Request for Incidental Harassment Authorization

CIPL Cross Inlet Extension Project

Submitted to:

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Office of Protected Resources

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On Behalf of:

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1. DESCRIPTION OF THE ACTIVITY

1.1. Background and Location

Harvest Alaska, LLC (Harvest) plans to extend their Cook Inlet Pipeline (CIPL) located in upper Cook Inlet, Alaska (Figure 1-1). The modifications, referred to hereafter as the Project, include new onshore and offshore pipelines, pipeline junctions, shutdown valve stations, and work pads as well as modifications to existing mechanical, electrical, civil, cathodic protection, and structural infrastructure.

The marine components of the Project are subject to review under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). The MMPA prohibits the taking of marine mammals except under certain situations. Sections 101 (a) (5)(D) of the MMPA allows for the issuance of an Incidental Harassment Authorization (IHA), provided an activity results in negligible impacts on marine mammals and would not adversely affect subsistence use of these animals.

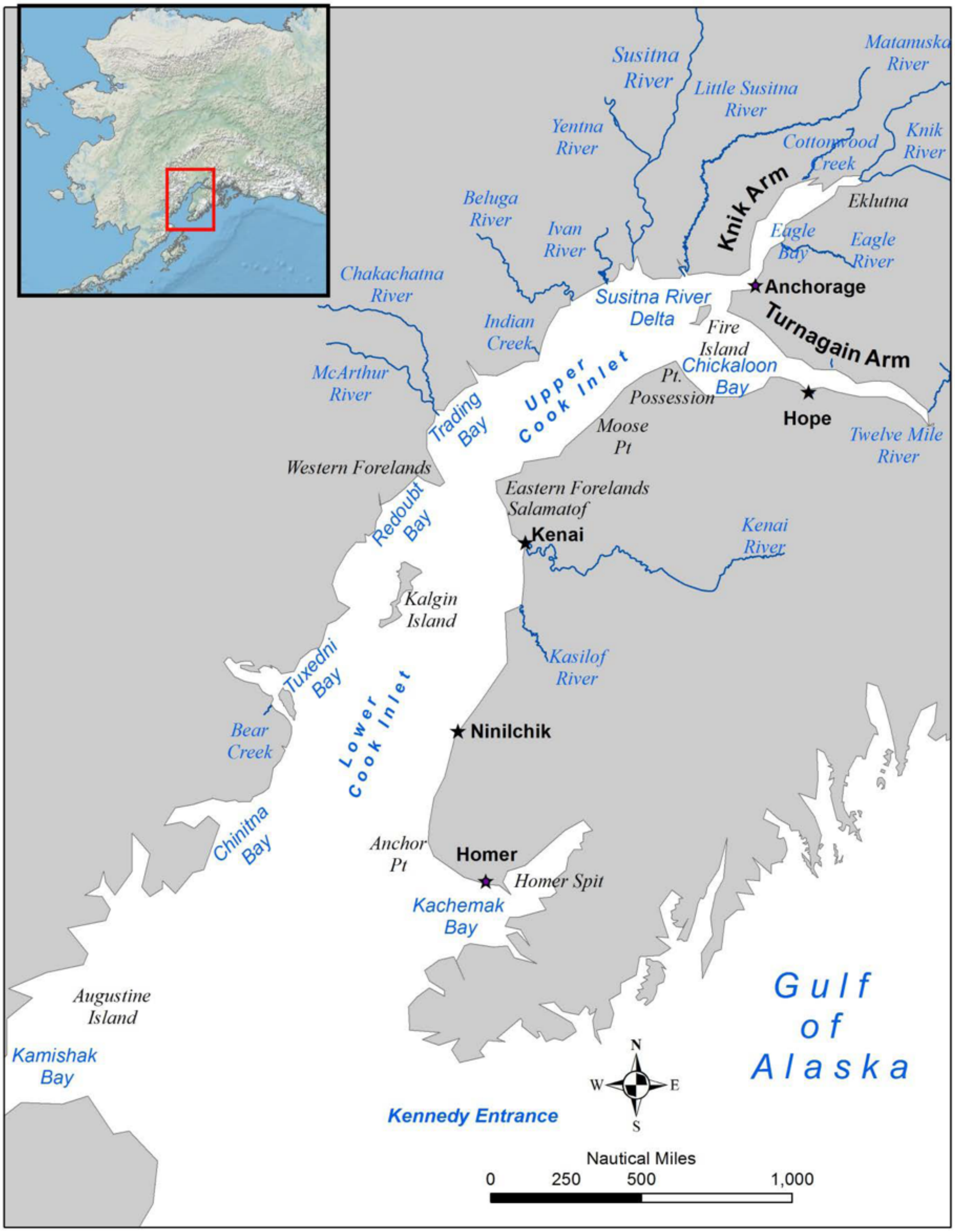
The proposed Project would occur in marine waters that support several marine mammal species. The timing and duration of specific Project-related activities may result in the incidental taking by acoustical harassment of marine mammals protected under the MMPA. Incidental take is an unintentional, but not unexpected, take of a marine mammal. The positioning and installation of the offshore pipeline would be accomplished using a variety of pipe pulling, positioning, and securing methods supported by dive boats, tug boats, and/or barges and winches. Harvest is requesting an IHA from the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) for the take by harassment of six marine mammal species under their jurisdiction that may occur in the vicinity of the Project including beluga whales, harbor seals, harbor porpoise, killer whales, Steller sea lions and humpback whales.

While the installation of the subsea pipelines has the potential to take marine mammals by harassment, it is not expected to result in serious injury or mortality of any marine mammal. Specifically, Harvest is requesting that NMFS issue an IHA in March 2018, effective for a 12-month period, allowing for the non-lethal taking of small numbers of marine mammals by acoustical harassment incidental to the proposed activities that would be conducted during all demolition and re-construction phases of the Project. This request is submitted pursuant to Section 101 (a) (5)(D) of the MMPA, 16 USC 1371.101 (a) (5), and 50 CFR 216, Subpart I.

1.2. Purpose and Need for the Action

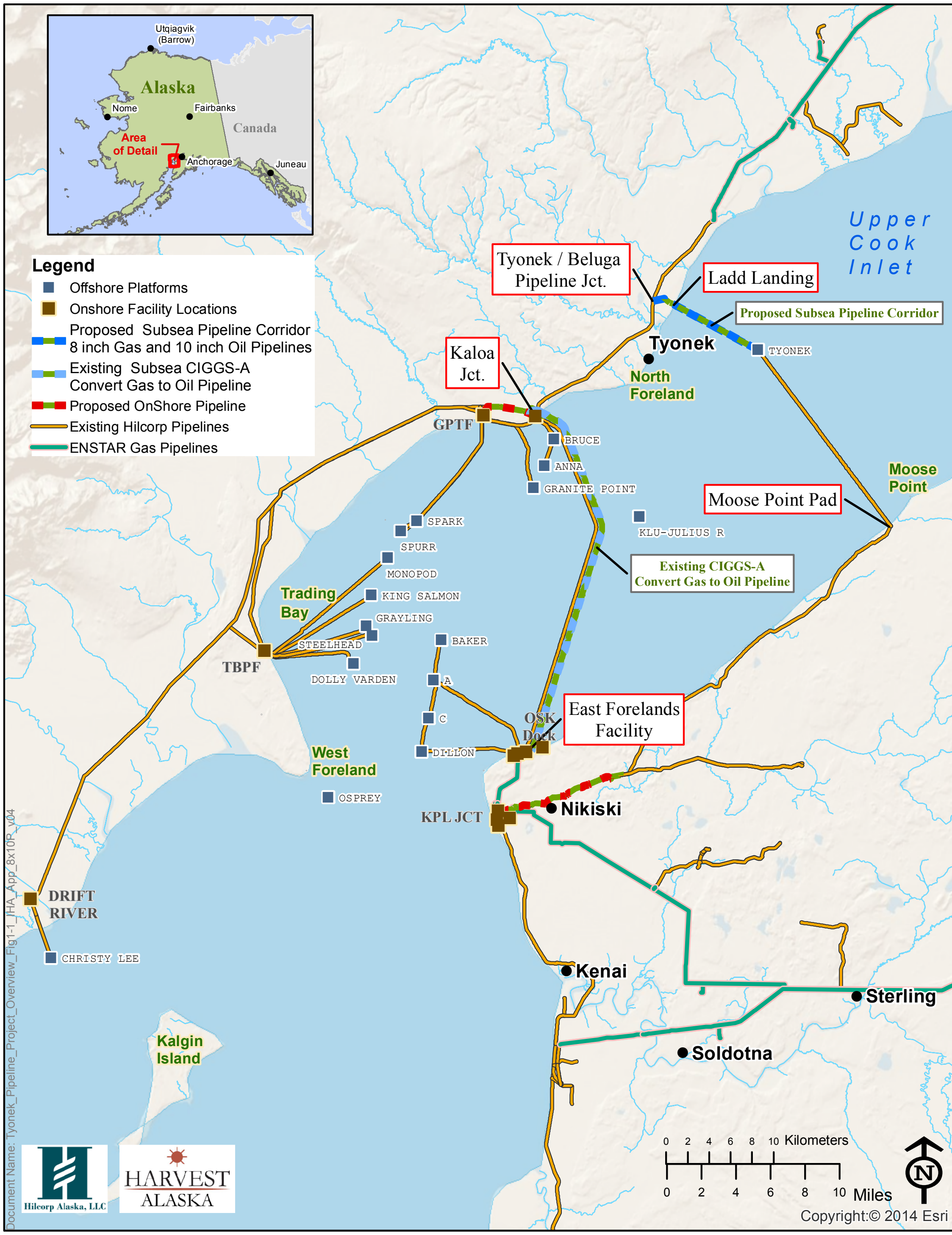
The purpose and need of the Project is to allow for the transportation of natural gas directly from the Tyonek Platform to the Beluga Pipeline (BPL) on the west side of Cook Inlet for use in the Southcentral natural gas system (see Figure 1-2). This would allow a direct connection for natural gas produced at the Tyonek platform to the Kenai Beluga Pipeline system. In addition to the 10-inch (in.) diameter gas pipeline between the Tyonek Platform and Ladd Landing, a new 8 in. oil pipeline would be installed within the same alignment to support future oil development at Tyonek Platform. The new oil pipeline could eventually be used to extend oil service across Cook Inlet, thereby eliminating tanker traffic across

FIGURE 1-1. COOK INLET, ALASKA



Source: NMFS 2016a.

FIGURE 1-2. HAREVST PIPELINE PROJECT OVERVIEW



Source: Harvest Alaska, LLC

the inlet and allowing for the Drift River Terminal to be decommissioned (see Figure 1-2).

1.3. Definition of the Action Area

For purposes of this IHA, the Action Area is defined as the area within which all direct and indirect effects of the Project could occur. The Action Area extends out to a point where no measurable effects from the Project are expected to occur. Therefore, Harvest considers the Action Area to be larger than the immediate area of the Tyonek Platform (see Figure 1-2). Support and work vessels would operate within the Action Area transiting along the pipeline corridor between the Tyonek platform and the west side of Cook Inlet. The Tyonek Platform, proposed Project, and the Action Area, are located in designated critical habitat for the Cook Inlet DPS of beluga whales (see Section 2.1.1.3).

1.4. Proposed Action

The Project includes the installation of two new steel subsea pipelines in the waters of Cook Inlet: the 10-in. nominal diameter Tyonek W 10 gas pipeline (Tyonek W 10) between the Tyonek Platform and the Beluga Pipeline (BPL) Junction and the 8-in. nominal diameter Tyonek W 8 oil pipeline (Tyonek W 8) between Tyonek Platform and Ladd Landing (Figure 1-2). The length of the Tyonek W 10 would be approximately 11.1 kilometers (km, 6.9 miles [mi]) with 2.3 km (1.4 mi) onshore and 8.9 km (5.5 mi) offshore in Cook Inlet waters. The Tyonek W 8 would be approximately 8.9 km (5.5 mi) in Cook Inlet waters. The new 8 in. oil pipeline would be placed and capped for future service. An existing subsea gas pipeline crossing the inlet from Koala Junction to the East Forelands facility would be converted from gas to oil (see Figure 1-2). No in-water noise is expected to be produced by this activity.

Pipeline installation would occur from approximately April through mid-September 2018. During this time, the vessels described in the following sections may be in the Project Area at any one time supporting pipeline installation. For the purposes of determining potential exposure of marine mammals to underwater noise, noise associated with the two proposed tugs has been used to establish the potential ensonified area as described in more detail in Section 6. Table 1-1 provides duration of activity for each Project component described in the following subsections. Broadband noise levels associated with these sources are described in Section 6. Section 6 also describes how these noise sources were used to estimate takes.

TABLE 1-1. ESTIMATED NOISE SOURCES AND DURATIONS THAT MAY RESULT IN TAKE OF MARINE MAMMALS

Project Component	Noise Source	Approximate Duration (days)	Approximate Hours per Day
Obstruction Removal & Stabilization Pipeline Pulling – Offshore Sections	Tugs[1] Dive Boat[2] Sonar Boat[3] Work/Crew Boat Anchoring[4]	68 28 9 68 68	10-12 9 12 8 6
Trenching	Tug Backhoe or Bucket Crane[5]	10 10	12 12
Pipeline Pulling - Nearshore Sections	Tug	16	10-12
Mid-line Pipeline Tie-In Work (connecting the two halves together offshore)	Tugs Dive Boat[2] Work/Crew Boat Anchoring[2]	7 4 7 7	10-12 9 12 6
Connections at Tyonek Platform	Tugs Work/Crew Boat Dive Boat	7 7 7	10-12 8 9
TOTAL Approximate Duration for In-Water Work For Each Vessel	**Tugs** **Work /Crew Boat** **Sonar Boat** **Dive Boat**	**108**[6] **108**[6] **9** **39**	

[1]Includes 15 days for repositioning obstacles along the pile pull path.
[2] The shorter duration assumes the dive boat would be tied to the barge most of the time. Main engines would not be running while tied up, but a generator and compressors would be running to support diving operations.
[3] Sonar boat engine noise only. Sonar array equipment would operate at frequencies over 200 kHz, which is outside of the hearing range for marine mammals expected in the Action Area.
[4] Included with tug noise.
[5] Backhoe and tug would be used approximately 2-4 hours per low/slack tide to complete transition zone installation.
[6] Total time does not include 6 weather days because vessels would not be in the water during those days.

1.4.1. Project Planning and Mobilization

Mobilization of materials and equipment to pipe storage areas at Ladd Landing began in the Fall of 2017. Land-based bluff stabilization at Ladd Landing and vegetation clearing at onshore pipe pulling and fabrication areas was also conducted. To prepare for pipeline installation beginning Spring 2018, preliminary mobilization of materials to the west side of Cook Inlet followed established shipping lanes and occurred in Fall of 2017. Additional equipment and material mobilization would occur sporadically through 2018 along these same lanes.

Project-related marine construction work associated with the subsea pipelines would occur in April 2018. When the construction is complete, equipment would be demobilized from the west side of Cook Inlet, likely using the Beluga Landing and Tyonek dock for load-out. Demobilization would occur for east side scopes of work in late 2018.

1.4.2. Obstacle Removal

Prior to initiating pulling activities, obstacles along the pipeline corridor would be repositioned. A subsea sonar survey was conducted in Spring 2017 to identify any obstacles that could damage the pipe during installation or impede the pipe pulling activities. A number of items 5 feet (ft) (1.5 meters [m]) in diameter or greater were identified during the survey and would be relocated to a position that does not interfere with the pipeline route. Repositioning would occur over a 15-day period prior to the pulling activities in Spring 2018. It is estimated that fewer than 50 obstacles would need to be moved.

Equipment needed to move the obstacles would include a barge with crane (Manitowoc 4000 with 3.5 yard bucket) or winch, two tugs, and dive boat. If the barge winch is used, it would pull a wire cable onto a drum (i.e., bucket) to move the obstacle. The obstacle would be moved the minimum distance to clear the route. During slack tide, divers would attach the pull device to the boulder, which would then be repositioned using the crane or tug. The tug boat alone may be used to reposition smaller obstacles using main engines. No thrusters would be required. The wire cable attached to the obstacle would intermittently be in and out of the water for relatively short periods (i.e., long enough for divers to attach it to an obstacle, move it, and retract the wire). Slack wire would not remain in the water. The operation would occur 24 hours/day but tugs would only move the barge and anchors during slack tide. Four anchors would be used to secure the barge as it moves along the pipeline route.

1.4.3. Subsea Pipeline Installation

The new Tyonek W 10 and Tyonek W 8 pipelines would be installed concurrently, parallel to each other offshore from Ladd Landing to the Tyonek Platform. Pipeline installation would be accomplished by pulling the pipe from Ladd Landing to the Tyonek Platform. To support offshore pipeline installation, an onshore pipe fabrication and pulling area would be developed. Pipeline sections would be constructed onshore at Ladd Landing fabrication area, and pulled offshore with additional sections added until the new pipeline reaches the Tyonek Platform. Additional pipe sections would be welded together, section splice welds inspected, and coatings applied to welds in the onshore fabrication area. Pipeline sections would be inspected and hydrotested, and coatings would be verified prior to pulling into place. Upon completion of pulling, the pipeline would be buried in the tidal transition zone. The entire pipeline installation process is expected to occur over a period of about 108 days in the Spring/Summer of 2018 (see Table 1-1).

