tree diameter

8.1.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

8.1.2.2. **Action Step:** Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.

8.1.2.3. **Action Step:** Plant native riparian species and native conifers/hardwoods throughout riparian zones within the northern (Chileno and Keys Creek) and eastern (Walker and Salmon Creek) portions of the watershed to increase overall tree diameter

8.1.2.4. **Action Step:** Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.

9. Restoration- Sediment

9.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

9.1.1. **Recovery Action:** Improve instream gravel quality and food productivity.

9.1.1.1. **Action Step:** Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)

9.1.1.2. **Action Step:** Conduct instream and upslope sediment source surveys in upper Walker Creek and sub-watersheds (Salmon and Key Creeks) to identify existing sources of high sediment yield using accepted protocols and implement recommendations

9.1.1.3. **Action Step:** Implement recommendations of completed sediment source surveys in the watershed (See ROADS for specific actions)

9.1.1.4. **Action Step:** Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).

9.1.1.5. **Action Step:** Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC coho salmon recovery priorities.

9.1.2. **Recovery Action:** Improve and expand instream gravel quantity

9.1.2.1. **Action Step:** Increase the quantity and distribution of spawning gravels in 50% of streams within the watershed

9.1.2.2. **Action Step:** Implement high priority coho salmon enhancement projects for the reduction of sediment delivery and the restoration of riparian corridors as listed in the Walker Creek Enhancement Plan (Prunuske Chatham Inc. 2001, CDFG 2004).

9.1.2.3. **Action Step:** Develop habitat enhancement projects to establish additional riffle habitat and import spawning gravel from mining operations in the Russian River basin to select reaches of Chileno, Salmon, Verde Canyon, Frink Canyon and Walker Creeks

9.1.2.4. **Action Step:** Place instream structures to improve gravel retention and habitat complexity.

10. Restoration- Viability

10.1. **Objective:** Address the present or threatened destruction of the species habitat or range

10.1.1. **Recovery Action:** Increase abundance

10.1.1.1. **Action Step:** Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.

10.1.1.2. **Action Step:** Adopt hatchery guidelines defined in Spence et al. 2008.

10.1.1.3. **Action Step:** Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock in Russian River, Walker and Salmon Creeks

10.1.1.4. **Action Step:** Minimize departure from the genetic profile that historically existed in the population.

10.1.1.5. **Action Step:** Continue the operation of the Captive Broodstock Program in Walker Creek

10.1.2. **Recovery Action:** Increase spatial structure and diversity

10.1.2.1. **Action Step:** Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG

10.1.2.2. **Action Step:** Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.

10.1.2.3. **Action Step:** Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed

10.1.3. **Recovery Action:** Increase spawner density

10.1.3.1. **Action Step:** Fund monitoring actions in Walker Creek to evaluate success of adult reintroductions towards salmon recovery

10.2. **Objective:** Develop and implement a monitoring program to evaluate the performance of recovery efforts.

10.2.1. **Recovery Action:** Measure or estimate the condition of key habitat attributes across the watershed. Prioritize Core tributaries first, followed by Phase I and Phase II areas as appropriate.

10.2.1.1. **Action Step:** Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.

10.2.1.2. **Action Step:** To better understand changes in sedimentation, monitoring in the basin should include: longitudinal profiles, cross-sections, V*, LWD volume and distribution, and embeddedness.

10.2.1.3. **Action Step:** Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.

10.2.2. **Recovery Action:** Conduct habitat surveys to monitor change in key habitat variables

10.2.2.1. **Action Step:** Specific locations to be monitored will be determined through implementation of the Coastal Salmonid Monitoring Plan

10.2.2.2. **Action Step:** To better understand changes in sedimentation, monitoring in the basin should include: longitudinal profiles, cross-sections, V*, LWD volume and distribution, and embeddedness.

10.2.3. **Recovery Action:** Monitor population status for response to recovery actions.

10.2.3.1. **Action Step:** Support MMWD in operation of outmigrant traps

10.2.3.2. **Action Step:** Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions

11. Restoration- Water Quality

11.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

11.1.1. **Recovery Action:** Improve stream temperature conditions

11.1.1.1. **Action Step:** Improve water temperature conditions for migrating smolts and summer rearing juvenile salmonids throughout 35% of watershed

11.1.1.2. **Action Step:** Reduce temperature levels within lower and upper Salmon and Walker Creeks.

11.1.1.3. **Action Step:** Reduce water temperatures in Chileno and Frink Canyon Creek.

11.1.1.4. **Action Step:** Plant native vegetation to promote streamside shade.

11.1.1.5. **Action Step:** Rehabilitate or restore riparian corridor conditions within all current and potential high value habitat summer rearing areas.

11.1.1.6. **Action Step:** Develop site-specific recommendations, including incentives, to remedy high temperatures and implement (CDFG 2004) initially in core areas, following with phase 1 and 2 areas.

11.1.1.7. **Action Step:** Explore releasing cooler flow out of Walker Dam (CDFG and NMFS 2002).

11.1.2. **Recovery Action:** Improve stream water quality conditions

11.1.2.1. **Action Step:** Identify and provide solutions for point and non-point sources contributing to toxicity and turbidity.

11.1.2.2. **Action Step:** Install continuous water quality monitoring stations in lower Walker and within Salmon Creeks

11.1.2.3. **Action Step:** Implement recommendation to rest the Gambioni Mine

11.1.2.4. **Action Step:** Work with livestock and ranch owners to implement BMP's to control sediment and nitrates

11.1.3. **Recovery Action:** Reduce turbidity and suspended sediment

11.1.3.1. **Action Step:** Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.

THREAT ABATEMENT ACTIONS

12. Threat- Agricultural Practices

12.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

12.1.1. **Recovery Action:** Prevent impairment to riparian species and composition

12.1.1.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

12.1.1.2. **Action Step:** Coordinate with the agencies that authorize forest land conversions to discourage conversions to agriculture.

12.2. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range.

12.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity

12.2.1.1. **Action Step:** Keep agricultural activities from within 100 feet of the edge of the stream

12.2.2. **Recovery Action:** Prevent impairment to hydrology

12.2.2.1. **Action Step:** Utilize BMP's for irrigation (cover crop, drip) and frost protection (wind machines, cold air drains, heaters, or micro-sprayers) which eliminate or minimize water use

12.2.2.2. **Action Step:** If water is being used as part of frost protection measures, flow metering should accompany water management to ensure flows are maintained for other beneficial uses

12.2.3. **Recovery Action:** Prevent impairment to habitat complexity

12.2.3.1. **Action Step:** Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors

12.2.4. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

12.2.4.1. **Action Step:** Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels (see Roads for specific actions/areas)

12.2.4.2. **Action Step:** Encourage the NRCS, RCDs, and other appropriate organizations to increase the number of landowners participating in sediment reduction planning and implementation.

12.2.4.3. **Action Step:** Continue the use of cover crops in agriculture fields.

12.2.5. **Recovery Action:** Prevent impairment to riparian

12.2.5.1. **Action Step:** Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to address sediment source reduction, riparian habitat, forest health, and restoration.

12.2.5.2. **Action Step:** Implement Best Management Practices in DS level actions

12.2.5.3. **Action Step:** Re-establish native plant communities in riparian zones to increase stream canopy to 80%

12.2.5.4. **Action Step:** Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to provide future recruitment of large wood and other shelter components

12.2.5.5. **Action Step:** Monitor instream water temperatures to determine baseline conditions and judge the efficacy of restoration actions. High priority streams include tributary and mainstem reaches within Salmon and Walker Creeks (CDFG stream survey reports).

13. Threat- Channel Modification

13.1. **Objective:** Address the inadequacy of existing regulatory mechanisms

13.1.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

13.1.1.1. **Action Step:** All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.

13.1.1.2. **Action Step:** Prevent additional channel modification or utilize BMP's described in DS level actions to address flood control or bank stabilization issue

13.1.1.3. **Action Step:** Evaluate design alternatives to riprap bank repairs. Where riprap is necessary, evaluate integration of other habitat-forming features – including large woody debris to ensure improved habitat at the restoration site.

13.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

13.2.1. **Recovery Action:** Prevent impairment to floodplain connectivity (impaired quality & extent)

13.2.1.1. **Action Step:** Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.