The proposed method of construction is to fabricate the pipelines in approximately 0.5 mi (0.8 km) segments onshore in the cleared pull area. Additional segments would be connected on shore, and the entire section would be pulled offshore following connection of each new segment, until the pipeline section is approximately half of the entire offshore length of the pipeline (approximately 2.5 mi [4 km]). Then the entire 2.5-mile section would be pulled into place where the 10-in. line can be connected to Tyonek Platform. The 8-in. line would be capped subsea adjacent to the platform and would be connected to platform in the future. Following this, a second section would be constructed using the same technique as the first. It would be pulled into place where it can be connected to the first section using a subsea mechanical connection.

Pipeline segments/sections would be pulled from shore using a winch mounted on an anchored pull barge, which would be repositioned by utilizing two tugs. The maximum velocity during pulling would be about 20 ft per minute or 0.2 knots. The barge would have four anchors, which would be set at slack tide. Each anchor weighs 35,000 pounds (lbs) (15,900 kilograms [kg]), with 15 ft (4.6 m) of chain and 4,200 ft (1280 m) of wire cable. Harvest estimates that about 100-110 anchor moves would be required intermittently over the 108-day construction period. Anchor handling would only occur during slack tide lasting for about 2 hours.

An additional winch onshore would maintain alignment of the pipeline during pulling and the winch on the pull barge would pull the pipeline from shore out to the platform. A dive boat would be used to pull the tag line to the main winch line. Both pipelines would be installed concurrently. Once a segment for one pipeline has been pulled, the corresponding segment for the other pipeline would be pulled, until the long sections for both pipelines have been constructed. Then both pipelines would be placed in the final locations. After the first long sections have been pulled to the Tyonek Platform, fabrication and pulling of the second long sections would be completed. A subsea mechanical connection would be completed approximately half way to the platform.

Pulling would occur between slack tides with repositioning occurring during the slack water periods per day, and could take up to 21 days. Pulling into position mainly during slack tide would minimize cross currents and maximize control of pipeline routing. Tugs would be powered on for 24-hrs a day during the pipe pulling activities. However, the engines would only be at full power while actually pulling during the slack tide periods per day (about 12 hours total); otherwise they would be in stand-by mode. Tugs, other boats, and/or the shore-mounted winch would be used intermittently for pipeline positioning, or to adjust the routing of the pipeline if necessary due to impedance. A sonar array would be used to confirm that the pipe is being installed in the correct position and location.

Once the pipeline sections are in place, divers working from a dive boat located beside the barge would install sand or Seacrete bags on or under the pipelines for anchoring and stabilization as needed. Stabilization is expected to take about 10-11 days. Tugs would be used during slack tide to move four anchors and reposition the barge along the pipeline route, similar to pulling the pipe. Upon completion of pipeline stabilization activities, the dive boat would be used to install cathodic protection (anode sleds) along the pipelines as required. Additional sonar surveys would be completed after installation to confirm that pipeline placement is correct. Equipment to be used from the survey boat would operate on frequencies higher than 200 kHz. As shown in Table 1-1, it is estimated that pipeline installation (including obstacle removal described in Section 1.4.2 and stabilization) would occur over a 108-day period.

1.4.4. Transition Zone at Ladd Landing

At the end of the subsea pipeline installation, the new pipelines would extend from the shore to a point close to the Tyonek Platform. In the tidal transition zone, the pipeline would be exposed on the ground surface. The exposed pipelines would be buried through the tidal transition zone and each would be connected to its respective onshore pipeline and shutdown valve station. The proposed method for pipeline burial in the transition zone is by trenching adjacent to the pipeline using the open cut method, placing the pipeline in the trench, followed by direct burial of the pipeline to a depth of approximately 6 ft (1.8 m). Each pipeline would be buried in a separate trench.

The trench from the cut in the bluff would be continued into the tidal zone area and would be dug from the beach side as far offshore as possible. The barge *Ninilchik* would then be anchored as close to the beach as possible and the trench continued the required distance from shore to adequately protect the pipe from ice damage. This would be done from the barge with the crane equipped with a clam shell bucket or backhoe. Alternatively, an excavator could be utilized from the barge deck for this work. If the trench is filled in by the tidal action and prevents the pipe from being pulled a cofferdam may be required to prevent the trench filling prior to the completion of the pull. If a cofferdam is required to keep the trench open during tidal swings, a 4-sided or 3-sided trench box (moveable partial cofferdam) would be used. Walls would be made of sheet piles and bracing would be placed between the walls for support. The sheet piles would not be driven into seafloor. The trench would be opened up when tide was out and then the trench box placed into the trench area to keep trench open during tide change. Walls would extend from the bottom of trench (6 feet) to above the high tide water level. A 3-sided box could be used when the high tide line would not go past the upper part of open trench.

Trenching in the tidal transition zone would take place during low tide to allow shore-based excavators maximum distance into the tidal zone. Work in the intertidal zone in waters less than 30-ft (9-m) deep work would occur for approximately 2-4 hours per slack tide over a 4- to 6-week period.

1.4.5. Underwater Connection of Pipeline Segments and at Tyonek Platform

Once each 2.5-mi section of each pipeline (four sections total) have been pulled into place, divers would measure the specific distances between the sections. Steel spool sections with gaskets that would connect the two sections of each pipeline would be fabricated onshore; divers would use the spool sections to connect the pipeline segments underwater. The dive boat would be operating intermittently during the 9-day period needed to complete the underwater connections. The barge would be stationary, with tugs powered on and standing-by.

The subsea gas pipeline (Tyonek W10) would be connected to new riser at the Tyonek Platform by new subsea connections. In addition to modifications to existing piping, a shutdown valve would be installed. An existing pipeline lateral (from platform to subsea flange) would be capped and abandoned in place; it would be available for future use. The connections would be fabricated onshore, transported to the platform on a workboat, and lowered to the seafloor. A dive boat, tugs, workboat and barge would facilitate the connection from new pipeline to the base of the new gas riser. During the connections, the dive boat and work boat would likely be secured to the pull barge and no engines running. The Tyonek W 8 oil pipeline would not be connected to the Tyonek Platform at this time. Work in the transition zone would occur over a period of about 8 days in late Summer/Fall of 2018.

Connection activities at the platform would occur in late Spring/Summer 2018 after the pipeline is installed. A set of underwater tools may be used for a brief period to expose the location where the new subsea gas pipeline would be connected to the existing pipeline and prepare the pipeline for connection. Tools used for this work may include chipping hammers, a hydraulic wrench to loosen bolts, underwater pressure washer to clean the existing infrastructure, and hydraulic grinder. These tools may include a hydraulic wrench, hydraulic grinder, and a hydraulic breaker and pressure washer (i.e., Garner Denver

Series Pressure Washer) for removing concrete from existing infrastructure. The use of the these tools would only be required during one dive for a short duration (i.e., less 30 minutes). Noise generated from the underwater hand tools would be lower than the anticipated levels estimated for the tugs which would occur at the same time. Therefore, takes associated with the use of underwater tools is considered as part of the takes associated with tug use (see Section 6.2).

1.4.6. Pipeline Operation and Maintenance

The design life of the new gas pipeline is approximately 30 years. A design life does not indicate the pipeline and associated structure would be depleted, failure-prone, or require replacement after 30 years. For this Project, the 30-year design life assumes the systems, components, and structures would perform their primary functions with acceptable safety, regulatory, and environmental performance, and would not experience large failures, require extensive replacements, or need significant repairs[1]. The pipeline is designed in accordance with all Federal and State regulations, and accepted industry standards. Geology, soils, seismic hazards and faults, tsunamis, temperature, and water and seafloor characteristics are considered during pipeline design. The pipelines are being designed to withstand the pressure and forces of the Cook Inlet tidal currents, wind waves, ice, scour, and physical obstacles that may contact the pipe. The offshore and transition zone portions of the pipeline would be coated with a Fusion Bonded Epoxy and an additional Abrasion Resistant Overlay coating.

1.4.7. Pressure and Leak Tests

During pipeline construction, all welds would be radiographically or ultrasonically examined prior to pulling the pipe along the seafloor. Once construction is complete for each pipeline segment, hydrostatic testing would occur onshore prior to pulling the segment into place. A final hydrostatic test of the entire pipeline would occur before it is placed into service. Hydrostatic testing of the subsea pipeline would be conducted in accordance with requirements at 49 CFR 195, and would take about 5-6 days. During hydrotesting, the barge would be anchored near the Tyonek Platform and would not be required to move. The pipeline would be tested to a minimum of 125 percent of the design pressure for a minimum of 4 hrs. An additional 4-hr leak test would be conducted following the pressure test.

Water used to test each pipeline segment would be withdrawn from Cook Inlet and discharged back into the inlet after treatment (if required), when the test is complete. The discharge would follow all ADEC wastewater permit requirements.

1.4.8. Cathodic Protection

Leak protection systems for the pipelines include the use of protective coatings and cathodic protection against corrosion. Cathodic protection considers the annual variations in soil resistivity due to seasonal frost. External corrosion would be controlled in accordance with federal regulations. Conductive connections to the pipeline would be strictly controlled. An isolation system would be installed to control stray electric currents in the pipeline and facility piping systems. The isolation system would increase the effectiveness of the cathodic protection system and confine or eliminate electrolytic corrosion.

[1] Repair work is covered under the August 29, 2017 Letter of Concurrence from NMFS to USACE for Hilcorp's 5-year Maintenance Plan.

Cathodic protection would be installed on the new subsea pipelines and subsea valves at the Tyonek Platform as necessary. Existing subsea anode sleds that may interfere with the offshore pipeline installation would be moved prior to pipeline installation. Existing sleds would be inspected and if damaged, replaced. Sand bags would be installed over the cables for new anode sleds or sleds that have been moved as part of pipeline installation. Additional sleds would be installed if required, based on size of subsea components.

1.5. Description of the Action Area

The proposed Project, and the Action Area are located in designated critical habitat for the Cook Inlet Distinct Population Segment (DPS)[2] of beluga whales. For purposes of this application the Action Area is defined consistent with ESA regulations[3] as the area within which all direct and indirect effects of the Project would occur. Various vessels would operate within the Action Area along the pipeline corridor and transit to and from the area between the Tyonek platform and Ladd Landing on the west side of Cook Inlet, and Moose Point on the east side.

From these vessel corridors, the Action Area extends out to a point where no measurable effects from the Project are expected to occur. This includes the zone extending from the barge and support vessels working along the pipeline corridor to a distance where marine mammals are no longer affected by the underwater and in-air sounds produced by the pipe-laying or pulling activities or by noise from the vessels. These sounds might result in increased noise levels that may exceed the behavioral threshold for "takes" (i.e., from behavioral disturbance or harassment) to marine mammals as defined in the MMPA and ESA, and consistent with NMFS acoustic injury guidelines (NMFS 2016b).

The Action Area is close to the noisiest waters in Cook Inlet (Castellote *et al.* 2016). Anthropogenic noise is present every day. Noise from commercial vessels entering and departing from the Port of Anchorage already exceed the behavioral thresholds of 120 decibels referenced to 1 micropascal (dB re 1µPa *or* dB) for marine mammals (Castellote *et al.* 2016). The current noise levels are well above heavy traffic noise reported by Richardson *et al.* (1995) for upper Cook Inlet. This specific source of anthropogenic noise was present in the recordings from all months analyzed, with highest levels occurring in August (Castellote *et al.* 2016). For the purposes of this application, vessels transiting in and out of the Project site are not included in the estimate of potential marine mammal takes.

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[2] A DPS or "distinct population segment" is the smallest division of a taxonomic species permitted to be protected under the ESA recognized as a taxonomic species or subspecies of plant or animal, or in the case of vertebrate species (61 FR 4722: February 7, 1996).

[3] 50 CFR 402.02

2. DATES, DURATION, AND SPECIFIED GEOGRAPHIC REGION

2.1. Dates and Durations of Activities

The proposed date for the issuance of the IHA is approximately March 2018. Pipeline installation would occur from approximately April through mid-September 2018.

Table 2-1 provides duration of activity for each project component described in Section 1.4 and shown on Table 1-1. These durations are used to calculate the number of takes as requested in Section 6.

TABLE 2-1. ESTIMATED DURATION BY NOISE SOURCE AND PROJECT COMPONENT

Project Component	Noise Source	Approximate Duration (days)	Approximate Hours per Day
Obstruction Removal & Stabilization Pipeline Pulling – Offshore Sections	Tugs[1] Dive Boat[2] Sonar Boat Work/Crew Boat Anchoring[3]	68 28 9 68 68	10-12 9 12 8 6
Trenching	Tug Backhoe or Bucket Crane[4]	10 10	12 12
Pipeline Pulling - Nearshore Sections	Tug	16	10-12
Mid-line Pipeline Tie-In Work (connecting the two halves together offshore)	Tugs Dive Boat[2] Work/Crew Boat Anchoring[3]	7 4 7 7	10-12 9 12 6
Connections at Tyonek Platform	Tugs Work/Crew Boat Dive Boat	7 7 7	10-12 8 9
TOTAL Approximate Duration for In-Water Work For Each Vessel	**Tugs** **Work /Crew Boat** **Sonar Boat** **Dive Boat**	**108[4]** **108[4]** **9** **39**	

[1]Includes 15 days for repositioning obstacles along the pile pull path.
[2]The shorter duration assumes the dive boat would be tied to the barge most of the time. Main engines would not be running while tied up, but a generator and compressors would be running to support diving operations.
[3]Included with tug noise.
[4]A tug is needed to place and remove a work barge near the platform.

2.2. Geographic Setting

2.2.1. Physical Environment

Cook Inlet is a complex Gulf of Alaska estuary (as described in BOEM 2016) that covers roughly 7,700 square miles (mi^2; 20,000 square kilometers [km^2]), with approximately 840 mi (1,350 linear km) of coastline (Rugh *et al.* 2000). Cook Inlet is generally divided into upper and lower regions by the East and West Forelands (see Figure 1-1). Northern Cook Inlet bifurcates into Knik Arm to the north and Turnagain Arm to the east. Overall, Cook Inlet is shallow, with an area-weighted mean depth of 148 ft (44.7 m). The average water depth generally increases from north to south in Cook Inlet. Between Fire Island and the Forelands, upper Cook Inlet has an average depth of approximately 18.3 m (60 ft). Central Cook Inlet, from the Forelands to Kachemak Bay, has an average depth of about 27.4 m (90 ft). The average depth from Kachemak Bay to the Inlet mouth of the Barren Islands is approximately 36.6 m (120 ft).

The physical oceanography of Cook Inlet is characterized by complex circulation with variability at tidal, seasonal, annual, and interannual timescales (Musgrave and Statscewich 2006). This region has the fourth largest tidal range in the world and as a result, extensive tidal mudflats that are exposed at low tides occur throughout Cook Inlet, especially in the upper reaches. These tides are also the driving force of surface circulation. Strong tidal currents drive the circulation in the greater Cook Inlet area with average velocities ranging from 1.5 to 3 m per second (3 to 6 knots) (Musgrave and Statscewich 2006; BOEM 2016). The general circulation pattern of lower and middle Cook Inlet is characterized by denser, saltier water that flows northward along the eastern shore and fresher, silty outflowing water moving southward along the western shore (LGL Alaska Research Associates, Inc. 2000).

Freshwater input is also important in determining the circulation within Cook Inlet (Okkonen, Pegau, and Saupe 2009). Freshwater input to Cook Inlet comes from snowmelt and rivers, many of which are glacially fed and carry high sediment loads. Discharge measurements on the Susitna River, the largest draining into upper Cook Inlet, shows a maximum discharge in May (Okkonen, Pegau and Saupe 2009). Four major rivers (the Kenai, Knik, Matanuska and Susitna rivers) drain into Cook Inlet and constitute the largest riverine drainage into the Gulf of Alaska (BOEM 2016). This freshwater input is critical to anadromous fishes for spawning, and is considered critical to at least one of the five Primary Constituent elements (PCEs) of critical habitat for the Cook Inlet DPS of beluga whales.

During winter months, sea, beach, and river ice are dominant physical forces within Cook Inlet. Along the pipeline corridor in upper Cook Inlet sea ice generally forms in October to November and continues to develop through February or March (Moore *et al.* 2000).

2.2.2. Acoustic Environment

Cook Inlet is a high-energy, dynamic environment with large tides, strong currents, natural seismic activity, and seasonal sea ice cover (Moore *et al.* 2000), all of which contribute to a generally high noise environment when compared to open ocean habitats. Cook Inlet includes several active ports and harbors, commercial and recreational fishing activities, an on-water tourism industry, and several sea-plane ports. All of which contribute to ambient noise conditions in Cook Inlet waters.

In 2001, underwater recordings were made from four sound sources within Cook Inlet: 1) overflights by commercial and military aircraft landing at or taking off from Anchorage International Airport (ANC) or Joint Base Elmendorf Richardson (JBER); 2) an oil platform in northwest Cook Inlet; 3) large and small vessel traffic operating in the Anchorage Harbor; and 4) ambient sounds in areas removed from industrial activities (Blackwell and Greene, 2003). Ambient measurements showed broadband levels ranging from 95 to 120 dB re 1µPa. While the levels varied broadly among sites, measurements at individual sites did not vary greatly.

The extreme tidal currents observed in Cook Inlet can produce noise at frequencies greater than (>) 10 Hz from at least three mechanisms (Urick 1983): 1) noise from turbulent flow in the water; 2) noise from water flow over the bottom, especially if there are loose rocks that can move as bedload; and 3) noise from the surface if the flow induces surface roughness. Therefore, it is likely that tidal influences in Cook Inlet are a predominant contributor of noise to the acoustic environment (BOEM 2016).