13.2.1.2. **Action Step:** Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats in lower Walker Creek or other areas where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity, (See FLOODPLAIN for specific actions/criteria).

13.2.1.3. **Action Step:** Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.

14. Threat- Disease/Predation/Competition

No species-specific actions were developed.

15. Threat- Fire/Fuel Management

No species-specific actions were developed.

16. Threat- Fishing/Collecting

No species-specific actions were developed.

17. Threat- Hatcheries

No species-specific actions were developed.

18. Threat- Livestock

18.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.1.1. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

18.1.1.1. **Action Step:** Where necessary, establish predetermined stream crossings when herding cattle between pastures.

18.1.1.2. **Action Step:** Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.

18.1.1.3. **Action Step:** To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes

18.1.2. **Recovery Action:** Prevent adverse alterations to riparian species composition and structure

18.1.2.1. **Action Step:** Develop a watershed wide program with Marin RCD to identify riparian corridors subject to livestock grazing, and develop and implement livestock exclusion measures to protect and improve riparian resources

18.1.2.2. **Action Step:** Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.

18.1.2.3. **Action Step:** Aid landowners willing to fence off riparian areas with development of offstream alternative water sources

18.1.2.4. **Action Step:** Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.

18.1.2.5. **Action Step:** Manage rotational grazing to aid in the reduction of noxious weeds.

18.1.3. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

18.1.3.1. **Action Step:** Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.

18.2. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

18.2.1. **Recovery Action:** Improve canopy cover

18.2.1.1. **Action Step:** Assess riparian canopy, extent of exotic vegetation (e.g., Arundo donax, etc.), and prioritize, develop and implement riparian habitat projects using native vegetation

18.2.1.2. **Action Step:** Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.

18.2.1.3. **Action Step:** Increase the width of riparian corridors to 150' to allow multi-age stands of native trees and shrubs, and eventual recruitment of LWD

18.2.1.4. **Action Step:** Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).

18.2.2. **Recovery Action:** Improve tree diameter

18.2.2.1. **Action Step:** Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)

18.2.2.2. **Action Step:** Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.

18.2.2.3. **Action Step:** Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.

19. Threat- Logging

19.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

19.1.1. **Recovery Action:** Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)

19.1.1.1. **Action Step:** Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels

19.1.2. **Recovery Action:** Prevent impairment to riparian

19.1.2.1. **Action Step:** Conserve and manage forestlands for older forest stages.

20. Threat- Mining

No species-specific actions were developed.

21. Threat- Recreation

No species-specific actions were developed.

22. Threat- Residential/Commercial Development

22.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

22.1.1. **Recovery Action:** Prevent impairment to riparian species and composition

22.1.1.1. **Action Step:** Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do

22.1.1.2. **Action Step:** Reduce impacts of existing development in floodplains/riparian zones by encouraging willing landowners to restore these areas

22.1.1.3. **Action Step:** Explore the use of conservation easements to provide incentives for private landowners to preserve riparian corridors

22.1.1.4. **Action Step:** Utilize native plants when landscaping and discourage the use of exotic invasives

22.1.2. **Recovery Action:** Prevent impairment to watershed hydrology

22.1.2.1. **Action Step:** Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating coho.

22.1.2.2. **Action Step:** Implement performance standards in Stormwater Management Plans.

22.1.2.3. **Action Step:** Implement DS level actions

23. Threat- Roads/Railroads

23.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

23.1.1. **Recovery Action:** Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)

23.1.1.1. **Action Step:** Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources

23.1.1.2. **Action Step:** Assess roads in Salmon Creek, Walker Creek and Keys Creek to identify high priority and high sediment yield sources.

23.1.1.3. **Action Step:** Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.

23.1.1.4. **Action Step:** Reduce the hydrologic connectivity of roads and trails to adjacent crossings across watercourses.

23.1.1.5. **Action Step:** Restoration projects that upgrade or decommission high risk roads in Core areas should be considered an extremely high priority for funding (e.g., PCSRF). Where no Core areas are designated, apply this action to Phase I areas.

23.1.1.6. **Action Step:** Decommission riparian roads and skid trails on forestlands that deliver sediment into adjacent watercourses. High priority streams identified by CDFG habitat reports include Verde Canyon, Frink Canyon, and Salmon Creek (http://coastalwatersheds.ca.gov/)

23.1.1.7. **Action Step:** Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.

23.1.1.8. **Action Step:** Utilize best management practices for road maintenance, management (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

23.1.1.9. **Action Step:** Utilize BMP's to reduce the lengths of ditches, increase the size of ditch relief culverts, or replace with rolling dips

23.1.2. **Recovery Action:** Prevent impairment to passage and migration

23.1.2.1. **Action Step:** Assess private and public road stream crossings for barrier potential and implement recommendations

23.1.2.2. **Action Step:** Utilize BMP's to upgrade existing crossings (bridges, culverts, fills, and other crossings) to accommodate 100-year flood flows and associated bedload and debris.

23.1.2.3. **Action Step:** All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.

23.1.2.4. **Action Step:** Utilize best management practices for road construction, maintenance, management and decommissioning (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).

24. Threat- Severe Weather Patterns

24.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

24.1.1. **Recovery Action:** Prevent impairment to water quality (impaired instream temperature)

24.1.1.1. **Action Step:** Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas (See WATER QUALITY for specific actions/areas

24.1.1.2. **Action Step:** Implement DS level actions

25. Threat- Water Diversion/Impoundment

25.1. **Objective:** Address the present or threatened destruction, modification or curtailment of the species habitat or range

25.1.1. **Recovery Action:** Prevent impairment to stream hydrology (impaired water flow)

25.1.1.1. **Action Step:** Allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.

25.1.1.2. **Action Step:** Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).

25.1.1.3. **Action Step:** Promote water conservation best practices such as drip irrigation for vineyards.

25.1.1.4. **Action Step:** Implement DS level actions

25.1.2. **Recovery Action:** Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)

25.1.2.1. **Action Step:** Identify upstream pollution sources which contribute to poor water quality conditions in the estuary

25.1.3. **Recovery Action:** Prevent reduced density, abundance, and diversity

25.1.3.1. **Action Step:** Adequately screen water diversions to prevent juvenile salmonid mortalities.

26. Threat- Watershed Process

No species-specific actions were developed.

Table 3: Implementation Schedule ~ Walker Creek

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-1.1	**Objective**	**Estuary**	**Address the inadequacy of existing regulatory mechanisms**										
WalC-CCC-1.1.1	Recovery Action	Estuary	Implement estuary protection and enhancement measures to restore estuary to properly functioning conditions.										
WalC-CCC-1.1.1.1	Action Step	Estuary	Prevent future encroachment of landuse (agricultural, residential and commercial) into floodplain areas of the estuary	3	50	CDFG, RWQCB, Sonoma County, USACE						In-Kind	
WalC-CCC-1.1.1.2	Action Step	Estuary	Evaluate the effect of nearby landuse practices and development structures which may impair or reduce the historical tidal prism and other estuarine functions and implement improvements	3	10	CA Coastal Commission, California Coastal Conservancy, CDFG						TBD	Costs associated with removal of structures will depend on the number and type of structures identified and cannot be accurately determined at this time.
WalC-CCC-1.2	**Objective**	**Estuary**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-1.2.1	Recovery Action	Estuary	Increase the extent of estuarine habitat										
WalC-CCC-1.2.1.1	Action Step	Estuary	Support a salmonid limiting factors assessment in Keys Estero and Tomales Bay (CDFG 2004).	2	5	MMWD, Tomales Bay Watershed Council	273.00					273	Cost for estuary use/residence timing estimated at $273,217/project.
WalC-CCC-1.2.1.2	Action Step	Estuary	Per a completed limiting factors assessment, and utilizing adaptive management guidelines, develop restoration projects in areas which have high value physical and chemical properties for rearing salmonids	2	15	NMFS, Sonoma County Water Agency						TBD	Cost accounted for in below action steps.
WalC-CCC-1.2.1.3	Action Step	Estuary	Evaluate alterations to river mouth dynamics and implement changes to restore natural function	2	10	California Coastal Conservancy, CDFG, NMFS, Sonoma County, Sonoma County Water Agency, State Parks, USACE						In-Kind	
WalC-CCC-1.2.2	Recovery Action	Estuary	Improve the quality of each estuarine habitat zone										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-1.2.2.1	Action Step	Estuary	Restore estuarine wetlands and sloughs, and improve prey abundance by increasing shoreline perimeter and planting native emergent and riparian species to improve foraging and cover.	2	10	CA Coastal Commission, California Coastal Conservancy, CDFG, Private Landowners	878	878				1,755	Cost based on treating 6.5 acres (assume 5% of total estuarine habitat) at a rate of $272,120/acre.
WalC-CCC-1.2.3	Recovery Action	Estuary	Improve the quality of each estuarine habitat zones (see WQ parameters)										
WalC-CCC-1.2.3.1	Action Step	Estuary	Improve estuarine water quality by identifying and remediating upstream pollution sources which contribute to poor water quality conditions in the estuary	2	10	Sonoma County, Sonoma County Water Agency, SWRCB	7.50	7.50				15	Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume minimum of 3 for lagoon. Cost does not account for maintenance or data management.
WalC-CCC-1.2.3.2	Action Step	Estuary	Modify alterations to freshwater inflow and water quality (temperature, dissolved oxygen)	2	12	CDFG, NMFS, Sonoma County Water Agency, USACE						TBD	
WalC-CCC-2.1	**Objective**	**Floodplain Connectivity**	**Address the inadequacy of existing regulatory mechanisms**										
WalC-CCC-2.1.1	Recovery Action	Floodplain Connectivity	Prevent impairment to floodplain connectivity.										
WalC-CCC-2.1.1.1	Action Step	Floodplain Connectivity	Set-back existing levees in strategic areas to increase flood-flow detention and promote flood-tolerant land uses.	3	10	MMWD	193.50	193.50				387	Cost for treating 10 miles (assume 1 project/mile in 25% High IP) at a rate of $36,046/mile.
WalC-CCC-2.2	**Objective**	**Floodplain Connectivity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-2.2.1	Recovery Action	Floodplain Connectivity	Rehabilitate and enhance floodplain connectivity										
WalC-CCC-2.2.1.1	Action Step	Floodplain Connectivity	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	10	Marin County, MMWD, Tomales Bay Watershed Council	116.50	116.50				233	Cost to treat 6.5 miles (assume 1 project/mile in 15% High IP) at a rate of $36,046/mile.
WalC-CCC-2.2.2	Recovery Action	Floodplain Connectivity	Increase and enhance velocity refuge										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-2.2.2.1	Action Step	Floodplain Connectivity	Identify the floodplain activation flow - the smallest flood pulse event that initiates substantial beneficial ecological processes when associated with floodplain inundation (Williams et al. 2009).	2	10	Private Consultants, Private Landowners, Sonoma County	31.50	31.50				63	Cost for stream flow model estimated at $63,005/project.
WalC-CCC-2.2.2.2	Action Step	Floodplain Connectivity	Delineate reaches possessing both potential winter rearing habitat and floodplain areas.	2	10	Marin RCD, MMWD	103.50	103.50				207	Cost for wetland restoration monitoring estimated at $206,493/project.
WalC-CCC-2.2.2.3	Action Step	Floodplain Connectivity	Identify areas where floodplain connectivity can be re-established in low gradient response reaches of Walker Creek. Develop and implement site specific plans to improve these conditions to re-create, and restore alcove, backwater, or perennial pond habitats.	2	20	Farm Bureau, NMFS HCD, Public Works, RCD						TBD	Cost accounted for in above action steps.
WalC-CCC-2.2.2.4	Action Step	Floodplain Connectivity	Support landowners and the Marin RCD in developing projects to improve channel conditions and restore natural channel geomorphology, including side channels and dense contiguous riparian vegetation (CDFG 2004).	2	40	Marin County, MMWD, Tomales Bay Watershed Council						TBD	Cost cannot be determined due to unknown number of projects at various scales.
WalC-CCC-3.1	**Objective**	**Habitat Complexity**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WalC-CCC-3.1.1	Recovery Action	Habitat Complexity	Improve habitat complexity										
WalC-CCC-3.1.1.1	Action Step	Habitat Complexity	Conduct habitat assessment in Keys Creek	2	5		23.00					23	Cost for habitat survey estimated at $333/IP km.
WalC-CCC-3.1.1.2	Action Step	Habitat Complexity	Utilize recommendations to prioritize reaches for habitat improvement	2	5	CDFG, Marin RCD, Private Landowners							
WalC-CCC-3.1.2	Recovery Action	Habitat Complexity	Improve pool:riffle:flatwater ratio										
WalC-CCC-3.1.2.1	Action Step	Habitat Complexity	Increase the frequencies of riffles in 55% of the streams within the watershed	2	10		275.00	275.00				550	Cost based on treating 22 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile.
WalC-CCC-3.1.2.2	Action Step	Habitat Complexity	Increase riffle frequency to 20% by converting flatwater habitats (glides, runs, etc.) utilizing boulders and log structures in select reaches of Chilen, Salmon and Walker Creek	2	5	CDFG, Marin RCD, NOAA RC, Private Consultants, Private Landowners, RCD						TBD	Cost likely accounted for in above action step.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-3.1.3	Recovery Action	Habitat Complexity	Improve large wood frequency										
WalC-CCC-3.1.3.1	Action Step	Habitat Complexity	Increase large wood frequency in 75% of streams within the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	10		275.00	275.00				550	Cost based on treating 22 miles (assume 1 project/mile in 50% High IP) at a rate of $25,000/mile. Cost may be reduced if done in concert with increase frequencies of riffles.
WalC-CCC-3.1.3.2	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>2 key LWD pieces/100 meters) in middle and upper reaches of Walker Creek	2	10	CDFG, Marin RCD, MMWD, NOAA RC, Private Landowners						TBD	Cost accounted for in above action steps.
WalC-CCC-3.1.3.3	Action Step	Habitat Complexity	Modify MMWD's multi-agency MOU for Large Woody Debris to include Walker Creek.	2	1	CDFG, Marin RCD, MMWD, NMFS						TBD	
WalC-CCC-3.1.3.4	Action Step	Habitat Complexity	Increase LWD frequency to optimal conditions (>6 key LWD pieces/100 meters) in all reaches of Chileno, Salmon and Verde Canyon	2	10	CDFG, Marin RCD, MMWD, NOAA RC, Private Consultants, Private Landowners, RCD						TBD	Cost accounted for in above action steps.
WalC-CCC-3.1.3.5	Action Step	Habitat Complexity	Modify MMWD's multi-agency MOU for Large Woody Debris to include Walker Creek.	3									
WalC-CCC-3.1.4	Recovery Action	Habitat Complexity	Improve frequency of primary pools										
WalC-CCC-3.1.4.1	Action Step	Habitat Complexity	Increase primary pool frequency in 75% of streams within the watershed to improve conditions for adults, and summer/winter juveniles	2	10							TBD	Cost for this action step may be accounted for in other action steps above. Increasing primary pools likely part of LWD placement and increase riffles.
WalC-CCC-3.1.4.2	Action Step	Habitat Complexity	Increase primary pool frequency to achieve optimal conditions (>40% of pools meet primary pool criteria (>2.5 feet deep in 1st and 2nd order streams; >3 feet in third order or larger streams)) in all reaches of Chileno, Verde Canyon, and Walker Creek	2	10	CDFG, Marin RCD, NOAA RC, Private Consultants, Private Landowners						TBD	
WalC-CCC-3.1.5	Recovery Action	Habitat Complexity	Improve shelter rating										
WalC-CCC-3.1.5.1	Action Step	Habitat Complexity	Increase shelter ratings in 75% of streams across the watershed to improve conditions for adults, and winter/summer rearing juveniles	2	20							TBD	Cost likely accounted for in increase pools, riffles, and LWD frequency.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-3.1.5.2	Action Step	Habitat Complexity	Increase shelter ratings to optimal conditions (>80 pool shelter value) in all reaches of Chileno, Salmon, Verde Canyon and Walker Creeks	2	10	CDFG, Marin RCD, NOAA RC, Private Consultants, Private Landowners						TBD	
WalC-CCC-4.1	**Objective**	**Hydrology**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
WalC-CCC-4.1.1	Recovery Action	Hydrology	Improve flow conditions (baseflow conditions)										
WalC-CCC-4.1.1.1	Action Step	Hydrology	Monitor, identify problems, and prioritize needed changes to water diversion on current or potential coho streams that go dry in some years (CDFG 2004).	2	60	MMWD, SPAWN						TBD	Cost accounted for in stream flow model.
WalC-CCC-4.1.1.2	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	30	Marin County, Marin RCD, MMWD						In-Kind	
WalC-CCC-4.1.1.3	Action Step	Hydrology	To improve connectivity of surface flows with groundwater reduce aggradation and overall sediment load at the watershed scale by treating roads and sources of mass wasting.	3	10	Marin RCD						TBD	
WalC-CCC-4.1.1.4	Action Step	Hydrology	Promote off-channel storage to reduce impacts of water diversion (e.g. storage tanks for rural residential users).	2	30	Marin County, Marin RCD, MMWD						TBD	Cost difficult to determine because of landowner participation.
WalC-CCC-4.1.1.5	Action Step	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (CDFG 2004).	3	10	DWR, NMFS, SWRCB						TBD	
WalC-CCC-4.1.2	Recovery Action	Hydrology	Improve passage flows										
WalC-CCC-4.1.2.1	Action Step	Hydrology	Continue to assess the release of water from Soulejule Reservoir to develop the optimum flow release for coho salmon (CDFG 2004).	3	60	CDFG, MMWD, NMFS						In-Kind	