Shipping noise is a potentially major contributor to the acoustic environments of Alaska and the Arctic region (Huntington *et al.* 2015). Basin-scale modeling has not been conducted for Cook Inlet; however, evaluation of potential noise contribution from shipping can be inferred from vessel traffic density information. In a 2012 Cook Inlet Vessel Traffic Study Report (Cape International, Inc. 2012), patterns of activities were described for vessels >300 gross tons operating during 2010. Results showed that there were 480 port calls or transits through Cook Inlet. Eighty percent of the transits made by 15 ships were for the purposes of: crude oil and product transport; packaged commodity shipments; and passenger/vehicle carriage. Vessel traffic can be used to infer how the acoustic environment would be affected by shipping noise. Vessel activity patterns were used as a general proxy for shipping contribution of noise in the acoustic habitat (BOEM 2016) Activity patterns over one year show high levels of vessel traffic transiting through the Port of Kodiak, Port of Homer and Port of Anchorage, with offshore supply vessels (OSV), tug vessels, and tour boats representing 86 percent of the total underway operating days for vessels in Cook Inlet (BOEM 2016). Ship traffic density maps show that most transits are made along the eastern margin of Cook Inlet between the southern end of the Kenai Peninsula and Anchorage (BOEM, 2016). The seasonal nature of activity in Cook Inlet and the inflow of ice into the region during winter likely decrease the contribution of ship noise during the winter month, and there is a seasonal intensity of anthropogenic noise during the summer months from all sources.

Oil and gas activities contribute to the acoustic environment of Cook Inlet. As of 2015, there were 17 oil and gas platforms within Cook Inlet, of which 13 are active (BOEM 2016). Position-keeping in Cook Inlet is a challenge due to the strong currents, and many platforms may be anchored rather than use dynamic positioning (DP); however, ships using dynamic positioning are used extensively in oil and gas and marine construction operations, and often represent the loudest sources of sound in the inlet during operations.

3. SPECIES AND ABUNDANCE OF MARINE MAMMALS IN THE ACTIVITY AREA

Nineteen marine mammal species are known to occur in the Cook Inlet region (Allen and Angliss 2014, 2015; BOEM 2016; Muto *et al.* 2016). The majority of these species have geographic ranges that do not extend north of the Forelands and into upper Cook Inlet. However, three marine mammal species are common in the Project Area and are likely to be observed in the Action Area: beluga whales (*Delphinapterus leucas*), harbor seals (*Phoca vitulina*), and harbor porpoises (*Phocoena phocoena*) (Rugh *et al.* 2010; Hobbs *et al.* 2011; Shelden *et al.* 2012; Lomac-MacNair *et al.* 2014). Killer whales (*Orcinus orca*) and Steller sea lions (*Eumetopiaa jubatus*) occur less frequently in upper Cook Inlet (Shelden *et al.* 2003), but may still be encountered in the Action Area. Humpback whales (*Megaptera novaenagliae*) are also considered to be infrequent to rare in upper Cook Inlet and observed more frequently near the mouth of lower Cook Inlet. However, these whales have been observed in recent years north of the Forelands; and may be encountered in the Action Area; therefore, they are included in this IHA application.

Other species that have been observed in lower Cook Inlet but are considered rare in the Action Area include the minke whale (*Balaenoptera acutorostrata*), fin whale (*B. physalus*), and gray whale (*Eschrichtius robustus*). Generally, fin whales and gray whales migrate past Cook Inlet, although small numbers have been noted by fishing vessels near Kachemak Bay, and north of Anchor Point (BOEM 2016). The greatest densities of gray whales in lower Cook Inlet occur from November through January, and March through May; the former are southbound, the latter are northbound (Ferguson *et al.* 2015). While these whale species are not included in this IHA application due to the unlikelihood of their occurrence north of the Forelands, proposed monitoring and mitigation techniques would document whether these species were observed in the Action Area and would minimize any potential effects.

Table 3-1 provides a summary of the abundance of the species that occur, even infrequently, in the Action Area. Detailed descriptions of these six species are provided in Section 4.

TABLE 3-1. MARINE MAMMAL SPECIES POTENTIALLY PRESENT IN THE ACTION AREA

Common Name	Scientific Name	Stock Abundance Estimate[1]	ESA Status	MMPA Status	Frequency of Occurrence in Project Area
Beluga whale	*Delphinapterus leucas*	328[2] (Cook Inlet stock)	Endangered	Depleted	Likely
Harbor seal	*Phoca vitulina*	27,386	Not listed	Not Strategic, Non-depleted	Likely
Harbor porpoise	*Phocoena phocoena*	31,046	Not listed	Strategic, Non-depleted	Likely
Steller sea lion	*Eumetopias jubatus*	49,497[3]	Endangered	Endangered, Strategic, Depleted	Infrequent
Humpback whale	*Megaptera novaeangliae*	10,252[4]	Not Listed	Not Strategic, Non-depleted	Infrequent
Killer whale	*Orcinus orca*	1,475 resident 587 transient[5]	Not listed	Not Strategic, Non-depleted	Infrequent

[1]All abundance estimates except for belugas are considered best available abundance estimate, from Muto *et al.* (2016).
[2] Shelden 2017.
[3]Western DPS; Best available but also considered a Minimum Estimate.
[4]Hawaii DPS.
[5]AT1 transients have been seen only in Prince William Sound and in the Kenai Fjords region. They are not considered likely to occur in Cook Inlet especially north of the Forelands in the Action Area. The ATI transient stock is considered depleted and strategic under the MMPA.

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

4.1. Beluga Whales

Beluga whales are distributed throughout the Arctic and sub-Arctic waters of the Northern Hemisphere (Allen and Angliss 2015; Muto *et al.* 2016). Five stocks are recognized in Alaska: Beaufort Sea stock, eastern Chukchi Sea stock, eastern Bering Sea stock, Bristol Bay stock, and Cook Inlet stock (Allen and Angliss 2013). The Cook Inlet stock is the most isolated of the five stocks, as it is separated from the others by the Alaska Peninsula and resides throughout the year in Cook Inlet (Laidre *et al.* 2000; Goetz *et al.* 2012). Only the Cook Inlet stock inhabits the Project Area. The degree of genetic difference between the Cook Inlet beluga stock and other stocks indicate they are isolated and genetically distinct, and have probably been so for several thousand years (O'Corry-Crowe *et al.* 1997; 2002).

4.1.1. Status and Distribution

Status: Systematic surveys of Cook Inlet beluga whales were not conducted prior to 1994. An August 1979 survey (Calkins 1989) did not include all of upper Cook Inlet but it was the most complete survey of the Inlet prior to 1994 and incorporated a correction factor for beluga whales missed during the survey. The Calkins (1989) estimate of 1,300 beluga whales provides the best available estimate for the historical beluga whale abundance in Cook Inlet. For management purposes, NMFS used 1,300 beluga whales as the numerical value for beluga carrying capacity to be used in Cook Inlet[4].

NMFS surveys documented a decline in the population abundance of nearly 50 percent between 1994 and 1998, an estimated decrease from 653 to 347 whales (Rugh *et al.* 2000). Abundance estimates determined from each year of these surveys are found in Hobbs *et al.* (2000, 2011); Rugh *et al.* (2003, 2004a, 2004b, 2005a, 2005b, 2005c, 2006, 2007); and Shelden *et al.* (2012). These results indicated a population that was exhibiting a decline of up to 1.1 percent per year (Hobbs *et al.* 2011). Over the past 10 years, the Cook Inlet beluga whale population has shown a lack of recovery and continues to decline at an annual rate of < 1.0 percent.

In response to the 1994-1998 decline, NMFS initiated a status review on the Cook Inlet beluga whale stock pursuant to the MMPA and the ESA in 1998[5]. The precipitous decline documented in the mid-1990s was attributed to unsustainable subsistence practices by Alaska Native hunters (harvest of >50 whales per year) (Mahoney and Shelden 2000). In 2006, NMFS suspended the subsistence hunt of Cook Inlet beluga whales in an effort to protect the species. In 1999, NMFS also received petitions to list Cook Inlet beluga whales an endangered species under the ESA.[6] NMFS determined that the population decline was due to over harvest by Alaska Native subsistence hunters and, because the Native harvest was regulated in 1999, listing this stock under the ESA was not warranted at the time[7].

The Cook Inlet beluga whale stock was designated as depleted under the MMPA in 2000[8] because the minimum population estimate of 283 (Allen and Angliss 2013) was only 36 percent of the Optimum

[4] *Federal Register* 65 *FR* 34590
[5] *Federal Register* 63 *FR* 64228
[6] *Federal Register* 65 *FR* 17347
[7] *Federal Register* 65 *FR* 38778
[8] *Federal Register* 65 *FR* 34590

Sustainable Population (OSP) of 780 whales. The population estimate has remained at less than half of the OSP, which is the threshold NMFS uses to determine whether a stock/population is depleted under the MMPA (Angliss and Outlaw 2008). NMFS finalized the Conservation Plan for the Cook Inlet beluga in 2008 (NMFS 2008a).

Following the cessation of subsistence hunting of Cook Inlet beluga whales in 2006, the population was expected to recover at a rate of 2 to 6 percent per year (Hobbs *et al*. 2008). However, the population continued to decline at a rate of 1.3 percent per year between 1999 and 2012 (Hobbs *et al*. 2015). In 2006 as the result of the continued decline, NMFS initiated another status review after receiving another petition to list the Cook Inlet beluga whale under the ESA[9, 10].

NMFS issued a decision on the status review on April 20, 2007, concluding that the Cook Inlet beluga whale is a DPS in danger of extinction throughout its range. As a result, NMFS issued a proposed rule to list the Cook Inlet beluga whale as an endangered species[11]. On April 22, 2008, NMFS announced that it would delay the decision on the proposed rule until after it had assessed the population status in the summer of 2008, moving the deadline for the decision to October 20, 2008[12]. On October 22, 2008, NMFS listed the population as endangered under ESA[13].

Several viability analyses have been conducted on the Cook Inlet beluga population over the years (Hobbs *et al.* 2008; Hobbs *et al*. 2015), all of which indicate a population that is likely to continue to decline and face probable extinction within a few hundred years. NMFS published a notice in the Federal Register on May 15, 2015, announcing the availability of the draft Recovery Plan for public review and soliciting comments.[14] The Recovery Plan was finalized in December 2016 (NMFS 2016a).

<u>Distribution</u>: Generally, the range of Cook Inlet belugas has been contracting in recent years as first documented in Rugh *et al.* (2010). The 2009-2016 range was estimated to be only 29% of the range observed in 1978-79 (Shelden *et al.* 2017). Seasonal movements of Cook Inlet beluga whales appear to be influenced by a variety of factors including water, ice coverage, prey availability, and peak river discharge (Ezer *et al.* 2008, 2013; Goetz *et al.* 2012; Hobbs *et al.* 2005; Rugh *et al.* 2010). Depending upon the season, beluga whales can occur in both offshore and coastal waters. Although they remain in the general Cook Inlet area during the winter, they disperse throughout the upper and mid-Inlet areas.

Data from NMFS aerial surveys, opportunistic sighting reports, and satellite-tagged beluga whales confirm they are more widely dispersed throughout Cook Inlet during the winter months (November - April), with animals found between Kalgin Island and Point Possession on the Kenai Peninsula. During January through March, using location data from satellite-tagged Cook Inlet belugas, Ezer *et al.* (2013) also found the majority of tagged whales were located in the lower to middle Inlet (70 to 100 percent of tagged whales), were located near the Susitna River Delta from April to July (60 to 90 percent of tagged whales) and in the Knik and Turnagain Arms from August to December. Whale movements were correlated with the peak discharge of seven major rivers emptying into Cook Inlet. During the spring and

[9] *Federal Register* 65 *FR* 34590
[10] *Federal Register* 72 *FR* 19821
[11] *Federal Register* 72 *FR* 19821
[12] *Federal Register* 73 *FR* 21578
[13] *Federal Register* 73 *FR* 62919
[14] *Federal Register* 80 *FR* 27925

summer, beluga whales are generally concentrated near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore *et al.* 2000). Most beluga whale calving in Cook Inlet occurs from mid-May to mid-July in the vicinity of the river mouths, although Native hunters have described calving as early as April and as late as August (Huntington 2000).

NMFS surveys conducted May 31 – June 9, 2016 (Shelden *et al.* 2017), reported no observations of belugas in upper Cook Inlet south of North Foreland and Moose Point. Boat-based surveys from 2005 to the present (McGuire *et al.* 2014) support the seasonal patterns observed with other methods, and other surveys confirm the presence of Cook Inlet belugas near the Kenai River during summer months (McGuire and Bourbon 2012; McGuire *et al.* 2014). Therefore, although Cook Inlet beluga whales can be found throughout the Inlet at any time of year, they generally spend the ice-free months in the upper Cook Inlet, moving into middle and lower Inlet waters in the winter (Hobbs *et al.* 2005).

4.1.2. Critical Habitat

On April 11, 2011, NMFS designated two areas as critical habitat comprising 7,800 km^2 (3,016 mi^2) of marine habitat (Figure 4-1)[15]. Cook Inlet beluga whale critical habitat Area 1 encompasses all the area from the mouth of Three Mile Creek north and east to include waters of the Susitna, Little Susitna, and Chickaloon Rivers below the Mean Higher High Water (MHHW) level. This area provides important whale habitat during ice-free months, and is used intensively by Cook Inlet beluga whales between April and November (NMFS 2008a). Many rivers in Area 1 habitat support large eulachon and salmon runs. Belugas visit Turnagain Arm in early spring traveling up to the Twenty Mile River and Placer Creek, indicating the importance of eulachon runs for beluga feeding. Beluga use of upper Turnagain Arm decreases in the summer and then increases again in August through the fall, coinciding with the coho salmon run in the Inlet. Early spring (March to May) and fall (August to October) use of Knik Arm is confirmed by studies by Funk *et al.* (2005). Intensive summer feeding by belugas occurs in the Susitna delta area, Knik Arm and Turnagain Arm. All of these areas are within critical habitat Area 1.

Critical habitat Area 2 includes locations of known fall and winter Cook Inlet beluga use (Figure 4-1). This area encompasses all marine waters of Cook Inlet south of a line connecting Point Possession and the mouth of Three Mile Creek, and north of 60.25°N, including waters within 3.7 km (2 nautical miles [nm]) of MHHW along the western shoreline of Cook Inlet between 60.25°N and the mouth of the Douglas River; all waters of Kachemak Bay east of 40.00°W; and waters of the Kenai River below the Warren Ames Bridge at Kenai.

Area 2 critical habitat supports dispersed fall and winter feeding and transit areas, in waters where Cook Inlet belugas typically occur in smaller densities or deeper waters. It includes nearshore and offshore areas of Cook Inlet, north of a line connecting the village of Tyonek and Point Possession, and nearshore areas of the lower Cook Inlet. Area 2 critical habitat includes fall feeding areas in Tuxedni, Chinitna, and Kamishak bays on the western side of Cook Inlet, and a portion of Kachemak Bay on the eastern side. Kachemak Bay was included because Cook Inlet belugas commonly occur there: off the Homer Spit, in Mud Bay, and near the head of Kachemak Bay at Fox River flats[16].

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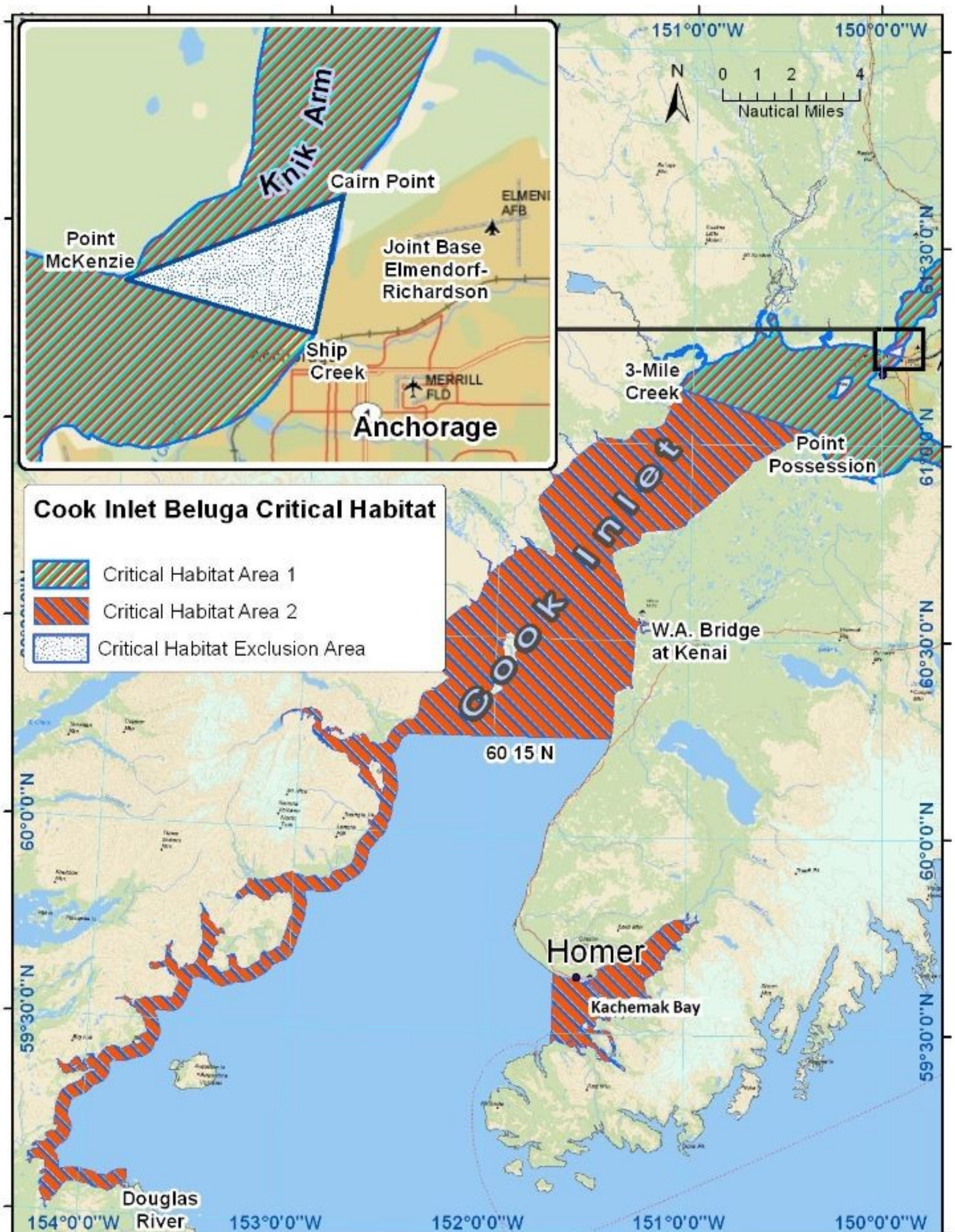
[15] *Federal Register* 76 *FR* 20180
[16] *Federal Register* 76 *FR* 20180

FIGURE 4-1. FINAL DESIGNATED CRITICAL HABITAT AREA FOR COOK INLET BELUGA WHALES



Source: NMFS 2016a

Primary Constituent Elements: The ESA defines critical habitat in terms of essential physical or biological features referred to as Primary Constituent Elements (PCEs). PCEs are physical or biological features essential to the conservation of a species for which its designated or proposed critical habitat is based on, such as space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements …; and habitats that are protected from disturbance or are representative of the species historic geographic and ecological distribution.