WalC-CCC-4.1.2.2	Action Step	Hydrology	Manage reservoirs and dam releases to maintain suitable rearing temperatures and migratory flows in downstream habitats (e.g., pulse flow programs for adult upstream migration and smolt outmigration).	2	60	CDFG, MMWD, NMFS						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-5.1	**Objective**	**Landscape Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-5.1.1	Recovery Action	Landscape Patterns	Improve sediment transport										
WalC-CCC-5.1.1.1	Action Step	Landscape Patterns	Implement DS level actions for treating watershed road networks	2	50	Private Landowners, RCD						TBD	
WalC-CCC-5.1.2	Recovery Action	Landscape Patterns	Improve watershed hydrology										
WalC-CCC-5.1.2.1	Action Step	Landscape Patterns	Implement DS level recommendations to improve baseflows, and hydrologic connectivity	2		CDFG, Farm Bureau, NRCS, Private Consultants, Private Landowners, SWRCB							
WalC-CCC-5.1.3	Recovery Action	Landscape Patterns	Prevent landscape disturbance										
WalC-CCC-5.1.3.1	Action Step	Landscape Patterns	Implement Best Management Practices from DS level actions to prevent impairment due to Agriculture, Livestock and Residential Development.	2	100	Farm Bureau, Private Landowners, RCD							
WalC-CCC-5.1.3.2	Action Step	Landscape Patterns	Conserve open space in un-fractured landscapes, protect floodplain areas and riparian corridors, and develop conservation easements	3									
WalC-CCC-6.1	**Objective**	**Passage**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
WalC-CCC-6.1.1	Recovery Action	Passage	Improve access of spawning adults and juveniles										
WalC-CCC-6.1.1.1	Action Step	Passage	Evaluate the feasibility of bypassing large dams (CDFG 2004) in the watershed.	3	20	MMWD, NMFS						TBD	Evaluate truck and trap operations
WalC-CCC-6.1.1.2	Action Step	Passage	Evaluate the potential for Laguna Lake to serve as rearing habitat, and the potential passage, and outmigration challenges and issues	3	10	CDFG, Marin County, MMWD, NMFS, NMFS PRD, NOAA SWFSC	56.00	56.00				112	Cost for fish/habitat effectiveness monitoring estimated at $111,192/project.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-8.1	**Objective**	**Riparian**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-8.1.1	Recovery Action	Riparian	Improve canopy cover										
WalC-CCC-8.1.1.1	Action Step	Riparian	Assess riparian canopy, extent of exotic vegetation (e.g., Arundo donax, etc.), and prioritize, develop and implement riparian habitat projects using native vegetation	1	20	Marin RCD	2,405	2,405	2,405	2,405		9,620	Cost for riparian restoration monitoring estimated at $71,436/project. Cost for riparian planting based on treating 160 acres (assume 80 acres/mile in 5% High IP) at a rate of $20,057/acre. Cost for exotic vegetation removal base on treating 160 acres (assume 80 acres/mile in 5% High IP) at a rate of $39,574/acre.
WalC-CCC-8.1.1.2	Action Step	Riparian	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	1	60	Marin RCD, RWQCB						In-Kind	
WalC-CCC-8.1.1.3	Action Step	Riparian	Increase the width of riparian corridors to 150' to allow multi-age stands of native trees and shrubs, and eventual recruitment of LWD	3	50							In-Kind	
WalC-CCC-8.1.1.4	Action Step	Riparian	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).	2	30	City Planning, Land Trusts, Sonoma County						In-Kind	
WalC-CCC-8.1.2	Recovery Action	Riparian	Improve tree diameter										
WalC-CCC-8.1.2.1	Action Step	Riparian	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	2	30							TBD	Cost likely accounted for in above action steps.
WalC-CCC-8.1.2.2	Action Step	Riparian	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.	2	20							TBD	Cost likely accounted for in above action steps.
WalC-CCC-8.1.2.3	Action Step	Riparian	Plant native riparian species and native conifers/hardwoods throughout riparian zones within the northern (Chileno and Keys Creek) and eastern (Walker and Salmon Creek) portions of the watershed to increase overall tree diameter	1	20	CDFG, NOAA RC, Private Consultants, Private Landowners, RCD						TBD	Cost accounted for in above action steps.
WalC-CCC-8.1.2.4	Action Step	Riparian	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	2	10	Marin RCD, MMWD						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-9.1	**Objective**	**Sediment**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range.**										
WalC-CCC-9.1.1	Recovery Action	Sediment	Improve instream gravel quality and food productivity.										
WalC-CCC-9.1.1.1	Action Step	Sediment	Reduce embbeddness levels to the extent that 75% to 90% of streams within the watershed meet optimal criteria (>50% stream average scores of 1 & 2)	2	20							TBD	Habitat typing analysis should identify areas with high embeddness.
WalC-CCC-9.1.1.2	Action Step	Sediment	Conduct instream and upslope sediment source surveys in upper Walker Creek and sub-watersheds (Salmon and Key Creeks) to identify existing sources of high sediment yield using accepted protocols and implement recommendations	2	10	Marin County, Marin RCD, Private Consultants, Private Landowners, RCD	73.00	73.00				146	Cost for erosion assessment estimated at $12.22/acre (assume 25% of total watershed acres).
WalC-CCC-9.1.1.3	Action Step	Sediment	Implement recommendations of completed sediment source surveys in the watershed (See ROADS for specific actions)	2	5	CDFG, Marin County, Marin RCD, Private Landowners, RCD						TBD	
WalC-CCC-9.1.1.4	Action Step	Sediment	Fence riparian areas from grazing (using fencing standards that allow other wildlife to access the stream).	3	20	CDFG, Marin RCD, NOAA RC, NRCS							
WalC-CCC-9.1.1.5	Action Step	Sediment	Solicit cooperation from NRCS, RCDs, Farm Bureau, and others to devise incentive programs and incentive-based approaches to encourage and support landowners who conduct operations in a manner compatible with CCC coho salmon recovery priorities.	3	60	Marin RCD, NRCS						In-Kind	
WalC-CCC-9.1.2	Recovery Action	Sediment	Improve and expand instream gravel quantity										
WalC-CCC-9.1.2.1	Action Step	Sediment	Increase the quantity and distribution of spawning gravels in 50% of streams within the watershed	2	20							TBD	Cost difficult to determine at this time. Information from habitat typing will identify areas deficient in suitable spawning substrate.
WalC-CCC-9.1.2.2	Action Step	Sediment	Implement high priority coho salmon enhancement projects for the reduction of sediment delivery and the restoration of riparian corridors as listed in the Walker Creek Enhancement Plan (Prunuske Chatham Inc. 2001, CDFG 2004).	2	20	Marin RCD, MMWD, RWQCB						TBD	Cost accounted for in above action steps.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-9.1.2.3	Action Step	Sediment	Develop habitat enhancement projects to establish additional riffle habitat and import spawning gravel from mining operations in the Russian River basin to select reaches of Chileno, Salmon, Verde Canyon, Frink Canyon and Walker Creeks	2	5	CDFG, NMFS, NOAA RC, Private Consultants, Private Landowners, RCD, Trout Unlimited						TBD	Cost accounted for in above action steps.
WalC-CCC-9.1.2.4	Action Step	Sediment	Place instream structures to improve gravel retention and habitat complexity.	2	10	Marin RCD, MMWD, RWQCB							
WalC-CCC-10.1	**Objective**	**Viability**	**Address the present or threatened destruction of the species habitat or range**										
WalC-CCC-10.1.1	Recovery Action	Viability	Increase abundance										
WalC-CCC-10.1.1.1	Action Step	Viability	Re-establish a naturally reproducing run of coho salmon in appropriate subwatersheds.	1	10							TBD	Cost difficult to determine because first need to identify appropriate subwatersheds.
WalC-CCC-10.1.1.2	Action Step	Viability	Adopt hatchery guidelines defined in Spence et al. 2008.	2	10	NMFS						TBD	
WalC-CCC-10.1.1.3	Action Step	Viability	Annually capture or retain (during rescue efforts) - small numbers of surplus fish from drying streams/habitats in Marin and Sonoma Counties for purposes of broodstock in Russian River, Walker and Salmon Creeks	1	10	CDFG						TBD	
WalC-CCC-10.1.1.4	Action Step	Viability	Minimize departure from the genetic profile that historically existed in the population.	1	100							In-Kind	
WalC-CCC-10.1.1.5	Action Step	Viability	Continue the operation of the Captive Broodstock Program in Walker Creek	1	50								
WalC-CCC-10.1.2	Recovery Action	Viability	Increase spatial structure and diversity										
WalC-CCC-10.1.2.1	Action Step	Viability	Continue to rescue juvenile coho salmon with existing permittees that are under an imminent risk of stranding and mortality and relocate to suitable habitat when deemed appropriate by NMFS and CDFG	2	10	CDFG, MMWD, NMFS, Tomales Bay Watershed Council, Trout Unlimited						In-Kind	Existing operations
WalC-CCC-10.1.2.2	Action Step	Viability	Utilize broodstock from Marin County to repopulate remaining extirpated streams within the watershed.	1	10	CDFG, USACE						TBD	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-10.1.2.3	Action Step	Viability	Conduct outreach with landowners to expand broodstock releases within core areas, and remaining extirpated streams within the watershed	2	5	CDFG, Marin RCD, NMFS						In-Kind	
WalC-CCC-10.1.3	Recovery Action	Viability	Increase spawner density										
WalC-CCC-10.1.3.1	Action Step	Viability	Fund monitoring actions in Walker Creek to evaluate success of adult reintroductions towards salmon recovery	3	10	MMWD, NMFS						TBD	Cost accounted for in above action steps.
WalC-CCC-10.2	**Objective**	**Viability**	**Develop and implement a monitoring program to evaluate the performance of recovery efforts.**										
WalC-CCC-10.2.1	Recovery Action	Viability	Measure or estimate the condition of key habitat attributes across the watershed. Prioritize Core tributaries first, followed by Phase I and Phase II areas as appropriate.										
WalC-CCC-10.2.1.1	Action Step	Viability	Develop standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	3	5	CDFG, Marin County, Marin RCD, MMWD, NMFS						In-Kind	
WalC-CCC-10.2.1.2	Action Step	Viability	To better understand changes in sedimentation, monitoring in the basin should include: longitudinal profiles, cross-sections, V*, LWD volume and distribution, and embeddedness.	3	60	Marin RCD, MMWD						TBD	
WalC-CCC-10.2.1.3	Action Step	Viability	Implement standardized assessment protocols (i.e., CDFG habitat assessment protocols) to ensure ESU-wide consistency.	3	60	Marin RCD, MMWD						TBD	
WalC-CCC-10.2.2	Recovery Action	Viability	Conduct habitat surveys to monitor change in key habitat variables		10								
WalC-CCC-10.2.2.1	Action Step	Viability	Specific locations to be monitored will be determined through implementation of the Coastal Salmonid Monitoring Plan	3	20	CDFG, NMFS						TBD	
WalC-CCC-10.2.2.2	Action Step	Viability	To better understand changes in sedimentation, monitoring in the basin should include: longitudinal profiles, cross-sections, V*, LWD volume and distribution, and embeddedness.	3	60	Marin RCD, MMWD						TBD	
WalC-CCC-10.2.3	Recovery Action	Viability	Monitor population status for response to recovery actions.										
WalC-CCC-10.2.3.1	Action Step	Viability	Support MMWD in operation of outmigrant traps	3	10		292.00	292.00				584	Cost for annual smolt outmigrant trapping estimated at $58,404/year.

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-10.2.3.2	Action Step	Viability	Adjust population targets and indicator ratings to reflect new habitat improvements and accessible habitat expansions	3	10	NMFS						TBD	
WalC-CCC-11.1	**Objective**	**Water Quality**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-11.1.1	Recovery Action	Water Quality	Improve stream temperature conditions										
WalC-CCC-11.1.1.1	Action Step	Water Quality	Improve water temperature conditions for migrating smolts and summer rearing juvenile salmonids throughout 35% of watershed	2	10		2.50	2.50				5	Cost for stream temperature gauges estimated at $500/gauge. Assume minimum of 10. Cost does not account for maintenance or data management.
WalC-CCC-11.1.1.2	Action Step	Water Quality	Reduce temperature levels within lower and upper Salmon and Walker Creeks.	2									
WalC-CCC-11.1.1.3	Action Step	Water Quality	Reduce water temperatures in Chileno and Frink Canyon Creek.	2									
WalC-CCC-11.1.1.4	Action Step	Water Quality	Plant native vegetation to promote streamside shade.	2		Marin RCD							
WalC-CCC-11.1.1.5	Action Step	Water Quality	Rehabilitate or restore riparian corridor conditions within all current and potential high value habitat summer rearing areas.	2									
WalC-CCC-11.1.1.6	Action Step	Water Quality	Develop site-specific recommendations, including incentives, to remedy high temperatures and implement (CDFG 2004) initially in core areas, following with phase 1 and 2 areas.	2	3	Marin RCD						TBD	Cost difficult to determine without temperature monitoring data.
WalC-CCC-11.1.1.7	Action Step	Water Quality	Explore releasing cooler flow out of Walker Dam (CDFG and NMFS 2002).	2	20							TBD	Cost vary widely based on suitable alternatives.
WalC-CCC-11.1.2	Recovery Action	Water Quality	Improve stream water quality conditions										
WalC-CCC-11.1.2.1	Action Step	Water Quality	Identify and provide solutions for point and non-point sources contributing to toxicity and turbidity.	2									