The following five PCE descriptions are from the final rule designating critical habitat for the Cook Inlet beluga whale.

- PCE # 1 - Intertidal and subtidal waters of Cook Inlet with depths less than 9 m (30 ft). Mean Lower Low Water (MLLW) and within 8 km (5 miles) of high and medium flow anadromous fish streams;
- PCE # 2: Primary prey species consisting of four species of Pacific salmon (Chinook, chum, coho, and sockeye), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole;
- PCE # 3: Waters free of toxins or other agents of a type or amount harmful to Cook Inlet beluga whales;
- PCE # 4 - Unrestricted passage within or between the critical habitat areas; and
- PCE # 5 -Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

NMFS established these five elements based on scientific data on the ecology and natural history of the Cook Inlet beluga whale. All five PCEs described above are found or identified within the areas designated as critical habitat.

Regarding PCE #5, anthropogenic noise above ambient levels may cause behavioral reactions in whales (harassment) or mask communication between these animals. The effects of harassment may also include abandonment of habitat. At louder levels, noise may result in temporary or permanent damage to the whales' hearing. Empirical data exist on the reaction of beluga whales to in-water noise (harassment and injury thresholds) but are lacking regarding levels that might elicit more subtle reactions such as avoiding certain areas. Noise capable of injuring beluga whales or that might cause the abandonment of important habitats would be expected to have consequences to the Cook Inlet DPS in terms of survival and recovery. Therefore, NMFS considered quiet areas in which noise levels do not interfere with important life history functions and behavior of these whales to be a necessary element of critical habitat. For this reason, NMFS established a 'noise exclusion' zone. Because the use of sound is so important to Cook Inlet beluga whales, NMFS has determined that in-water noise requires special management considerations (NMFS 2011).

During the seismic surveys conducted by Apache in 2014, NMFS required that a 160-dB Level B harassment shut down zone be established and monitored in Cook Inlet during all seismic surveys. Whenever a beluga whale or an aggregation of killer whales or harbor porpoises (five or more individuals of any age/sex class) was observed approaching the 160-dB zone around the survey operations, the survey activity was required to shut down until they were no longer present within the 160-dB zone of seismic surveying operations. NMFS also required that no activities shall not occur within 10 mi1(6 km) of the

MHHW line of the Susitna Delta (Beluga River to the Little Susitna River) between April 15 and October 15[17]. The context of the term 'activities' in this case, referred specifically to the 2014 Apache seismic surveys and not to other vessel traffic or activities that may result in an increase in noise levels considered detrimental to beluga whales. The purpose of the noise exclusion zone is to protect the designated critical habitat in this area known to be important for beluga whale feeding and calving during the spring and fall months. The range of the setback required creates an effective buffer where sound does not encroach on this important habitat during those months. Activities can occur within this area from October 16–April 14.

4.1.3. Presence in Project Area

Since 1994, annual aerial surveys have provided systematic coverage of 13 to 33 percent of the entire inlet each June or July including a 1.9-mi (3-km) wide strip along the shore and approximately 621 mi (1,000 km) of offshore transects (Rugh *et al.* 2005a, 2005b, 2006, 2007). Surveys designed to coincide with known seasonal feeding aggregations have been conducted two to four days per year in June or July at or near low tide in order to reduce the search area (Rugh *et al.* 2000).

The following discussion on the distribution of beluga whales in upper Cook Inlet is based on NMFS aerial surveys and other data sources as referenced:

- NMFS data from satellite-tagged belugas and opportunistic sightings (NMML 2004);
- Baseline studies of beluga whale occurrence in Knik Arm conducted for Knik Arm Bridge and Toll Authority (KABATA) (Funk *et al.* 2005);
- Marine studies associated with the Port of Anchorage (Cornick and Kendall 2008a, 2008b; Cornick *et al.* 2010; Markowitz *et al.* 2007; Prevel Ramos *et al.* 2006; Širović and Kendall 2009);
- Baseline studies of beluga whale occurrence in Turnagain Arm conducted in preparation for Seward Highway improvements (Markowitz *et al.* 2007);
- Marine mammal surveys conducted at Ladd Landing to assess a coal shipping project (Prevel Ramos *et al.* 2008);
- Marine mammal surveys off Granite Point, the Beluga River, and further south at North Ninilchik (Brueggeman *et al.* 2007a, 2007b, 2008); and
- Passive acoustic monitoring of beluga whales in Cook Inlet (Small 2010); and Apache 2D Seismic Test Program 90-day report (Lomac-MacNair *et al.* 2014).

The Cook Inlet beluga whale has been historically distributed throughout Cook Inlet, with occasional sightings in the Gulf of Alaska (Huntington 2000; Laidre *et al.* 2000; Rugh *et al.* 2000). However, in recent years the range of the Cook Inlet beluga whale has contracted to the upper reaches of Cook Inlet (Rugh *et al.* 2010). The collective survey results show that beluga whales have been consistently found near or in river mouths along the northern shores of upper Cook Inlet (i.e., north of East and West Foreland). In particular, beluga whale groups are seen in the Susitna River Delta, Knik Arm, and along the shores of Chickaloon Bay. Small groups had also been recorded farther south in Kachemak Bay,

[17] *Federal Register* 79 *FR* 13626

Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but very rarely thereafter. Since the mid-1990s, most (96 to 100 percent) beluga whales in upper Cook Inlet have been concentrated in shallow areas near river mouths, and no longer occur in the central or southern portions of Cook Inlet (Hobbs *et al.* 2008). Beluga whale concentrations in upper Cook Inlet during April and May correspond with eulachon migrations to rivers and streams in the northern portion of upper Cook Inlet (NMFS 2003; Angliss and Outlaw 2005). Based on aerial surveys, the concentration of beluga whales in the northernmost portion of Cook Inlet appears to be fairly consistent from June to October (Rugh *et al.* 2000, 2004a, 2005a, 2006, 2007; Shelden *et al.* 2008, 2009, 2010, 2012, 2015). NMFS surveys conducted May 31to June 9, 2016 (Shelden *et al.* 2017), reported no observations of belugas in upper Cook Inlet south of North Foreland and Moose Point.

The concentration of beluga whales in upper Cook Inlet from June to October is supported by tagging data and the 2016 surveys conducted by NMFS (Shelden *et al.* 2017). Studies for the Knik Arm Bridge and Toll Authority (KABATA) in 2004 and 2005 confirmed the use of Knik Arm by beluga whales from July to October (Funk *et al.* 2005). Data from NMFS aerial surveys, opportunistic sightings, and satellite-tagged beluga whales confirm that they are concentrated along the rivers and nearshore areas of upper Cook Inlet (Susitna River Delta, Knik Arm, and Turnagain Arm) from May through October (NMML 2004; Rugh *et al.* 2004a). Also, data from tagged whales (14 tags between July and March 2000 through 2003) show beluga whales use upper Cook Inlet intensively between summer and late autumn (Hobbs *et al.* 2005). Beluga whales are commonly seen from early July to early October at the mouth of Ship Creek where they feed on salmon and other fish, and also in the vicinity of the Port (e.g., alongside docked ships and within 300 ft [91m] (Blackwell and Greene 2002). Beluga whales have also been observed feeding immediately offshore of the tidelands north of the Port and south of Cairn Point (NMFS 2004).

As late as October, beluga whales tagged with satellite transmitters continued to use Knik Arm, Turnagain Arm and Chickaloon Bay, but some ranged into lower Cook Inlet south to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) (Hobbs *et al.* 2005). In November, beluga whales moved between Knik Arm, Turnagain Arm, and Chickaloon Bay, similar to patterns observed in September-October (Hobbs *et al*. 2005). By December beluga whales were distributed throughout the upper to mid-Inlet. From January into March, they moved as far south as Kalgin Island and slightly beyond in central offshore waters. Beluga whales also made occasional excursions into Knik Arm and Turnagain Arm in February and March despite ice cover greater than 90 percent (Hobbs *et al.* 2005). While they moved widely around Cook Inlet, there was no indication that tagged whales (Hobbs *et al.* 2005) had a seasonal migration in and out of Cook Inlet. Based on monthly surveys (e.g., Rugh *et al.* 2000), opportunistic sightings, and satellite-tag data, there are generally fewer observations of these whales in the Anchorage and Knik Arm area from November through April (Rugh *et al.* 2004a).

4.1.4. Life History

Belugas are social animals generally found in small to large aggregations during travel and feeding. Benefits from group cohesion and larger group sizes include reduced risk of predation and cultural transmission of information pertinent to survival (e.g., about prey, calving sites, and oceanographic conditions) (Reluga and Viscido 2005).

Data on Cook Inlet beluga prey species come from stomach contents and stable isotope analyses (Quakenbush *et al.* 2015), and observations from Alaska Native subsistence hunters (Fall *et al.* 1984; Huntington 2000). Beluga whales are opportunistic feeders, foraging at the mouths of rivers and along the benthos. These sources found Cook Inlet beluga whales have broad diets that include fish, crustaceans, and cephalopods. Quakenbush *et al.* (2015) analyzed the contents of 28 Cook Inlet beluga whale stomachs collected between March and November in years 2002-2012. Ten of 28 stomachs (36 percent) were empty. Of the 18 stomachs with food, 17 (94 percent) contained fish remains and nine (50 percent) contained invertebrates. A minimum of 12 fish species and eight invertebrate species were identified. The 12 fish species represented seven families. Salmon (67 percent frequency of occurrence), cod (39 percent frequency of occurrence), smelt (11percent frequency of occurrence), and flounder (11 percent frequency of occurrence) were most prevalent.

In Cook Inlet, the primary foraging locations for beluga whales are the Susitna River Delta (the Big and Little Susitna rivers), Eagle Bay, Eklutna River, Ivan Slough, Theodore River, Lewis River, and Chickaloon Bay and River (NMFS 2008a). Cook Inlet belugas feed on a wide variety of prey species, particularly those that are seasonally abundant. Hobbs *et al.* (2008) presents the most current analysis of stomach contents derived from stranded or harvested belugas in Cook Inlet. In spring, the preferred prey species are eulachon and cod. Other fish species found in the stomachs of belugas may be from secondary ingestion by cods that feed on polychaetes, shrimp, amphipods, mysids, as well as other fish (e.g., walleye pollock and flatfish), and invertebrates.

From late spring and throughout summer most beluga stomachs sampled contained Pacific salmon corresponding to the timing of fish runs in the area. Anadromous smolt and adult fish concentrate at river mouths and adjacent intertidal mudflats (Calkins 1989). Five Pacific salmon species: Chinook, pink, coho, sockeye, and chum spawn in rivers throughout Cook Inlet (Moulton 1997; Moore *et al*. 2000). Calkins (1989) recovered 13 salmon tags in the stomach of an adult beluga found dead in Turnagain Arm. Beluga hunters in Cook Inlet reported one whale having 19 adult Chinook salmon in its stomach (Huntington 2000). Salmon, overall, represent the highest percent frequency of occurrence of the prey species in Cook Inlet beluga stomachs. This suggests that their spring feeding in upper Cook Inlet, principally on fat-rich fish such as salmon and eulachon, is very important to the energetics of these animals. In the fall, as anadromous fish runs begin to decline, belugas return to consume fish species (cod and bottom fish) found in nearshore bays and estuaries. Bottom fish include Pacific staghorn sculpin, starry flounder, and yellowfin sole. Stomach samples from Cook Inlet belugas are not available for winter months (December through March), although dive data from belugas tagged with satellite transmitters suggest whales feed in deeper waters during winter (Hobbs *et al*. 2005), possibly on such prey species as flatfish, cod, sculpin, and pollock. This analysis is ongoing and provides information on prey availability and prey preferences of Cook Inlet belugas.

Known and potential sources of mortality and injury and contributing factors to cause of death and injury of Cook Inlet belugas stem from natural and anthropogenic sources. Natural sources of mortality include predation by killer whales, stranding, malnutrition, disease, trauma, perinatal issues, and environmental issues (Burek-Huntington *et al.* 2015; NMFS 2015a). Anthropogenic sources have included subsistence harvest, commercial whaling, poaching and intentional harassment, vessel activities, fisheries activities, research activities, and entanglements, or ingestion of trash and debris. The NMFS Recovery Plan (NMFS 2016a) extensively outlines these sources of mortality and injury.

Pollution occurs throughout much of Cook Inlet, and several chemical and biological pollution sources have been evaluated by URS Corporation (2010) as sources of concern to belugas. Cook Inlet belugas may be exposed to contaminants found in the water, through inhalation of contaminants in the air, ingestion of contaminants in prey, or from exposure in the abiotic environment (NMFS 2015a). For the contaminants that have been studied, Cook Inlet belugas generally have lower contaminant levels than do belugas from other populations (Becker 2009; Becker *et al.* 2000; Hoguet *et al.* 2013; Lebeuf *et al.* 2004; NMFS 2008a; Reiner *et al.* 2011; Wetzel *et al.* 2010).

4.1.5. Acoustics

In terms of hearing ability, beluga whales are one of the most studied odontocetes because they are commonly found in public aquariums around the world. Beluga whales are known to be among the most adept users of sound of all marine mammals, using sound rather than sight for many important functions especially in the highly turbid waters of upper Cook Inlet. Beluga whales use sound to communicate, locate prey, and navigate, and may make different sounds in response to different stimuli. Beluga whales produce high frequency sounds which they use as a type of sonar for finding and pursuing prey, and likely for navigating through ice-laden waters. In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds.

Although belugas are known to respond to a wide range of frequencies, their greatest sensitivity is around 10 to 100 kHz (Richardson *et al.* 1995), well above sounds produced by most industrial activities (<100 Hz or 0.1 kHz) recorded in Cook Inlet. Average hearing thresholds for captive beluga whales have been measured at 65 and 121 dB re 1 µPa at frequencies of 8 kHz and 125 Hz, respectively (Awbrey *et al.* 1988). Masked hearing thresholds were measured at approximately 120 dB re 1 µPa for a captive beluga whale at three frequencies between 1.2 and 2.4 kHz (Finneran *et al.* 2002a, 2002b). Beluga whales do have some limited hearing ability down to approximately 35 Hz, where their hearing threshold is about 140 dB re 1 µPa (Richardson *et al.* 1995). Thresholds for pulsed sounds will be higher, depending on the specific durations and other characteristics of the pulses (Johnson 1991). Southall *et al.* (2007) classified this species in the mid-frequency hearing range for cetaceans.

4.2. Harbor Seals

4.2.1. Status and Distribution

Harbor seals range throughout Alaska from the British Columbia-Southeast Alaska coasts north throughout Southeast Alaska; west through the Gulf of Alaska, Prince William Sound, and the Aleutian Islands; and north in the Bering Sea to Cape Newenham and the Pribilof Islands. The statewide abundance is estimated at 152,602 animals (Allen and Angliss 2015). Harbor seals occupy a wide variety of habitats in freshwater and saltwater in protected and exposed coastlines. NMFS has documented a strong seasonal pattern of more coastal and restricted spatial use during the spring and summer for breeding, pupping, and molting, and more wide-ranging seal movements during the winter months (Boveng *et al.* 2012).

NMFS and its co-management partner, the Alaska Native Harbor Seal Commission, defined 12 separate stocks of harbor seals (Allen and Angliss 2012) based largely on genetics (O'Corry-Crowe *et al.* 2003). Harbor seal stocks in Cook Inlet are considered to be from the Cook Inlet/Shelikof Stock, with a population estimate of 22,900 individuals (Allen and Angliss 2013; Muto *et al.* 2016). The Cook Inlet/Shelikof Stock is distributed from Anchorage into lower Cook Inlet during summer and from lower Cook Inlet through Shelikof Strait to Unimak Pass during winter (Boveng *et al.* 2012). This stock is not listed under the ESA and is not considered depleted or strategic under the MMPA.