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-11.1.2.2	Action Step	Water Quality	Install continuous water quality monitoring stations in lower Walker and within Salmon Creeks	3	5	NMFS, Private Landowners, RWQCB	25.00					25	Cost for continuous water quality monitoring stations estimated at $5,000/station. Assume a minimum of 5 strategically placed in watershed. Cost does not account for maintenance or data management. This action step should be in concert with estuary continuous water quality monitoring.
WalC-CCC-11.1.2.3	Action Step	Water Quality	Implement recommendation to rest the Gambioni Mine	2	5	CDFG, CDFG Law Enforcement, NMFS HCD, NMFS OLE, RWQCB, USEPA							
WalC-CCC-11.1.2.4	Action Step	Water Quality	Work with livestock and ranch owners to implement BMP's to control sediment and nitrates	2		NRCS, Private Landowners, RCD						In-Kind	
WalC-CCC-11.1.3	Recovery Action	Water Quality	Reduce turbidity and suspended sediment										
WalC-CCC-11.1.3.1	Action Step	Water Quality	Conduct sediment source surveys to identify existing sources of high sediment yield using accepted protocols and develop and implement recommendations to address sources of detrimental sediment input.	3	10	CDFG, Marin County, Marin RCD, MMWD, NMFS	33.00	33.00				66	Elevated instream sediment levels are a problem in the watershed. Restoration actions should focus on identifying and prioritizing current sources of sediment within the basin. High priority sites should receive initial restoration funding. Areas identified as shallow or deep seated landslides should be protected from future activities that could contribute to further instability. In particular, new roads should be carefully evaluated for their potential to contribute to further erosion as a result of major rainfall or flooding events. Cost accounted for in other recovery actions. Cost for sediment assessment estimated at $12.22/acre.
WalC-CCC-12.1	**Objective**	**Agricultural Practices**	**Address the inadequacy of existing regulatory mechanisms**										
WalC-CCC-12.1.1	Recovery Action	Agricultural Practices	Prevent impairment to riparian species and composition										
WalC-CCC-12.1.1.1	Action Step	Agricultural Practices	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2		City Planning, Marin County, RWQCB						TBD	
WalC-CCC-12.1.1.2	Action Step	Agricultural Practices	Coordinate with the agencies that authorize forest land conversions to discourage conversions to agriculture.	3	50	Board of Forestry, CDFG, Marin County						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-12.2	**Objective**	**Agricultural Practices**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range.**										
WalC-CCC-12.2.1	Recovery Action	Agricultural Practices	Prevent impairment to floodplain connectivity										
WalC-CCC-12.2.1.1	Action Step	Agricultural Practices	Keep agricultural activities from within 100 feet of the edge of the stream	2	50	Farm Bureau, NRCS, Private Landowners, RCD						In-Kind	
WalC-CCC-12.2.2	Recovery Action	Agricultural Practices	Prevent impairment to hydrology										
WalC-CCC-12.2.2.1	Action Step	Agricultural Practices	Utilize BMP's for irrigation (cover crop, drip) and frost protection (wind machines, cold air drains, heaters, or micro-sprayers) which eliminate or minimize water use	3	60	NRCS, Private Consultants, Private Landowners, RCD						In-Kind	
WalC-CCC-12.2.2.2	Action Step	Agricultural Practices	If water is being used as part of frost protection measures, flow metering should accompany water management to ensure flows are maintained for other beneficial uses	3	50	NRCS, Private Consultants, Private Landowners, RCD, UC Extension							Cost for flow metering should be incorporated into requirements for water diverters utilizing frost protection measures.
WalC-CCC-12.2.3	Recovery Action	Agricultural Practices	Prevent impairment to habitat complexity										
WalC-CCC-12.2.3.1	Action Step	Agricultural Practices	Preserve snags, leave downed wood on the banks or in the stream, and encourage multi-age stands within existing corridors	3		Private Landowners						In-Kind	
WalC-CCC-12.2.4	Recovery Action	Agricultural Practices	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WalC-CCC-12.2.4.1	Action Step	Agricultural Practices	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels (see Roads for specific actions/areas)	2	60	CDFG, Private Consultants, Private Landowners, RCD							Cost accounted for in ROADS/RAILROADS
WalC-CCC-12.2.4.2	Action Step	Agricultural Practices	Encourage the NRCS, RCDs, and other appropriate organizations to increase the number of landowners participating in sediment reduction planning and implementation.	3	10	CDFG, NMFS, NRCS, Private Landowners, RCD						In-Kind	Encouragement is free.
WalC-CCC-12.2.4.3	Action Step	Agricultural Practices	Continue the use of cover crops in agriculture fields.	3	100							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-12.2.5	Recovery Action	Agricultural Practices	Prevent impairment to riparian										
WalC-CCC-12.2.5.1	Action Step	Agricultural Practices	Complete Farm Conservation Plans (through the SRCD, NRCS, Fish Friendly Farming program or other cooperative conservation programs) to address sediment source reduction, riparian habitat, forest health, and restoration.	3	10	CDFG, Farm Bureau, NMFS, NRCS, Private Landowners, RCD						In-Kind	
WalC-CCC-12.2.5.2	Action Step	Agricultural Practices	Implement Best Management Practices in DS level actions	3		NRCS, Private Consultants, Private Landowners, RCD							Cost effective
WalC-CCC-12.2.5.3	Action Step	Agricultural Practices	Re-establish native plant communities in riparian zones to increase stream canopy to 80%	2	60	CDFG, Private Landowners, RCD, UC Extension						TBD	Cost accounted for in above action steps.
WalC-CCC-12.2.5.4	Action Step	Agricultural Practices	Promote the re-vegetation of the native riparian plant community within inset floodplains and riparian corridors to provide future recruitment of large wood and other shelter components	2	50	NRCS, Private Landowners, RCD						TBD	
WalC-CCC-12.2.5.5	Action Step	Agricultural Practices	Monitor instream water temperatures to determine baseline conditions and judge the efficacy of restoration actions. High priority streams include tributary and mainstem reaches within Salmon and Walker Creeks (CDFG stream survey reports).	3	5	CDFG, NMFS, NRCS, Private Landowners, RCD	5.00					5	Cost for stream temperature gauges estimated at $500/each. Assume a minimum of 10. Cost does not account for maintenance or data management.
WalC-CCC-13.1	**Objective**	**Channel Modification**	**Address the inadequacy of existing regulatory mechanisms**										
WalC-CCC-13.1.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WalC-CCC-13.1.1.1	Action Step	Channel Modification	All proposed flood control projects should include habitat protection, and/or alternatives that minimize impacts to salmon habitat.	3	60	Marin County, NMFS PRD, USACE						In-Kind	
WalC-CCC-13.1.1.2	Action Step	Channel Modification	Prevent additional channel modification or utilize BMP's described in DS level actions to address flood control or bank stabilization issue	3	60							In-Kind	
WalC-CCC-13.1.1.3	Action Step	Channel Modification	Evaluate design alternatives to riprap bank repairs. Where riprap is necessary, evaluate integration of other habitat-forming features – including large woody debris to ensure improved habitat at the restoration site.	3	30	CDFG, NMFS PRD, USACE						In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-13.2	**Objective**	**Channel Modification**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-13.2.1	Recovery Action	Channel Modification	Prevent impairment to floodplain connectivity (impaired quality & extent)										
WalC-CCC-13.2.1.1	Action Step	Channel Modification	Evaluate undeveloped and developed floodplain property for potential function and conservation easement and/or acquisition potential.	2	10	Marin County, RCD	103.50	103.50				207	Cost for wetland monitoring estimated at $206,493/project.
WalC-CCC-13.2.1.2	Action Step	Channel Modification	Improve conditions to re-create, and restore alcove, backwater, or perennial pond habitats in lower Walker Creek or other areas where channel modification has resulted in decreased shelter, LWD frequency, and habitat complexity, (See FLOODPLAIN for specific actions/criteria).	2	20	CDFG, NOAA RC, Private Landowners, USACE						TBD	Cost accounted for in above actions steps.
WalC-CCC-13.2.1.3	Action Step	Channel Modification	Promote bio-engineering solutions as appropriate (e.g. carefully evaluate feasibility where critical infrastructure is located) for bank hardening projects.	3	50	CDFG, NMFS PRD, USACE						In-Kind	
WalC-CCC-18.1	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-18.1.1	Recovery Action	Livestock	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WalC-CCC-18.1.1.1	Action Step	Livestock	Where necessary, establish predetermined stream crossings when herding cattle between pastures.	2	60	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.1.2	Action Step	Livestock	Substitute continuous season-long use of pastures in favor of rotational grazing strategies to reduce runoff. Short term, seasonal and long term rest from grazing in overgrazed areas would improve soil conditions for native revegetation and land values as well.	3	60	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.1.3	Action Step	Livestock	To minimize gully initiation, grazing should be kept at relatively low intensities on steeper slopes	3	60	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.2	Recovery Action	Livestock	Prevent adverse alterations to riparian species composition and structure										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-18.1.2.1	Action Step	Livestock	Develop a watershed wide program with Marin RCD to identify riparian corridors subject to livestock grazing, and develop and implement livestock exclusion measures to protect and improve riparian resources	2	30	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.2.2	Action Step	Livestock	Provide funding assistance to landowners willing to fence riparian and other sensitive areas (areas prone to erosion) to exclude cattle and sheep. Calf/cow operations should take first priority for riparian fencing programs over steer operations.	2	60	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.2.3	Action Step	Livestock	Aid landowners willing to fence off riparian areas with development of offstream alternative water sources	2	30	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.2.4	Action Step	Livestock	Develop and fund riparian restoration and bank stabilization projects to regain riparian corridors damaged from livestock and other causes.	2	30	Marin RCD, NRCS						TBD	
WalC-CCC-18.1.2.5	Action Step	Livestock	Manage rotational grazing to aid in the reduction of noxious weeds.	3		Marin RCD, NRCS						TBD	
WalC-CCC-18.1.3	Recovery Action	Livestock	Prevent impairment to stream hydrology (impaired water flow)										
WalC-CCC-18.1.3.1	Action Step	Livestock	Increase the use of water storage and catchment systems that collect rainwater in the winter for use during the dry summer and fall seasons.	2	60	Marin RCD, NRCS						TBD	Cost difficult to determine because of landowner participation.
WalC-CCC-18.2	**Objective**	**Livestock**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-18.2.1	Recovery Action	Livestock	Improve canopy cover										
WalC-CCC-18.2.1.1	Action Step	Livestock	Assess riparian canopy, extent of exotic vegetation (e.g., Arundo donax, etc.), and prioritize, develop and implement riparian habitat projects using native vegetation	2	5	Marin RCD						TBD	
WalC-CCC-18.2.1.2	Action Step	Livestock	Support grazing practices that minimize impacts to riparian and instream habitat: livestock exclusion, rotational grazing, etc.	2	60	Marin RCD, RWQCB						TBD	
WalC-CCC-18.2.1.3	Action Step	Livestock	Increase the width of riparian corridors to 150' to allow multi-age stands of native trees and shrubs, and eventual recruitment of LWD	2	50							In-Kind	

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-18.2.1.4	Action Step	Livestock	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers throughout the watershed (CDFG 2004).	3	60	City Planning, Land Trusts, Sonoma County						In-Kind	
WalC-CCC-18.2.2	Recovery Action	Livestock	Improve tree diameter										
WalC-CCC-18.2.2.1	Action Step	Livestock	Increase tree diameter within 55% of watershed to achieve optimal riparian forest conditions (55 - 69% Class 5 & 6 tree)	3	30								Cost accounted for in above action steps.
WalC-CCC-18.2.2.2	Action Step	Livestock	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.	3	30							TBD	
WalC-CCC-18.2.2.3	Action Step	Livestock	Encourage programs to purchase land/conservation easements to re-establish and enhance natural riparian communities.	3	10	Marin RCD, MMWD						In-Kind	
WalC-CCC-19.1	**Objective**	**Logging**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
WalC-CCC-19.1.1	Recovery Action	Logging	Prevent impairment to instream habitat complexity (reduced large wood and/or shelter)										
WalC-CCC-19.1.1.1	Action Step	Logging	Encourage forest management which allows for optimal levels of natural LWD recruitment of larger older trees into stream channels	3	60	Board of Forestry, Marin County, NMFS, Private Landowners, US EPA						In-Kind	Recruitment of LWD to the stream is critical. This action is mainly a policy issue, with little or no direct costs.
WalC-CCC-19.1.2	Recovery Action	Logging	Prevent impairment to riparian										
WalC-CCC-19.1.2.1	Action Step	Logging	Conserve and manage forestlands for older forest stages.	3	60	Board of Forestry, CDFG, Marin County, NMFS, USEPA						TBD	Costs cannot be determined at this time, due to an unknown number of variables and research priorities.
WalC-CCC-22.1	**Objective**	**Residential/Commercial Development**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
WalC-CCC-22.1.1	Recovery Action	Residential/Commercial Development	Prevent impairment to riparian species and composition										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-22.1.1.1	Action Step	Residential/Commercial Development	Develop riparian setbacks/buffers where they do not currently occur, and enforce requirements of local regulations where they do	2	30	City Planning, County Planning						In-Kind	
WalC-CCC-22.1.1.2	Action Step	Residential/Commercial Development	Reduce impacts of existing development in floodplains/riparian zones by encouraging willing landowners to restore these areas	3	15	CDFG, RWQCB						In-Kind	This action is basically a policy issue, however additional authorities may be developed to implement the action fully.
WalC-CCC-22.1.1.3	Action Step	Residential/Commercial Development	Explore the use of conservation easements to provide incentives for private landowners to preserve riparian corridors	3	10	Land Trusts, Private Consultants, Private Landowners, RCD						In-Kind	
WalC-CCC-22.1.1.4	Action Step	Residential/Commercial Development	Utilize native plants when landscaping and discourage the use of exotic invasives	3		Private Landowners, UC Extension							
WalC-CCC-22.1.2	Recovery Action	Residential/Commercial Development	Prevent impairment to watershed hydrology										
WalC-CCC-22.1.2.1	Action Step	Residential/Commercial Development	Assess efficacy and necessity of ongoing stream maintenance practices and evaluate, avoid, minimize and/or mitigate their impacts to rearing and migrating coho.	3	50	County Planning, MMWD						In-Kind	
WalC-CCC-22.1.2.2	Action Step	Residential/Commercial Development	Implement performance standards in Stormwater Management Plans.	3		County Planning, RWQCB							
WalC-CCC-22.1.2.3	Action Step	Residential/Commercial Development	Implement DS level actions	2									
WalC-CCC-23.1	**Objective**	**Roads/Railroads**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-23.1.1	Recovery Action	Roads/Railroads	Prevent impairment to instream substrate/food productivity (impaired gravel quality and quantity)										
WalC-CCC-23.1.1.1	Action Step	Roads/Railroads	Assess existing road networks and implement actions that hydrologically disconnect roads and reduce sediment sources	2	10		12.00	12.00				24	Cost for road inventory estimated at $927/mile (assume 25% of road network).

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-23.1.1.2	Action Step	Roads/Railroads	Assess roads in Salmon Creek, Walker Creek and Keys Creek to identify high priority and high sediment yield sources.	2		Private Consultants, Private Landowners, Public Works, RCD							
WalC-CCC-23.1.1.3	Action Step	Roads/Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	5	CDFG, Marin County, NMFS, NRCS	250.00					250	
WalC-CCC-23.1.1.4	Action Step	Roads/Railroads	Reduce the hydrologic connectivity of roads and trails to adjacent crossings across watercourses.	3	60	Marin County, Marin RCD, MMWD, Private Landowners						TBD	
WalC-CCC-23.1.1.5	Action Step	Roads/Railroads	Restoration projects that upgrade or decommission high risk roads in Core areas should be considered an extremely high priority for funding (e.g., PCSRF). Where no Core areas are designated, apply this action to Phase I areas.	2	60	CDFG, NMFS, RWQCB, WCB						TBD	
WalC-CCC-23.1.1.6	Action Step	Roads/Railroads	Decommission riparian roads and skid trails on forestlands that deliver sediment into adjacent watercourses. High priority streams identified by CDFG habitat reports include Verde Canyon, Frink Canyon, and Salmon Creek (http://coastalwatersheds.ca.gov/)	3	10	NRCS, Private Landowners, Public Works	18.00	18.00				36	Cost based on treating 3 miles of riparian road at a rate of $12,000/mile.
WalC-CCC-23.1.1.7	Action Step	Roads/Railroads	Establish adequate spoils storage sites throughout the watershed so material from landslides and road maintenance can be stored safely away from watercourses. Coordinate these efforts with all landowners in the watershed.	3		Private Landowners, Public Works							
WalC-CCC-23.1.1.8	Action Step	Roads/Railroads	Utilize best management practices for road maintenance, management (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3		Private Landowners, Public Works							
WalC-CCC-23.1.1.9	Action Step	Roads/Railroads	Utilize BMP's to reduce the lengths of ditches, increase the size of ditch relief culverts, or replace with rolling dips	3		Private Consultants, Private Landowners, Public Works, RCD, State Parks							
WalC-CCC-23.1.2	Recovery Action	Roads/Railroads	Prevent impairment to passage and migration										