A multi-year study of seasonal movements and abundance of harbor seals in Cook Inlet was conducted from 2004-2007 and again 2007-2011. These studies involved multiple aerial surveys throughout the year; data from this study indicate a stable population of harbor seals during the August molting period (Montgomery *et al.* 2007). The current population trend for the entire stock is +313 seals per year based on 2007-2011 data (Muto *et al.* 2016).

4.2.2. Presence in Cook Inlet and the Project Area

Harbor seals are found throughout the entire lower Cook Inlet coastline, hauling out on beaches, islands, mudflats, and at the mouths of rivers in the Cook Inlet where they whelp and feed. Large-scale patterns indicate a portion of harbor seals captured in Cook Inlet move out of the area in the fall and into habitats within Shelikof Strait, Northern Kodiak Island, and coastal habitats of the Alaska Peninsula. The seals are most concentrated in Kachemak Bay, across Cook Inlet toward Iniskin and Iliamna Bays, and south through the Kamishak Bay, Cape Douglas and Shelikof Strait regions (Boveng *et al.* 2012).

From November through January, most harbor seals leave Cook Inlet to forage in Shelikof Strait (Boveng *et al.* 2007; London *et al.* 2012). As the seals approach breeding in April and May, the seals move back into Cook Inlet and their spatial use is more concentrated around haulout areas (Boveng *et al.* 2012; London *et al.* 2012). Their summer distribution in Cook Inlet is primarily along coastal waters. In Cook Inlet, seal use of western habitats is greater than use of the eastern coastline (Boveng *et al.* 2012). Overwintering areas include the lower half of Cook Inlet and the Gulf of Alaska (Boveng *et al.* 2007). Large numbers concentrate at the river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay. Several haulouts have been identified on the southern end of Kalgin Island in lower Cook Inlet (Rugh *et al.* 2005a; Boveng *et al.* 2012). Montgomery *et al.* (2007) recorded over 200 haulout sites in lower Cook Inlet alone. Large aggregations of harbor seals have been observed hauled out at the mouths of the Theodore and Lewis rivers during seismic monitoring programs (NMFS 2015b).

The major haulout sites for harbor seals in Cook Inlet are also located in lower Cook Inlet although there is a seasonal presence of harbor seals in upper Cook Inlet (Rugh *et al.* 2005). Some seals expand their use of the northern portion of Cook Inlet, however seals that were captured and tracked in the southern portion of Cook Inlet generally remained south of the Forelands (Boveng *et al.* 2012). Important harbor seal haulout areas occur within Kamishak and Kachemak Bays and along the coast of the Kodiak Archipelago and the Alaska Peninsula. Chinitna Bay, Clearwater and Chinitna Creeks, Tuxedni Bay, Kamishak Bay, Oil Bay, Pomeroy and Iniskin Islands, and Augustine Island are also important spring-summer breeding and molting areas and known haulout sites.

In Upper Cook Inlet harbor seals haul out on rocks, reefs, beaches, and drifting glacial ice, and feed on capelin, eulachon, cod, pollock, flatfish, shrimp, octopus, and squid in marine, estuarine, and occasionally fresh waters. Their presence in the upper Inlet coincides with seasonal runs of prey species. For example, harbor seals are commonly observed along the Susitna River and other tributaries along upper Cook Inlet during the eulachon and salmon migrations (NMFS 2003). During aerial surveys of upper Cook Inlet in 2001, 2002, and 2003, harbor seals were observed 24 to 96 km (15 to 60 miles) south-southwest of Anchorage at the Chickaloon, Little Susitna, Susitna, Ivan, McArthur, and Beluga Rivers (Rugh *et al.* 2005a).

4.2.3. Life History

Harbor seals haul out on rocks, reefs, beaches, and drifting glacial ice. Seals feed on capelin, eulachon, cod, pollock, flatfish, shrimp, octopus, and squid in marine, estuarine, and occasionally fresh waters. Harbor seals movements are associated with tides, weather, season, food availability, and reproduction.

Seals are more likely to be hauled out during the pupping and breeding period, and haul out less frequently during late fall and winter (Boveng *et al.* 2012). Harbor seals haul out, give birth, and nurse their young on land, preferring tidally exposed habitats including reefs, offshore rocks and islets, mud and sand, sand and gravel beaches, and floating and shorefast ice (Bigg 1981; Pitcher and Calkins 1977).

Harbor seals are generally non-migratory; their local movements are associated with seeking food and breeding (Biggs 1981). Harbor seal diets vary with season and location, feeding opportunistically in marine, estuarine, and occasionally freshwater habitats (Ferrero *et al.* 2000). In the Gulf of Alaska, Pitcher and Calkins (1979) found that fish, pollock and capelin comprised 74.3 percent of total prey volume; cephalopods, 21 percent, and decapod crustaceans, 4 percent. Scat analysis from seals at Kodiak Island show Irish lords (*Hemilepidotus hemilepidotus)* (43 percent) and sand lances (family *Ammodytidae)* (25 percent) were predominate prey items (Jemison 2001).

4.2.4. Acoustics

Harbor seals respond to underwater sounds from approximately 1 to 80 kHz with the functional high frequency limit around 60 kHz and peak sensitivity at about 32 kHz (Kastak and Schusterman 1995). Hearing ability in the air is greatly reduced (by 25 to 30 dB); harbor seals respond to in air sounds from 1 to 22.5 kHz, with a peak sensitivity of 12 kHz (Kastak and Schusterman 1995).

4.3. Harbor Porpoise

4.3.1. Status and Distribution

The range of the harbor porpoise includes the waters of Cook Inlet, Shelikof Strait, and the Gulf of Alaska. They frequent coastal waters throughout Alaska and occur most frequently in waters less than 328 ft (100 m deep) where they are vulnerable to physical modifications of nearshore habitat (Dalheim *et al.* 2000; Hobbs and Waite 2010). In Alaskan waters, three stocks of harbor porpoise are currently recognized for management purposes: Southeast Alaska, Gulf of Alaska, and Bering Sea stocks (Allen and Angliss 2015). Harbor porpoise in Cook Inlet belong to the Gulf of Alaska stock and occur from Cape Suckling to Unimak Pass (Muto *et al.* 2016). Harbor porpoise are not listed under ESA and are not designated as depleted under the MMPA. However, because the most recent abundance estimate is more than eight years old and information on incidental harbor porpoise mortality in commercial fisheries is not well understood, the Gulf of Alaska stock of harbor porpoise is classified as a strategic stock (Muto *et al.* 2016).

In June and July of 1998 an aerial survey covered the waters of the western Gulf of Alaska from Cape Suckling to Sutwik Island offshore to the 1,000 fathom (1,828 m) depth contour. The 1998 survey resulted in an abundance estimate for the Gulf of Alaska harbor porpoise stock of 10,489 (CV = 0.115) animals (Hobbs and Waite 2010) which includes a correction factor (1.372; CV = 0.066) for perception bias to correct for animals that were present but not counted because they were not detected by observers. The estimated corrected abundance estimate from the 1998 survey is 31,046 (Hobbs and Waite 2010). This latest estimate of abundance (31,046) is considerably higher than the estimate reported in the 1999 stock assessment (8,271) which was based on surveys 1991-1993. This disparity largely stems from changes in the area covered by the two surveys and differences in harbor porpoise densities in those difference areas. The survey area in 1998 (46,000 mi^2 [119,183 km^2]) was greater than the area covered in the combined portions of the 1991-1993 surveys and included selected bays, channels, and inlets in Prince William Sound, outer Kenai Peninsula, south side of the Alaska Peninsula, and Kodiak Archipelago whereas the earlier survey included only open water areas. Several of the bays and inlets covered by the 1998 survey had higher harbor porpoise densities than observed in the open waters. For these reasons, the 1998 survey result is probably more representative of the size of the Gulf of Alaska harbor porpoise stock.

4.3.2. Presence in Cook Inlet and the Project Area

The Gulf of Alaska Stock of harbor porpoise is widespread throughout Cook Inlet, but they occur more often in coastal and offshore waters of the lower inlet (well south of the Project), where large aggregations are observed (Shelden *et al*. 2014). Harbor porpoise have been observed frequently during summer aerial surveys of Cook Inlet, with most sightings of individuals concentrated at Chinitna and Tuxedni Bays on the west side of lower Cook Inlet (Rugh *et al.* 2005). Harbor porpoises are year-round residents in the Inlet, although sightings are much less frequent in the fall and winter compared to spring and summer (Hansen and Hubbard 1999). They are one of the three marine mammals (the other two being belugas and harbor seals) regularly seen throughout Cook Inlet (Nemeth *et al.* 2007), especially during spring eulachon and summer salmon runs.

Small numbers (fewer than 20) of harbor porpoises have been consistently reported in upper Cook Inlet waters between April and October (Prevel Ramos *et al*. 2008; Brueggeman *et al*. 2007a; 2008). They are present, although infrequent, in upper Cook Inlet during winter (Shelden *et al.* 2014). The closest sightings to the Project location from recent passive acoustic research (Small 2010) indicate that harbor porpoises occur more frequently than expected in the West Foreland area in the spring, although total numbers are not known. The most recent estimated density of animals in Cook Inlet is 7.2 per 386 mi^2 (1,000 km^2) (Dahlheim *et al*. 2000).

4.3.3. Life History

Harbor porpoise move inshore in summer, and offshore in winter (Consiglieri *et al.* 1982). In spring and summer, harbor porpoise sightings are numerous in the Kodiak Island area and Kachemak Bay (Hansen and Hubbard 1999). A decline in numbers of porpoises observed in Prince William Sound during winter months also suggests seasonal dispersion (Hall 1979). Mating probably occurs from June or July to October, with peak calving in May and June (Consiglieri *et al.* 1982).

Harbor porpoise feed in coastal waters <328 ft (100 m) deep (Hobbs and Waite 2010) where their diet consists Pacific herring, other schooling fishes, and cephalopods, mackerel, and pollock (Leatherwood and Reeves 1987). Harbor porpoise sightings in the upper Inlet also appear to peak during ice-free months when there is an abundance of pelagic smelt (Shelden *et al.* 2014).

4.3.4. Acoustics

The harbor porpoise has the highest upper-frequency limit of all odontocetes investigated. Kastelein *et al.* (2002) found that the range of best hearing was from 16 to 140 kHz, with a reduced sensitivity around 64 kHz. Maximum sensitivity (about 33 dB re 1 µPa) occurred between 100 and 140 kHz. This maximum sensitivity range corresponds with the peak frequency of echolocation pulses produced by harbor porpoises (120-130 kHz). Southall *et al.* (2007) classified this species in the high frequency cetacean group.

4.4. Steller Sea Lions

4.4.1. Status and Distribution

The range of the Steller sea lion extends around the North Pacific Ocean rim from northern Japan, the Kuril Islands and Okhotsk Sea, through the Aleutian Islands and Bering Sea along Alaska's southern coast, and south to California (NMFS 2008b). Steller sea lions have been studied throughout their range for the past several decades (NMFS 1995, 2008, 2013). Their population declined from up to 265,000 animals in the late 1970s to less than 50,000 by 2000 (Merrick *et al*. 1987; Loughlin and York 2000, Burkanov and Loughlin 2005). In 1997, based on demographic and genetic dissimilarities, NMFS identified two DPSs of Steller sea lions under the ESA: a western DPS which is endangered, and an eastern DPS which is threatened[18]. These ESA determinations were based on genetic studies and phylo-geographical analyses from across the sea lions' range. Since 2000, population abundance has increased in some areas of the western region (Sease and Gudmunson 2002; Fritz *et al*. 2015).

A recovery plan was developed for Steller sea lions under the ESA in 1992 (NMFS 1992). A revised recovery plan which discusses separate recovery actions for the threatened and endangered populations was issued in 2008 (NMFS 2008b). On November 4, 2013, the eastern DPS was removed from the list of endangered species[19]; however, all Steller sea lions remain classified as strategic stocks and continue to be designated as depleted under the MMPA (Allen and Angliss 2015).

The 2014 Stock Assessment Report lists a minimum population estimate of 48,676 for the U.S. portion of the western DPS of Steller sea lions (Allen and Angliss 2015). The overall Steller sea lion western DPS is estimated to have increased at an annual rate of 1.67 percent from 2000 to 2012 (Allen and Angliss 2015). Count data used to estimate population trends and evaluate population status are of two types: counts of pups approximately 1 month of age, and counts of animals >1 year of age (i.e., non-pups) (NMFS 2008b).

Large numbers of individuals disperse widely outside of the breeding season (late May to early July), thus potentially intermixing with animals from other areas, probably to access seasonally important prey

[18] 50 CFR 226.202 (a) and (b)
[19] *Federal Register* 78 *FR* 66139.

resources (Allen and Angliss 2014). The geographic center of their distribution is considered to be the Aleutian Islands and the Gulf of Alaska (NMFS 2008b). Although as the western DPS has declined, rookeries in the west have become progressively smaller (NMFS 2008b). The center of abundance for the species is considered to extend from Kenai to Kiska Island (NMFS 2008b). Steller sea lion habitat includes terrestrial sites for breeding and pupping (rookeries), resting (haulouts), and marine foraging areas. Nearly all rookeries are at sites inaccessible to terrestrial predators on remote rocks, islands, and reefs.

Most adult Steller sea lions inhabit rookeries during the breeding season (late May to early July) (Gisiner 1985; Pitcher and Calkins 1981); some juveniles and non-breeding adults occur at or near rookeries during the breeding season but most are on haulouts. Adult males in particular may disperse widely after the breeding season; during fall and winter, many sea lions increase use of haulouts, especially terrestrial sites, but also on sea ice in the Bering Sea (NMFS 2008b).

4.4.2. Critical Habitat.

NMFS designated critical habitat for Steller sea lions on August 27, 1993[20]. At the time of designation, Steller sea lions were listed as a single species (not two DPSs). In the final rule that designated critical habitat for Steller sea lions, NMFS summarized that:

> *The physical and biological habitat features that support reproduction, foraging, rest, and refuge are essential to the conservation of the Steller sea lion. For the Steller sea lion, essential habitat includes terrestrial, air and aquatic areas. The essential features that were used to determine Steller sea lion critical habitat were the physical and biological features that support reproduction, foraging, rest, and refuge. Essential habitat for the Steller sea lion includes terrestrial, air, and aquatic areas.*

The designated critical habitat that includes marine waters within 20 nautical miles (nm [37 km]) of rookeries and haulouts within the breeding range of the western DPS and within three special aquatic foraging areas in Alaska[21]. Portions of the southern reaches of the lower Inlet designated as critical habitat are found near the mouth of Cook Inlet and are subject to the critical habitat buffer zones. However, these areas are far south of the Project Area.

4.4.3. Presence in Project Area

The western DPS of Steller Sea Lion occurs in Cook Inlet but ranges south of Anchor Point around the offshore islands and along the west coast of the upper Inlet in several bays such as Chinitna and Iniskin (Rugh *et al*. 2005a). Designated rookeries and haulout sites include those near the mouth of the Cook Inlet, which is well south of the Forelands and the Action Area. Critical habitat has not been designated in mid- to upper Cook Inlet and Steller sea lions are considered rare in upper Cook Inlet. Only two individual sea lions were observed in Cook Inlet during surveys conducted for Apache in 2014; both of these sightings were below Kalgin Island well south of the Forelands and the Project Area (Lomac-MacNair *et al.* 2014).

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[20] *Federal Register* 58 *FR* 45269.
[21] 50 CFR 226.202, a and c.

4.4.4. Life History

Steller sea lions feed on a variety of demersal, semi-demersal, and pelagic prey, indicative of a broad spectrum of foraging behaviors likely based primarily on prey availability (NMFS 2008b). Inferences about sea lion foraging ecology are based on data collected by monitoring animals with telemetry devices. Telemetry studies indicate that foraging trip duration and distance varies seasonally but rarely exceeds 20 hours and 20 km (12.4 miles) (Pitcher and McAllister 1981; Fadely *et al.* 2005; Loughlin *et al.* 2003; Merrick and Loughlin 1997; Raum-Suryan *et al.* 2004). Gregor and Trites (2008) determined that juvenile and female Steller sea lions in particular forage relatively close to rookeries and haulouts.

Scat analyses from 1990 show that pollock continue to be a dominant prey species for Steller sea lions in the Gulf of Alaska (Merrick *et al.* 1997; Sinclair and Zeppelin 2002; NMFS 2000). Pacific cod was found to be an important prey species especially in winter in the Gulf of Alaska, with salmon most frequently eaten during summer months. NMFS (2000) compiled and assessed available data on prey occurrence from stomach analyses for the eastern and western Steller sea lion populations from the 1950s to 1980s. Steller sea lions in lower Cook Inlet would likely forage adjacent to rookeries and haulouts.

Subsistence hunting and illegal killings are the primary anthropogenic sources of mortality for the western DPS of Steller sea lions. In recent years, as many as 19 Steller sea lions have been harvested in subsistence hunts (Allen and Angliss 2015). Alaska Natives actively subsist on Steller sea lions; harvest numbers are no longer collected statewide but periodically in subareas. Data were collected on Alaska Native harvest of Steller sea lions for seven communities on Kodiak Island for 2011. The Alaska Native Harbor Seal Commission and ADFG estimated a total of 20 adult sea lions were harvested, with a 95 percent confidence range between 15 to 28 animals (Wolfe *et al.* 2012).