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-23.1.2.1	Action Step	Roads/Railroads	Assess private and public road stream crossings for barrier potential and implement recommendations	2	5	CDFG, Private Consultants, Private Landowners, RCD, Trout Unlimited						TBD	
WalC-CCC-23.1.2.2	Action Step	Roads/Railroads	Utilize BMP's to upgrade existing crossings (bridges, culverts, fills, and other crossings) to accommodate 100-year flood flows and associated bedload and debris.	2	10	Private Consultants, Private Landowners, Public Works, State Parks	446.00	446.00				892	Cost based on treating 4 crossings (assume upgrade to bottomless arch) at a rate of $223,051/unit.
WalC-CCC-23.1.2.3	Action Step	Roads/Railroads	All new crossings and upgrades to existing crossings (bridges, culverts, fills, and other crossings) should accommodate 100-year flood flows and associated bedload and debris.	3		Public Works							
WalC-CCC-23.1.2.4	Action Step	Roads/Railroads	Utilize best management practices for road construction, maintenance, management and decommissioning (e.g. Fishnet 4C, 2004; Weaver and Hagans, 1994; Sommarstrom et al., 2002; Oregon Department of Transportation, 1999).	3		FishNet 4C, Private Landowners, Public Works							
WalC-CCC-24.1	**Objective**	**Severe Weather Patterns**	**Address the present or threatened destruction, modification, or curtailment of the species habitat or range**										
WalC-CCC-24.1.1	Recovery Action	Severe Weather Patterns	Prevent impairment to water quality (impaired instream temperature)										
WalC-CCC-24.1.1.1	Action Step	Severe Weather Patterns	Maintain canopy levels at desirable levels in all streams and restore canopy levels to desirable levels in high value habitat areas (See WATER QUALITY for specific actions/areas	2		CDFG, NOAA RC, Private Landowners, Trout Unlimited							
WalC-CCC-24.1.1.2	Action Step	Severe Weather Patterns	Implement DS level actions	2									
WalC-CCC-25.1	**Objective**	**Water Diversion/Impoundment**	**Address the present or threatened destruction, modification or curtailment of the species habitat or range**										
WalC-CCC-25.1.1	Recovery Action	Water Diversion/Impoundment	Prevent impairment to stream hydrology (impaired water flow)										
WalC-CCC-25.1.1.1	Action Step	Water Diversion/Impoundment	Allow all "fisheries flows" (baseflows, and passage, attractant, and channel maintenance flows) to bypass diversion facilities.	2		SWRCB							

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY 1-5	FY 6-10	FY 11-15	FY 16-20	FY 21-25	Entire Duration	
WalC-CCC-25.1.1.2	Action Step	Water Diversion/Impoundment	Promote off-channel storage to reduce impacts of water diversion (e.g., storage tanks for rural residential users).	2	20	CDFG, Private Landowners, RCD, RWQCB, Sonoma County, Sonoma County Water Agency						TBD	Costs are minimal to promote. Costs for implementation will depend on the number of participants.
WalC-CCC-25.1.1.3	Action Step	Water Diversion/Impoundment	Promote water conservation best practices such as drip irrigation for vineyards.	3	20	CDFG, Farm Bureau, NRCS, Water Agencies						0	Promoting water conservation best practices is not expected to result in additional costs.
WalC-CCC-25.1.1.4	Action Step	Water Diversion/Impoundment	Implement DS level actions	3									
WalC-CCC-25.1.2	Recovery Action	Water Diversion/Impoundment	Prevent impairment to water quality (increased turbidity, suspended sediment, and/or toxicity)										
WalC-CCC-25.1.2.1	Action Step	Water Diversion/Impoundment	Identify upstream pollution sources which contribute to poor water quality conditions in the estuary	2		County Planning, SWRCB, Water Agencies						TBD	
WalC-CCC-25.1.3	Recovery Action	Water Diversion/Impoundment	Prevent reduced density, abundance, and diversity										
WalC-CCC-25.1.3.1	Action Step	Water Diversion/Impoundment	Adequately screen water diversions to prevent juvenile salmonid mortalities.	2		CDFG, NMFS HCD							

SUPPLEMENTAL POPULATIONS

Central CA Coast Coho Salmon ~ Alder Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

26.1.1.3. **Action Step:** Address all water diversions (permitted and illegal) to ensure bypass flows are fully protective of all life stages for all water years (including critically dry years).

26.1.1.4. **Action Step:** Work with counties to discourage rezoning of forestlands to agricultural (e.g., vineyards) or rural residential landuses.

26.1.1.5. **Action Step:** Protect and enhance streamsides with buffers including buffers on non-fishbearing and ephemeral streams, to promote properly functioning processes of riparian areas, water flow and sediment control.

26.1.1.6. **Action Step:** Work with regulatory agencies and landowners to discourage marijuana cultivation and/or control riparian removal, water use and toxic inputs known to have adverse effects to coho salmon stream habitats.

26.1.1.7. **Action Step:** Hydrologically disconnect roads, and avoid new road construction that would impact spawning and rearing habitats.

26.1.1.8. **Action Step:** Conduct outreach to landowners regarding the status of CCC coho salmon and assist them in the adoption of best management practices to reduce impacts to coho salmon and their habitat.

26.1.1.9. **Action Step:** Discourage stream channel alterations that reduce habitat availability, channelize streams, and/or permanently disrupt the natural successional processes (e.g., let trees age and die) in riparian zones.

26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Brush Creek

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

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26.1.1.9. **Action Step:** Discourage stream channel alterations that reduce habitat availability, channelize streams, and/or permanently disrupt the natural successional processes (e.g., let trees age and die) in riparian zones.

26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate

genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho ~ DeHaven Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

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26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Elk Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

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26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Greenwood Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

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26.1.1.9. **Action Step:** Discourage stream channel alterations that reduce habitat availability, channelize streams, and/or permanently disrupt the natural successional processes (e.g., let trees age and die) in riparian zones.

26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Hare Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

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26.1.1.9. **Action Step:** Discourage stream channel alterations that reduce habitat availability, channelize streams, and/or permanently disrupt the natural successional processes (e.g., let trees age and die) in riparian zones.

26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Juan Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

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Central CA Coast Coho Salmon ~ Jug Handle Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

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26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Laguna Creek

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

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26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Little River

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range.

26.1.1. **Recovery Action:** Protect watershed processes.

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

26.1.1.3. **Action Step:** Address all water diversions (permitted and illegal) to ensure bypass flows are fully protective of all life stages for all water years (including critically dry years).

26.1.1.4. **Action Step:** Work with counties to discourage rezoning of forestlands to agricultural (e.g., vineyards) or rural residential landuses.

26.1.1.5. **Action Step:** Protect and enhance streamsides with buffers including buffers on non-fishbearing and ephemeral streams, to promote properly functioning processes of riparian areas, water flow and sediment control.

26.1.1.6. **Action Step:** Work with regulatory agencies and landowners to discourage marijuana cultivation and/or control riparian removal, water use and toxic inputs known to have adverse affects to coho salmon stream habitats.

26.1.1.7. **Action Step:** Hydrologically disconnect roads, and avoid new road construction that would impact spawning and rearing habitats.

26.1.1.8. **Action Step:** Conduct outreach to landowners regarding the status of CCC coho salmon and assist them in the adoption of best management practices to reduce impacts to coho salmon and their habitat.

26.1.1.9. **Action Step:** Discourage stream channel alterations that reduce habitat availability, channelize streams, and/or permanently disrupt the natural successional processes (e.g., let trees age and die) in riparian zones.

26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.

Central CA Coast Coho Salmon ~ Russian Gulch

ACTIONS FOR RESTORING HABITATS

Watershed Process

26.1. **Objective:** Address the present or threatened destruction, modification, or curtailment of the species habitat or range

26.1.1. **Recovery Action:** Protect watershed processes

26.1.1.1. **Action Step:** Identify and remediate upslope sediment sources that result in high rates of sedimentation and turbidity to levels commensurate with historical conditions.

26.1.1.2. **Action Step:** Implement restoration actions to improve summer and winter rearing habitats. Actions should include large woody material augmentation to create complex pool habitats, enhancement and creation of alcoves and off-channel habitats for velocity refuge, and estuarine enhancement.

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26.1.1.10. **Action Step:** Where coho salmon are extirpated and habitat and stream flows are adequate, reintroduce coho salmon to watersheds using appropriate genetic stocks. Reintroduced populations should be monitored to evaluate effectiveness of reintroduction efforts.