Between 2008 and 2012, there were incidental serious injuries and mortalities of western Steller sea lions observed in Alaska commercial fisheries. During the 5-year period from 2008 to 2012, there were six confirmed fishery-related Steller sea lion strandings in the range of the western DPS (Allen and Angliss 2014).

Pups die from drowning, starving after separation from their mother, disease, parasitism, predation, being crushed by larger animals, being bitten by other sea lions, and as a result of complications during parturition (Maniscalco *et al.* 2002, 2006; NMFS 2008b). Mortality of older animals may be caused by starvation, injuries, disease, predation, subsistence harvests, intentional shooting by humans, entanglement in trash and debris, research, and by fishery interactions (Merrick *et al.* 1987; NMFS 2008b).

4.4.5. Acoustics

Steller sea lions have similar hearing thresholds in air and underwater to other otariids. In-air hearing ranges from 0.250-30 kHz, with a region of best hearing sensitivity from 5-14.1 kHz (Muslow and Reichmuth 2010). The underwater audiogram shows the typical mammalian U-shape. The range of best hearing was from 1-16 kHz. Higher hearing thresholds, indicating poorer sensitivity, were observed for signals below 16 kHz and above 25 kHz (Kastelein *et al.* 2005).

4.5. Humpback Whales

4.5.1. Status and Distribution

The humpback whale population was considerably reduced as a result of intensive commercial exploitation during the 20th century (Perry *et al.* 1999). Historically, three stocks of humpback whales were defined within the North Pacific: the eastern, central, and western North Pacific stocks (Allen & Angliss 2013, 2014). In 1970, the humpback whale was listed as endangered under the ESA[22]. As a result of the ESA listing, the central North Pacific Stock was also designated as depleted and strategic under the MMPA. In 1991, NMFS published a Final Recovery Plan for Humpback Whales (NMFS 1991).

In the North Pacific, humpback whales migrate from low-latitude breeding and calving grounds to aggregate at geographically distinct higher-latitude feeding grounds. While a very small degree of interchange has been documented, these feeding aggregations are generally isolated from each other. The whales that have been observed in and outside of lower Cook Inlet are considered part of the central North Pacific Stock (Allen and Angliss 2013, 2014, 2015). This stock of whales has shown a population increase of 5.5 - 6.0 percent per year throughout its range since the early 1990s (Allen and Angliss 2012).

A large-scale study of humpback whales throughout the North Pacific was conducted in 2004-2006 (the Structure of Populations, Levels of Abundance, and Status of Humpbacks [SPLASH] project) (Calambokidis *et al.* 2008; Barlow *et al.* 2011; Witteveen *et al.* 2011). Using the identification photographs and biopsy tissue samples provided by SPLASH, NMFS initiated a status review of the humpback whale in 2009 to determine whether an endangered listing for the entire species was still appropriate[23]. On February 26, 2014, the State of Alaska submitted a petition to delineate the Central North Pacific stock of the humpback whale as a DPS and subsequently remove that DPS from the ESA List of Endangered and Threatened Species. NMFS conducted a review of the humpback whale DPS designation and ESA listings to prepare a status report[24]. Based on information presented in the status report, NMFS proposed a revision to the species-wide listing of the humpback whale in 2015[25]. A revision to the status of humpback whale DPSs was finalized by NMFS on September 8, 2016[26], effective October 11, 2016. In the final decision, NMFS recognized the existence of 14 DPSs, classified four of those as endangered and one as threatened, and determined that the remaining nine DPSs do not warrant protection under the ESA.

Three DPSs of humpback whales occur in waters off the coast of Alaska: the Western North Pacific DPS, listed as endangered under the ESA; the Mexico DPS, a threatened species; and the Hawaii DPS, which is considered no longer endangered or threatened under the ESA. Humpback whales in the Gulf of Alaska are most likely to be from the Hawaii DPS (89 percent probability) (Wade *et al.* 2016). Humpback whales that occur infrequently in Cook Inlet are considered part of the Hawaii DPS. Humpback whales from the endangered Western North Pacific DPS or the threatened Mexico DPS have only a 0.5 percent and 10.5 percent probability of occurring in Cook Inlet (Wade *et al.* 2016) and would be considered extremely rare in upper Cook Inlet (Shelden *et al.* 2013).

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[22] At *Federal Register* 35 FR 18319.
[23] At *Federal Register* 74 FR 40568.
[24] Status Review available at *http://www.fisheries.noaa.gov/pr/species/mammals/whales/humpback-whale.html*.
[25] At *Federal Register* 80 FR 22304.
[26] At *Federal Register* 81 FR 62259.

Under the MMPA, humpback whale DPSs are considered to be depleted based solely on their ESA listing status. Therefore, humpback whale DPSs that are listed as threatened or endangered would retain depleted status under the MMPA, and DPSs that are not listed as threatened or endangered would not be considered depleted under the MMPA. To determine whether any stocks should be realigned in light of the ESA, NMFS would conduct a review of humpback whale stock delineations in waters under the jurisdiction of the U.S. Until the MMPA stock delineations are reviewed, NMFS treats existing MMPA stocks that fully or partially coincide with a listed DPS as depleted and stocks that do not fully or partially coincide with a listed DPS as not depleted for management purposes. Therefore, as shown in Table 3-1, the Hawaiian DPS is considered as Not Strategic, Non-depleted under the MMPA, while the Mexico DPS is considered Strategic, Depleted. As noted above, humpback whales in southeast Alaska, including Sitka Sound, are most likely to be from the Hawaii DPS. However, for this application, based on NMFS recommendation for proposed actions off Southeast Alaska, a small percentage of humpback whales has been apportioned to the Mexico DPSs using the probabilities of occurrence noted by Wade *et al*. (2016).

Humpbacks are generally present during late spring through fall throughout the Gulf of Alaska and Southeast Alaska. The historic summer feeding range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk and north of the Bering Strait (Johnson and Wolman 1984). Humpback whales are currently found throughout this historic range, with sightings during summer months occurring as far north as the Beaufort Sea (Hashagen *et al.* 2009). The current winter range of humpback whales in the North Pacific is relatively well known. The winter range of humpback whales in Lower Cook Inlet includes the Main Hawaiian Islands.

4.5.2. Critical Habitat

Critical habitat has not been designated for humpback whales in the North Pacific (Allen and Angliss 2015).

4.5.3. Presence in Cook Inlet and the Project Area

In the summer, humpback whales are present regularly and feed outside of Cook Inlet, including Shelikof Strait, Kodiak Island bays, the Barren Islands, and the Kenai and Alaska peninsulas. Humpbacks may be present in some of these areas throughout the fall months (NMFS 2015b). They are infrequently observed each year in lower Cook Inlet from the Forelands south, and are considered rare visitors to upper Cook Inlet and the Project Area. However, in 2014 five humpback whale groups (including one mother/calf pair) were observed on the east side of Cook Inlet during the surveys conducted as part of the Apache project (Lomac-MacNair *et al.* 2014). Three of these sightings, including the mother-calf pair, were observed north of the Forelands but still well south of the Project Area.

4.5.4. Life History

The humpback whale is distributed worldwide in all ocean basins. It is a seasonal migrant that moves between high-latitude feeding areas in summer to subtropical calving/winter areas in waters of the Northern and Southern Hemispheres.

Humpback whales feed singly or in groups, employing a wide range of foraging behaviors to capture their prey. Although humpback whales travel to follow prey, they also exhibit a high degree of fidelity to feeding areas by segregating into discrete feeding aggregations between which little interchange occurs (Calambokidis *et al.* 2001; Calambokidis *et al.* 2008; Waite *et al.* 1999; Witteveen *et al.* 2004). Humpback whales feed on small schooling fishes, euphausiids, and other large zooplankton (Clapham and Mead 1999). Fish prey species for humpback whales in the North Pacific also include Pacific herring, capelin, juvenile walleye pollock, and sand lance. Humpback also feed on eulachon, Atka mackerel, Pacific cod, saffron cod, Arctic cod, juvenile salmon, and rockfish.

Ship strikes or entangled humpback whales found swimming, floating, or stranded with attached fishing gear have been documented in Alaska (Allen and Angliss 2015). All reports of mortalities or injuries of humpback whales from the Central North Pacific Stock from 2008 to 2012 in Alaskan waters are summarized in Allen *et al.* (2014) and Helker *et al.* (2015), along with details regarding injury determination and assessment. The estimated annual human-caused mortality and serious injury rate for 2008 to 2012 based on entanglements (marine debris, commercial and recreational fisheries), as well as vessel collisions for the Central North Pacific Stock was 7.96 animals (Allen and Angliss 2015).

Killer whales prey on humpback whales. In Alaska, 15-20 percent of the photographically identified humpback whales bear scars of killer whale attack (Perry *et al.* 1999). A 2008 study examined the incidence of rake marks from killer whales on humpback whale flukes to assess predation pressure throughout the North Pacific (Steiger *et al.* 2008). The prevalence of rake marks indicated that killer whale predation has the potential to be a major source of mortality (Steiger *et al*. 2008).

4.5.5. Acoustics

The humpback whale audiogram, which incorporates an extrapolation of frequency by position to 100 percent of basilar membrane length, was shown by Houser *et al.* (2001). The humpback audiogram is U-shaped and typically mammalian with a region of best hearing defined as relative threshold < 0.2 ranging from 700 Hz to 10 kHz. Maximum sensitivity, defined as threshold values < 0.1, ranged from 2 to 6 kHz. Southall *et al.* (2007) classified humpback whales as low-frequency cetaceans.

4.6. Killer Whale

4.6.1. Status and Distribution

Killer whales are found throughout the North Pacific. Along the west coast of North America killer whales occur along the entire Alaskan coast, in British Columbia and Washington inland waterways, and along the outer coasts of Washington, Oregon, and California (Allen and Angliss 2014). Seasonal and year-round occurrence has been documented for killer whales throughout Alaska and in the intra-coastal waterways of British Columbia and Washington State.

North Pacific killer whales have been labeled as resident, transient, or offshore ecotypes based on aspects of their morphology, ecology, genetics, and behavior (Bigg *et al.* 1990; Ford *et al.* 2000; Dahlheim *et al.* 2008; Ford and Fisher 1982; Baird and Stacey 1988; Baird *et al.* 1992; Hoelzel *et al.* 1998, 2002; Barrett-Lennard 2000; Dahlheim *et al.* 2008). Several studies provide evidence that the three ecotypes are genetically distinct in both mtDNA and nuclear DNA (Hoelzel and Dover 1991; Hoelzel *et al.* 1998, 2002; Barrett-Lennard 2000).

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the North Pacific U.S. EEZ (Muto *et al.* 2016). Members of three of these stocks may be found within or outside of Cook Inlet: the Alaska Resident stock which occurs from southeastern Alaska to the Aleutian Islands and Bering Sea; the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock found mainly from Prince William Sound through the Aleutian Islands and Bering Sea; and the AT1 transient stock which occurs from Prince William Sound through the Kenai Fjords. The offshore stock ranges from California to Alaska but likely occurs outside of Cook Inlet. The population of the North Pacific killer whales contains an estimated 1,123 animals in the resident group and 587 animals in the transient group (Allen and Angliss 2013). None of the killer whale resident groups in Alaska are listed under the ESA or considered depleted under the MMPA. The ATI transient stock is considered depleted and strategic under the MMPA.

4.6.2. Presence in Cook Inlet and the Project Area

Small numbers of killer whales are recorded in Cook Inlet compared to the overall population, and most are recorded in the lower Cook Inlet. Killer whales are rare in upper Cook Inlet, where transient killer whales feed on beluga whales and resident killer whales feed on anadromous fish (Shelden *et al.* 2003). The availability of prey species determines whether killer whales will be found in the area. Twenty-three sightings of killer whales were reported in aerial surveys by Rugh *et al.* (2005a) in the lower Cook Inlet between 1993 and 2004. Photographs show recognizable individuals and pods, and movements of whales between geographical areas have been documented. For example, resident whales identified in Prince William Sound have been observed in lower Cook Inlet (Matkin *et al.* 2010), whereas the AT1 transients have been seen only in Prince William Sound and in the Kenai Fjords region. AT1 transients are small in numbers andnot considered likely in Cook Inlet especially north of the Forelands in the Action Area.

Surveys over 20 years by Shelden *et al.* (2003) reported 11 sightings in upper Cook Inlet between Turnagain Arm, Susitna Flats, and Knik Arm. No killer whales were observed during surveys by Funk *et al.* (2005), Ireland *et al*. (2005), Brueggeman *et al.* (2007a, 2007b, 2008), or Ramos *et al.* (2006, 2008). Killer whales have also not been documented during any Port of Anchorage construction or scientific monitoring (Cornick and Pinney 2011; Cornick and Saxon-Kendall 2008; Cornick *et al*. 2010; Markowitz and McGuire 2007; Prevel-Ramos *et al.* 2006). Very few killer whales, if any, are expected to approach or be in the vicinity of the Project Area.

4.6.3. Life History

Killer whales generally prey on fish (resident stocks) or mammals (transient stocks), although some overlap may occur. Residents have been observed feeding on salmon throughout their range, congregating at locations where salmon are moving to spawn. Residents have also been observed to predate on fish trawls and longline fisheries. Likely prey for transient killer whales occurring in Cook Inlet include Steller sea lions, harbor seals and beluga whales. Transient killer whales are frequently observed around haulouts and rookeries throughout Alaska.

4.6.4. *Acoustics*

The hearing of killer whales is well developed. Szymanski *et al.* (1999) found that they responded to tones between 1 and 120 kHz, with the most sensitive range between 18 and 42 kHz. Their greatest sensitivity was at 20 kHz, which is lower than many other odontocetes but matches peak spectral energy reported for killer whale echolocation clicks. Southall *et al*. (2007) classified this species in the mid-frequency hearing group.

5. TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

The offshore Project work has the potential to generate underwater noise that would be detectable to marine mammals at some distance from the Project Area. This noise has the potential to expose up to six species of marine mammals protected under the MMPA to Level B[27] acoustic criteria. NMFS has implemented a lower threshold of 120 dB re 1 µPa rms SPL for animals exposed to non-impulsive sources as the criterion for when a Level B take might occur. However, being exposed to this level of noise does not automatically imply that a take has occurred. The MMPA and its implementing regulations have never had a clear operational definition of "take by harassment". There is general recognition that minor and brief changes in behavior generally do not have biologically significant consequences for marine mammals and do not "rise to the level of taking" (NRC 2005). Also, Southall *et al.* (2007) emphasized the need to distinguish minor, short-term changes in behavior with no lasting biological consequences from biologically significant effects on critical life functions such as growth, survival, and reproduction. The biological relevance of a behavioral response to noise exposure depends, at least in part, on how long the response persists. Southall *et al.* (2007) noted that "a reaction lasting less than 24 hours is not regarded as particularly severe unless it could directly affect survival or reproduction." Based on these considerations, it is highly unlikely that the potential behavioral effects from this Project would result in anything more than minor, biologically insignificant consequences for any individual animal or for the population. As such, the limited observed effects would not constitute a "take" under the definition of NMFS (2000), and minor, brief changes in behavior generally do not "rise to the level of taking".

Level A takes are not anticipated. In-water construction activities are planned to be completed within a 5-month period and are not expected to result in PTS or Level A serious injury or mortality of any marine mammal. Therefore, Harvest is applying for an IHA effective approximately April 2018, pursuant to Section 101(a)(5)(D) of the MMPA, 16 USC Section 1371.101 (a)(5), and 50 CFR Section 216, Subpart I, for incidental take of up to six species of marine mammals.

5.1. Methods of Incidental Taking

The activities outlined in Section 1.3 would be accomplished using a variety of pipe pulling, positioning, and securing methods supported by dive boats, crew boats, tug boats, and barges and winches. Noise produced during the activities may result in the incidental take of marine mammals by acoustical harassment due to exposure to underwater noise.

[27] Level A harassment may result in injury or death, whereas Level B only results in disturbance without the potential for injury.

For the purposes of determining potential exposure of marine mammals to underwater noise, noise associated with the two proposed tugs has been used to establish the potential ensonified area. For the purposes of this application, vessels transiting to and from the pipeline corridor are not included in the estimate of potential marine mammal takes. Seafloor mapping with side-scan sonar typically involves high frequency sound pulses (e.g., 100 kHz) directed towards the ocean bottom (Hildebrand 2009). While the source level at 1 m may be relatively high, the directivity of the source and requirement to use very high frequencies to achieve the desired image resolution means that noise from this source is not expected to propagate over large distances. Therefore, this assessment considers only the noise from the vessel propulsion systems that might occur during sonar activities during the activity period.

Most vessels required for the Project are expected to be relatively small (dive boat, crew boat, sonar vessel, or smaller tugs [120 feet in length]). The extent of noise produced above the 120 dB behavioral threshold would vary depending on several variables including water depth, tidal currents, vessel activity, wind speed and other factors. However, neither serious injury nor mortality is expected from activities within the Project Area. As described in Section 6, potential underwater noise exposure was assessed based on the concept that in-water work would be clustered in a small area along the pipeline corridor and move along that corridor as the pipeline installation progresses over time. Therefore, only a small portion of the Action Area would be ensonified at any one time. See Section 6 for additional detail.

5.2. Compliance with 'Small Numbers' and 'Negligible Impact' Requirements of MMPA

Upon request, Section 101(a)(5)(d) of the MMPA allows the incidental but not intentional taking of small numbers of marine mammals if certain findings are made (16 U.S.C. 1361 et seq.). NMFS authorizes incidental takes under the MMPA if the taking would: 1) be of small numbers; 2) have no more than a negligible impact on those marine mammal species or stocks; and 3) not have an immitigable adverse impact on the availability of the species or stocks for subsistence uses[28]. The estimate of takes requested relative to these requirements is included in in Section 7 of this application.

[28] See http://www.nmfs.noaa.gov/pr/permits/incidental/

6. TAKE ESTIMATES FOR MARINE MAMMALS

6.1. Threshold Criteria for Injury (Level A) and Behavioral (Level B) Disturbance

The effects of underwater noise on marine mammals is dependent on the ability of each mammal to perceive or hear the sounds. The Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2016b) uses marine mammal hearing groups defined by Southall *et al*. (2007) with some modifications. These groups and their generalized hearing ranges are shown in Table 6-1. Of the six marine mammal species (four cetaceans and two pinnipeds) that may occur in the Action Area, humpback whales are classified as LFC, beluga and killer whales are MFC, and harbor porpoise are classified as HFC (Southall *et al.* 2007). Harbor seals are members of the phocid group, while Steller sea lions are otariid pinnipeds. NMFS (2016b) considered acoustic thresholds by hearing group to acknowledge that not all marine mammals have identical hearing ability or identical susceptibility to noise or noise-induced PTS. NMFS (2016b) also used the hearing groups to establish marine mammal auditory weighting functions (Table 6-2). These functions are considered in the determination of Level A threshold criteria as discussed in Section 6.1.1.

TABLE 6-1. GENERALIZED HEARING RANGES FOR MARINE MAMMAL HEARING GROUPS IN WATER

Hearing Group	Hearing Range
Low-frequency cetaceans[1]	7 Hz to 35kHz
Mid-frequency cetaceans[2]	150 Hz to 160 kHz
High-frequency cetaceans[3]	275 Hz to 160 kHz
Phocids[4]	50 Hz to 86 kHz
Otariids[5] and other non-phocid marine carnivores	60 Hz to 39kHz

Source: NMFS 2016b.
[1] Humpback whales.
[2]Beluga and killer whales.
[3]Hih-frequency cetaceans are not likely to occur within the Action Area.
[4]Harbor seals.
[5]Steller sea lions.

TABLE 6-2. SUMMARY OF WEIGHTING AND EXPOSURE FUNCTION PARAMETERS

Hearing Group	*a*	*b*	*f₁* (kHz)	*f₂* (kHz)	*K* (dB)
Low-frequency cetaceans	1	2	0.20	19	0.13
Mid-frequency cetaceans	1.6	2	8.8	110	1.20
High-frequency cetaceans	1.8	2	12	140	1.36
Otariids and other non-phocid marine carnivores	2	2	0.94	25	0.64
Phocids in water	1	2	1.9	30	0.75

Source: NMFS 2016b.

6.1.1. *Auditory Injury (Level A) Threshold Criteria for Marine Mammals*

Acoustic thresholds for generating PTS effects in marine mammals are provided in NMFS (2016b). To determine the PTS thresholds, a dual metric approach considering both cumulative sound exposure and peak sound levels was used for impulsive sounds. For non-impulsive sounds, only the cumulative sound exposure level was used, unless the impulsive peak level threshold was exceeded. Different thresholds and auditory weighting functions are provided for different marine mammal hearing groups, which are defined in the Technical Guidance (NMFS, 2016b). The PTS thresholds corresponding to each hearing group are shown in Table 6-3.

TABLE 6-3. ACOUSTIC THRESHOLDS FOR LEVEL A INJURY

	PTS Onset Acoustic Thresholds (Received Level)		
	Impulsive Sources		Non-impulsive source
Hearing Group	Peak Pressure Level *(dB re 1 µPa)*	Cumulative Auditory-weighted SEL_{24h} *(dB re 1 µPa²·s)*	Cumulative Auditory-weighted SEL_{24h} *(dB re 1 µPa²·s)*
Low-frequency	219	183	199
Mid-frequency	230	185	198
High-frequency	202	155	173
Phocid pinnipeds in	218	185	201
Otariid pinnipeds in	232	203	219

Source: NMFS 2016b.
Notes: Peak sound pressure is "flat" or unweighted. Cumulative sound exposure level has a reference value of 1µPa2s. Cumulative levels should be appropriately weighted for the hearing group for assessment to the threshold
[1] Humpback whales.
[2] Beluga and killer whales.
[3] Harbor porpoise.
[4] Harbor seals.
[5] Steller sea lions.

6.1.2. *PTS Distance Estimation Method*

In relation to the potential for PTS, Appendix D of the NMFS Technical Guidance (NMFS 2016b) provides a calculation method to determine the radius r from the noise source at which the sound level is equal to the acoustic threshold. This method includes multiple conservative assumptions and is expected to result in higher estimates of hearing impairment than would be the case in a practical situation. In this study, the method is applied in the form of a screening calculation, since PTS is considered highly unlikely to result from the noise sources proposed in the Project activities. For the purpose of this assessment, all stationary sources are assumed to operate continuously for a total of 12 hours in any 24-hr period.

For stationary sources considered for estimating take (i.e., tugs, dive boat and sonar boat), the practical spreading loss model of 15 log(r) has been applied. The NMFS (2016b) Appendix D calculator method includes simplified weighting factor adjustments (WFA) to account for the hearing sensitivity of various species and the frequency content of the source. For this assessment, the default WFA frequency of 28 kHz for belugas (MFCs) is applied in all cases except for tugs. This assumption is highly conservative since the noise sources are dominated by low frequency components. For tugs, the upper frequency below which 95% of the total cumulative noise energy is contained has been estimated as 5 kHz with reference to measured noise from a range of tugs (Warner *et al*. 2014; Li *et al*. 2011). This frequency has been used to compute the WFA for stationary tugs in order to provide a more realistic estimate of the potential for PTS from this noise source.

All of the anticipated noise sources are continuous, with the possible exception of some minor impulsive noise that may be generated by impacts when pulling the pipeline along the seafloor. The peak noise level of this event at source is estimated to be below the impulsive peak noise thresholds shown Table 6-3. Therefore, it is concluded that there is no potential for the Project activities to cause marine mammal PTS due to impulsive noise peak levels and this possibility is not considered further in this assessment.

6.1.3. Behavioral Disturbance and Method for Determining Area Ensonified

The distances to the broadband behavioral distance thresholds have been estimated for each item of equipment using the practical spreading loss model of 15 log(*r*). Each item of equipment is assumed to operate in isolation. While there may be several vessels operating in an area, the noise from the tugs is used to estimate the potential area ensonified during pipeline installation activities based on the distances to Level A and Level B thresholds described in the following section.

6.2. Distances to Level A and Level B Noise Thresholds

6.2.1. Source Noise Level Estimations

Noise levels have been estimated for each potential source based on a literature review as shown in Table 6-4. Where required, source noise levels for various tugs and support vessels have been estimated by scaling from frequency-dependent reference vessel measurements to adjust source levels on the basis of ship length, power and speed as applied by Wales and Heitmeyer (2002).

This assessment identifies estimated source levels for a range of vessels and equipment that may be used, as determined in consultation with Harvest's Project team. In practice, noise from vessels would vary depending on propulsion system loading and vessel speed.

Table 6-5 presents the distances to marine mammal Level A and Level B thresholds for noise sources anticipated for the Project. The distances are based on NMFS (2016b) for Level A and the interim NMFS (2012) criteria for Level B (see Section 6-1). The reported distance for 24-hr SEL (Level A) thresholds are based on the assumption that marine mammals remain stationary or at a constant exposure range during the entire 24-hr period which is extremely unlikely to happen. These estimated distances for Level A represent an unlikely worst-case scenario.

The results shown in Table 6-5 indicate that an individual animal would need to remain within 25 m (82 ft) of the noisiest assessed tug for a total duration of 12 hours for there to be a risk of PTS. Since this is not a realistic scenario, the predicted conservative distances to the thresholds confirm that PTS to any animal is unlikely to occur from noise generated during the proposed Project activities. For this reason, Level A takes are not requested in this application.

TABLE 6-4. SOURCE NOISE LEVELS USED IN ESTIMATION OF DISTANCES TO ACOUSTIC THRESHOLDS

Noise Source	Notes	Source Level dB re 1µPa @ 1 m (rms)	Reference[1]
Dive Boat	Dive Support Vessel (70'-80')	170	Kipple and Gabriele, 2004
Sonar Boat	Sonar Vessel (30')	168	Kipple and Gabriele, 2004
Tugs[2]	120' and up to 5400 HP[3]	170	Warner *et al*. 2014
Pipe	Estimated bottom impact sounds during pipe pull (assumed similar to impact noise of bucket dredging)	179 peak	Reine *et al.* 2014
Barge	Anchoring – included with tug noise	n/a	See tug noise
	Backhoe trenching in transition zone	167	Reine *et al*. 2012
Underwater Tools (hydraulic wrench, pneumatic grinder, and pressure washer)	Potential use at platform tie-in location	~159	JASCO 2017

[1]Source SLR 2017.
[2]All tug source levels estimated with reference to Ross (1976), Wales and Heitmeyer (2002). Source levels may vary over time with variations in propulsion system loading and vessel speed.
[3]For example, CM Titan Class at 3.9 m/s (7.5 knots).
[4]While sound source verification for the grinder has not been conducted, it has been estimated at 159 dB based on "practical spreading loss" TL coefficient of 15 (JASCO 2017) a radius of 250 m to the 120 dB isopleth is expected for grinder operation.

TABLE 6-5. DISTANCES TO NOISE THRESHOLDS BY SOURCE

Noise Source	Notes	Source Level dB re 1µPa @ 1 m (rms)	Distance to Level A (PTS) Threshold (m)[1]	Distance to Level B (Behavior) Threshold (m)[2,3]
Dive boat	Dive Support Vessel (70'-80')	170	NA	2,200
Sonar boat	Sonar Vessel (30')	168	NA	1,600
Tugs[1]	120' and up to 5400 HP[2]	170	<11	2,200
Pipe	Estimated bottom impact sounds during pipe pull (assumed similar to impact noise of bucket dredging)	179 peak	NA	<10
Barge	Anchoring – see tug noise	NA	NA	NA
	Backhoe trenching in transition zone	167	<11	1,400
Underwater Tools (hydraulic wrench, pneumatic grinder, and pressure washer)	Potential use at platform tie-in.	~159[4]	NA[4]	250[4]

Source SLR 2017.
[1] PTS distances are maximums across all relevant marine mammal groups.
[2]Behavioral threshold is 120 dB_{rms} for continuous sources, and 160 dB_{rms} for impulsive noise sources
[3]Distances are approximate to the nearest 100 m.
[4]4While sound source verification for the grinder has not been conducted, it has been estimated at 159 dB based on "practical spreading loss" TL coefficient of 15 (JASCO 2017) a radius of 250 m to the 120 dB isopleth is expected for grinder operation.

While the extent of noise impacts above the Level B behavioral disturbance threshold of 120 dB rms is expected to vary considerably depending on the specific vessels used, tugs will be the consistent source of underwater noise during in-water activities for pipeline installation. Other support vessels may transit in and out of the Project Area, with certain vessels tethering to the barge during installation (i.e., the dive boat and other support boats would likely transit in and then tie up to the barge and turn the engine off). The range of distances to the behavioral thresholds for each noise source with relatively continuous activity is provided in Table 6-6, where the range presented indicates the possible variation in distance depending on the actual vessels selected for the Project. For the underwater tools, the behavioral threshold of 120 dB would not be exceeded; therefore takes associated with the use of underwater tools is not considered.

TABLE 6-6. DISTANCE TO LEVEL B BEHAVIORAL THRESHOLDS BY NOISE SOURCE

Noise Source	Estimated distance to Level B Threshold (m)
Tugs	2,200
Dive Boat	2,200
Sonar Boat	1,600
Backhoe or Bucket Crane	1,400

Noise from vessels is the dominant source generated by the Project as a whole. The types of vessels proposed for the work and their respective noise source levels are similar to existing vessels operating in Cook Inlet (Blackwell and Greene 2002). The majority of vessels required for the Project are expected to be relatively small (dive boats, sonar vessels, smaller tugs up to about 120 ft). As shown in Table 6-6, the furthest distance to the noise threshold for behavioral disturbance (Level B) is expected to be around 2.2 km for tug boats.

Underwater source levels for the hydro grinder are not available, but are estimated at 159 dB based on the reported in-air source level of 97 dB (Stanley 2014). While sound source verification for the grinder has not been conducted, it has been estimated at 159 dB based on "practical spreading loss" TL coefficient of 15 (JASCO 2017) a radius of 250 m to the 120 dB isopleth is expected for grinder operation. Specific data on source levels for the other tools are not readily available but are expected to be similar to the grinder. As stated in the 2018 addendum to the August 29, 2017 Letter of Concurrence for Hilcorp's 5-year maintenance plan in Cook Inlet (NMFS 2017), the U.S. Navy published data for a diamond wire saw was approximately 85 dB (U.S. Navy 2016) and while this specific tools is not proposed for use here, the other tools are expected to have a similar noise profile under water.

For these reasons, use of these tools will have no direct or indirect effects other than potentially minor biologically insignificant behavioral disturbance. Noise generated from the underwater hand tools would be lower than the anticipated levels estimated for the tugs which would occur at the same time. Therefore takes associated with the use of underwater tools is considered as part of the takes associated with tug use.

6.3. Estimated Takes

For all marine mammals except beluga whales, Level B takes are estimated by considering the density of marine mammals per km^2, and multiplying that density by the ensonified area and the number of days the noise source could occur under any project component (i.e., noise from tug engines). For beluga and killer whales, it is important to consider the average group size that could occur within the Action Area and therefore, average group size based on recent sighting data is used to estimate potential takes for belugas. The following subsections describe the process for each step and conclude with the estimated number of takes anticipated for the Project that is used to develop the final take request numbers.

6.3.1. Estimating the Area Ensonified

The estimated area that will be ensonified above behavioral thresholds by source is calculated based on the distance from the shoreline to the platform (i.e., the pipeline corridor) and multiplying part of that distance by the distance from the tugs which would be operating consistently during pipeline installation[29]. The pipeline corridor is approximately 8.9 km long and during pipeline installation, vessel activity would be clustered in a small area along this length. For this reason and for the purposes of estimating the potential area ensonified during in-water activities, half this distance 4.45 km is multiplied by 4.4 km (the total distance to the Level B threshold that could propagate from each side of the tug) which results in a total ensonified area of 19.58 km^2 during in-water work during installation. Pipeline installation activities would move along the pipeline corridor as pipeline pulling or stabilization activities take place and therefore would not be concentrated in one specific area over the duration of the Project. In

[29] Note that metric numbers are used exclusively in this section because noise modeling outputs are in metric.

addition, based on available literature described in Section 3, marine mammals are expected to be transiting through this area.

6.3.2. Marine Mammal Densities

Marine mammal densities in upper Cook Inlet as shown in Table 6-7 are based on the most recent information available. HDR (2015) calculated densities for beluga whales using the aerial survey data in Cook Inlet (from Goetz *et al*. 2012). Three different beluga distribution maps were produced from a habitat model based on sightings of beluga whales during these aerial surveys. First, the probability of beluga whale presence was mapped using a binomial (i.e., yes or no) distribution, and the results ranged from 0.00 to 0.01. Second, the expected group size was mapped. Group size followed a Poisson distribution and ranged from 1 to 232 individuals in a group. Third, the output (using multiplication) from predictive models results in predicted densities of beluga whales throughout Cook Inlet at a scale of one square kilometer (Figure 6-1). Beluga whale densities (in June) ranged from 0 (generally in mid- to lower Cook Inlet, Critical Habitat Area 2) to 1.12 beluga whales/km^2 (upper Cook Inlet, Critical Habitat Area 1). Habitat maps for beluga whale presence, group size, and density (beluga whales/km^2) were produced from these data (Figure 6-1, from Goetz *et al.* 2012).

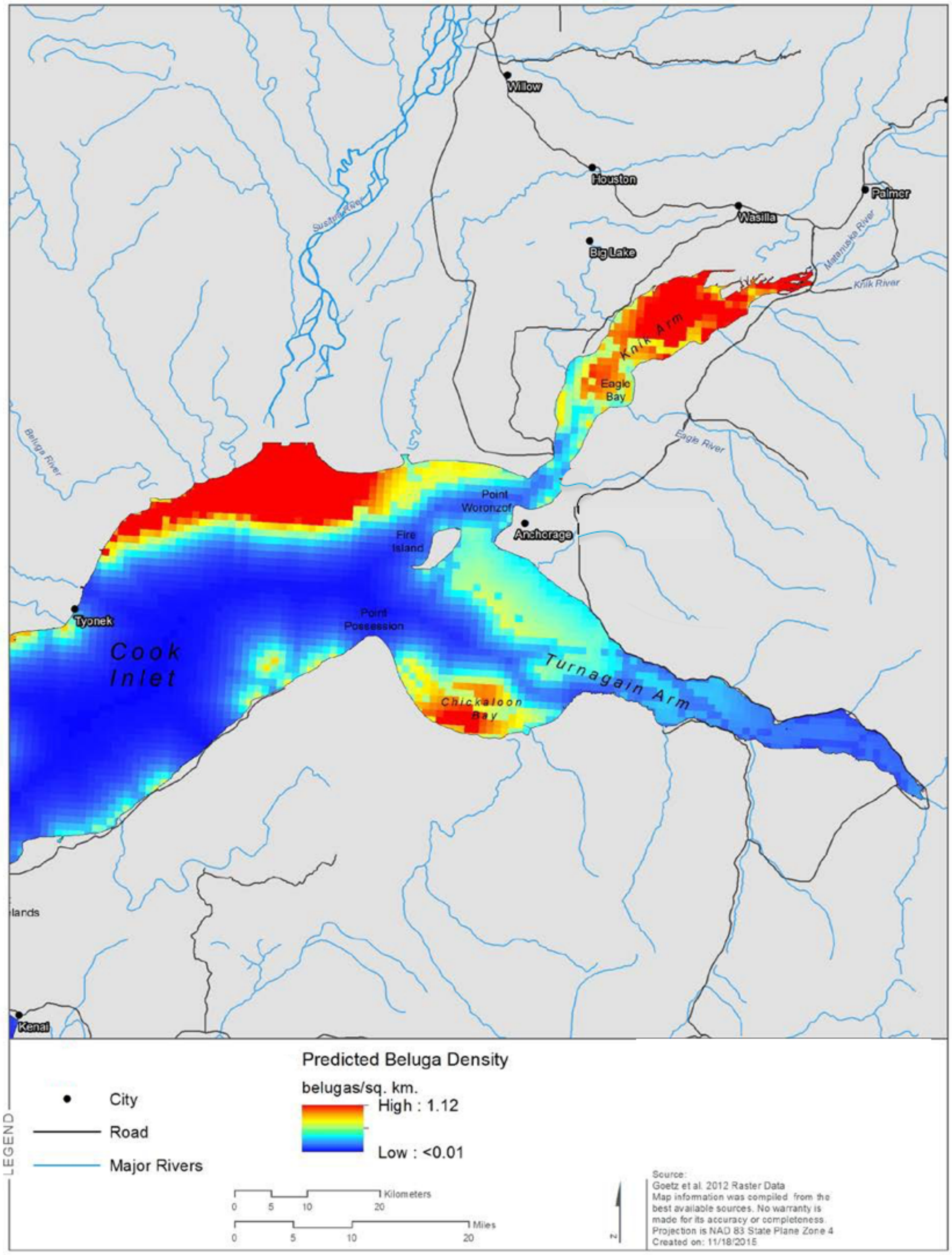
TABLE 6-7. SUMMARY OF DENSITY ESTIMATES/DAY (ANIMALS/KM^2)

Species[1]	**Average Density**
Cook Inlet Beluga Whales	0.001
Harbor Seals	0.0051
Harbor Porpoise	0.00009
Steller Sea Lions	0.00016
Humpback Whales[2]	0.00001
Killer Whales	0.00001

[1]Goetz *et al*. (2012) was used to estimate beluga whale density; ASRC (2013, 2014) for other species.
[2]Humpback whales were not seen during the ASRC surveys. The total number of humpback whales observed in recent years (Lomac-McNair *et al.* 2014) is approximately the same as for gray whales during earlier surveys. Therefore 2002-2012 density estimates for gray whales serves as proxy for humpback whale densities in more recent years.

This method of estimating density does not assume a random distribution of beluga whales throughout the area. The HDR (2015) estimates use density-related habitat features including depth soundings, coastal substrate type, an environmental sensitivity index, and information on anadromous fish streams to develop a predictive beluga whale habitat model (Goetz *et al.* 2012). It is understood from NMFS aerial surveys, opportunistic sightings, and satellite-tagging data that beluga whales are concentrated along the rivers and nearshore areas of upper Cook Inlet (Susitna River Delta, Knik Arm, and Turnagain Arm) from May through October (NMML 2004; Rugh *et al*. 2004a). Ezer *et al.* (2013) found that 70 to 90 percent of

FIGURE 6-1. PREDICTED COOK INLET BELUGA WHALE DENSITIES WITHIN COOK INLET



Source: HDR (2015) using Goetz *et al*. (2012) geospatial data.

observations from tagged whales from April through July-August were located near the Susitna River Delta and in the Knik and Turnagain Arms.

Based on this information, the lower density estimates reflected in Figure 6-1 represent the best density estimate for beluga whales throughout the Action Area at the time of the Project. A density of 0.001 (Table 6-7) reflects a realistic density estimate along the pipeline corridor, and generally throughout the Action Area, and is consistent with the density of beluga whales calculated along seismic survey routes in 2013 and 2014 for the same area (ASRC 2013, 2014). The high-density areas in Figure 6-1 (red areas) are considerably north of the pipeline corridor which is situated in areas that are largely dark blue (<0.01 density area). For the purposes of this application and for estimating take, an average group size of eight is applied based on the aerial surveys from which the estimated average group size for belugas observed west/south of the Beluga River (the general Action Area) ranged between three and eight whales (Shelden *et al.* 2017). While larger group sizes have been observed offshore near the Tyonek platform, the Project work will be concentrated within the pipeline corridor closer to shore between the shoreline and the platform.

For other marine mammal species considered in this request for IHA, sighting data summaries and density estimates from surveys associated with seismic efforts or other activities that have occurred in the middle and upper Cook Inlet regions in recent years were used to estimate the densities shown in Table 6-7. ASRC (2013, 2014) estimated densities of all marine mammals in the proposed Project Area using data from the annual aerial surveys conducted by NMFS for Cook Inlet beluga whale between 2000 and 2012 (Rugh *et al.* 2000, 2001, 2002, 2003, 2004b, 2005b, 2006, 2007; Shelden *et al.* 2008, 2009, 2010, 2012; Hobbs *et al.* 2011). These surveys were flown in June to collect abundance data of beluga whales but observations of other marine mammals were also reported. Although these data were only collected during one month each year, ASRC determined that these surveys provided the best available relatively long-term data set for marine mammal observations in Cook Inlet. Also, the timing of these surveys (June) are relevant to this Project. However, the total number of animals observed for the entire survey includes both lower and upper Cook Inlet so the total number reported and used to calculate density is higher than the number of marine mammals anticipated to be observed in the Action Area of this Project. Therefore, the use of these data to estimate density is considered conservative and likely results in higher density estimates of these animals than what may actually occur in the Project Area.

The density of marine mammals in upper Cook Inlet during spring through fall correlates with the presence or absence of anadromous fish species during spawning activities. While there is a temporal overlap between Project activities and the occurrence of several species of marine mammals in upper Cook Inlet (primarily beluga whales and seals and possibly harbor porpoise), the spatial overlap is considerably smaller. The distance between the activities at the Project site and dense concentrations of foraging marine mammals at the mouths of major spawning rivers in upper Cook Inlet exceeds 20 to 30 km much of the time and over 31 mi (50 km) between the pipeline corridor and foraging areas in Knik and Turnagain Arms.

6.3.3. Estimated Incidental Take

The NMFS application for IHAs requires applicants to determine the number of marine activities that have the potential to take marine mammals by harassment only. This Project may result in the take of marine mammals primarily through elevated levels of in-water noise.

The following assumptions were made when calculating incidental take:

- Takes were calculated based on the potential area ensonified during Project activities;
- To be conservative, takes for belugas were estimated based on the potential to encounter small groups of whales;
- Vessels transiting to and from the pipeline corridor would introduce intermittent noise. Therefore, the consistent noise from the tugs has been used to estimate the area ensonified during pipeline installation. The entire pipeline installation process may take up to 108 days as described in Section 1.4 and shown in Table 1-1. Therefore, potential takes are calculated based on this approximately 3 and ½ month period;
- All marine mammal individuals potentially occurring in the Action Area are assumed to be incidentally taken;
- An individual can only be taken once during a 24-hour period; and
- Exposures to sound levels at or above the relevant thresholds equate to take, as defined by the MMPA.

6.3.3.1. Estimated Level A Incidental Take

Level A takes are not anticipated for this Project. The estimated distances from the identified noise sources to the behavioral and PTS noise thresholds are summarized in Table 6-4. As shown it the table, the greatest distance from any sound source at which PTS thresholds for any Project component would be exceeded is 23 m (75 ft). This means that for a Level A take and risk of PTS to occur, an individual animal would need to remain within 23 m of the loudest source for a total duration of 12 hours. This is extremely unlikely.

6.3.3.2. Estimated Level B Incidental Take

The number of exposures by Project component is determined in large part by the noise source (from Table 6-4), which determines the area ensonified above the behavioral (Level B) threshold. That in combination with the duration of pipeline installation including all project components (approximately 108 days; see Table 1-1) results in an estimate of take. With the exception of beluga whales, potential Level B take is estimated by multiplying the Level B ensonified area (19.58 km^2; see Section 6.3.1) times the species density shown in Table 6-7.

To determine the estimated beluga whale takes, an average group size of eight was used based on data reported in Shelden *et al.* (2017). The assumption was then made that approximately one group of eight animals per month may transit through the Project Area during the 108 days of in-water Project activities (3.6 months) when pipeline installation would occur. This results in a total of 28.8 beluga whale Level B takes over the course of the Project (see calculation below). The following calculations were used to calculate takes shown in Table 6-8:

For harbor seals, the calculation is:

- Tugs[30]: 19.58 km^2 (ensonified area per day) X 108 days (duration of tug use) X 0.0051 harbor seals/km^2 = 10.78 harbor seals
- **Total for Harbor Seals: 10.78**

For beluga whales, the calculation is:

- 3.6 months[31] (Project Duration for In-Water Work) X 8 (average group size[32]) = 28.8 beluga whales
- **Total for Beluga Whales: 28.8**

Calculations for all other estimated takes shown in Table 6-8 were completed in the same manner using the appropriate animal densities from Table 6-7.

TABLE 6-8. ESTIMATED LEVEL B EXPOSURES WITHOUT MITIGATION

Species	Estimated Level B Exposures[1]
Cook Inlet DPS of Beluga Whale	28.8[2]
Harbor Seal	10.78
Harbor Porpoise	0.19
Steller Sea Lion western DPS	0.34
Humpback Whale HI DPS	0.02
Killer Whale	0.02

[1]Based on continuous exposure to tug boat noise over the 108 days of the Project.
[2]Based on an average group size of eight whales exposed once a month over the 3.6 month (108 day) Project.

The MMPA and its implementing regulations have never had a clear operational definition of Level B "take by harassment". There is general recognition that minor and brief changes in behavior generally do not have biologically significant consequences for marine mammals and do not "rise to the level of taking" (NRC 2005). Based on this and other considerations (see Section 5), it is highly unlikely that the potential behavioral effects from this project would result in anything more than minor, biologically insignificant, consequences for any individual animals or for the population. As such the limited observed effects would not constitute a "take" under the definition that minor and brief changes in behavior generally do not "rise to the level of taking". Also, the actual level of take may be less than that the totals shown in Table 6-8 if other combinations of the components are decided upon during Project performance. This allows for flexibility within the Project but provides a worst-case estimate so that requested takes are not exceeded.

The estimated exposures in Table 6-8 are conservative because they assume all work could continue for a 24-hr period and do not include mitigation measures discussed in Section 11. These measures will further reduce takes. Table 6-9 shows the calculated estimate of Level B exposures (without mitigation) as a

[30] Ensonified area for two tugs is the same as one tug due to masking, resulting in one sound source.
[31] Calculation assumes that approximately one group of 8 whales would transit through the Project Area once per month.
[32] Based on Shelden *et al.* 2017.

percentage of each DPS and stock. For this application, the estimates of take for harbor porpoise, western DPS of Steller sea lions, humpback whales and killer whales have been rounded up to one.

TABLE 6-9. ESTIMATED LEVEL B EXPOSURES AS A PERCENTAGE OF ABUNDANCE

Species	Calculated Level B Take Estimate	Stock or DPS Abundance[1]	Take Estimate (% of Abundance)
Cook Inlet DPS of Beluga Whale	29	328	8.8
Harbor Seal	11	27,386	<0.01
Harbor Porpoise	1	31,046	0
Steller Sea Lion western DPS	1	49,497	0
Humpback Whale HI DPS	1	10,252	0
Killer Whale	1	resident 1,475 transient 587	0 0

[1]From Table 3-1.

6.3.4. Level B Take Requests

Table 6-10 summarizes the number of requested Level A and B takes for each species. Takes have been requested based on the maximum number of potential exposures of marine mammals to noise levels that exceed thresholds for Level B take that could occur at any time throughout the duration of the pipeline installation based on worst-case scenario.

TABLE 6-10. LEVEL A AND LEVEL B TAKE REQUESTS

Species	Level A Take Request	Level B Take Request
Cook Inlet DPS of Beluga Whale	0	29
Harbor Seal	0	11
Harbor Porpoise	0	1
Steller Sea Lion (western DPS)	0	1
Humpback Whale (Hawaii DPS)	0	3[1]
Killer Whale	0	5[2]

[1]Based on one exposure to a group size of three.
[2]Based on one exposure to a group size of five individuals.

The estimated 29 Level B takes for beluga whales represents 8.8 percent of the DPS abundance (Table 6-9). The projected Level B takes of all other marine mammal species are considered negligible; are significantly less than 1 percent of the best estimate of abundance for each stock or DPS and most are at percentages approaching zero.

The number of takes for Steller sea lions is based, in part, on animals observed during surveys in the middle to lower Cook Inlet (HDR 2015). Steller sea lions are infrequent to rare in upper Cook Inlet and it is not anticipated that individual sea lions would be exposed to noise levels exceeding behavioral thresholds as a result of this Project. These estimates of exposure that could exceed the Level B take threshold are unmitigated and considered precautionary.

As shown in Table 6-10, additional Level B takes for humpback whales and killer whales are requested over the estimated number of exposures shown in Table 6-8. This is necessary to accommodate average group sizes that could be encountered. While only one humpback whale sighting might occur during the Project, it could be a female-calf pair and a companion humpback whale as were observed in 2014, so a potential group size of three is considered. Similarly, killer whales rarely travel solo and are often observed in groups of four to five individuals. Therefore, the request would accommodate a small group of animals entering the Action Area. These estimates present the worst-case of encountering whales in the Project Area during pipeline installation.

7. ANTICIPATED IMPACT OF THE ACTIVITY ON SPECIES AND STOCKS

Harvest is requesting authorization for Level B takes by acoustical harassment of marine mammals. Any incidental take would likely be multiple takes of the same individual, rather than single takes of different individuals. The estimates of take as percentage of stock abundance shown in Table 6-9 assume takes of individual animals, do not differentiate repeated takes of the same animal, and are based on the loudest noise sources within each component (tugs) for the maximum duration. Therefore, the estimates of take as a percentage of abundance shown in Table 6-9 are very conservative. The take requests shown in Table 6-10 are considered small relative to stock or DPS size, and negligible because they are not expected to adversely affect the species' or stocks' annual rates of recruitment or survival.

7.1. Hearing Impairment and Non-auditory Injury

For this Project, temporary hearing impairment or threshold shifts (TTS) could occur if marine mammals are exposed to noise levels over a prolonged period. Hearing sensitivity is affected by prolonged exposure to sounds that exceed behavioral thresholds (NMFS 2016b), even though the levels are not considered injurious.

NMFS revised acoustic guidelines (2016b), take into account the most recent scientific data on TTS (NMFS 2014). Hearing impairment and non-auditory physical effects (e.g., stress) might occur in marine mammals exposed to strong, pulsed underwater sounds. However, the limited data available from captive marine mammals do not provide definitive evidence that any of these effects occur, even for marine mammals in close proximity to sound sources. No studies have determined levels that cause PTS in beluga whales. Laboratory experiments on captive beluga whales investigating TTS onset have been conducted for both pulsed and non-pulsed sounds (Finneran *et al.* 2002; Schlundt *et al.* 2000). These studies found TTS masking in some cases and the TTS effect gradually increased with prolonged exposures ranging from 1 to 30 minutes. However, these studies considered intense noise from seismic guns and simulated explosions, and are not applicable to the engine noise expected from this Project.

Harvest does not expect PTS levels to be reached and Level A takes are not being requested. Level B behavioral disturbance would be reduced by mitigation measures proposed in Section 11. Given the brief duration of exposure of any marine mammal, in combination with the proposed monitoring and mitigation measures, auditory impairment or other non-auditory physical effects are unlikely to occur during the proposed Project.

7.2. Masking

Increased levels of natural and artificial sounds can disrupt behavior by masking. The masking of communication signals by anthropogenic noise may reduce the communication space of animals (Clark *et al.* 2009). The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Erbe *et al.* (2016) reviewed the current understanding of masking in marine mammals, including anti-masking strategies for both receivers and senders. When a signal and noise are received from different directions, a receiver with directional hearing can reduce the masking impact. This is known as spatial release from masking, an ability that has been found in dolphins, killer whales and harbor seals. Given the hearing abilities of marine mammals, it is likely that most, if not all, species have this ability to some extent.

The detectability of a signal amidst noise may also be affected by the temporal and spectral properties of the signal. Cunningham *et al.* (2014) conducted masking experiments where the signals were complex, including frequency and amplitude modulation as well as the presence of harmonics, parameters that are typical for natural animal signals. The ability of the receivers to detect complex signals was far better than predicted using simple energetic masking predictions, likely because of the complex structure of the signal.

Animals may attempt to counteract masking by increasing the source level of their vocalizations in the presence of noise. The ADFG Cook Inlet Beluga Acoustics research program in Cook Inlet, Alaska, collected recordings from July 2008 to May 2013 to describe anthropogenic sources of underwater noise, acoustic characteristics, and frequency of occurrence as well as evaluate the potential for acoustic impact to Cook Inlet belugas (Castellote *et al.* 2016). Based on received levels and spatial and temporal prevalence Castellote *et al.* (2016) suggested that anthropogenic noise in Cook Inlet has the potential to mask beluga communication and hearing in most of the locations and periods sampled during their study. They further suggested that the potential communication and echolocation range reduction for Cook Inlet belugas by anthropogenic noise is considerable. Anthropogenic noise was present in every single day sampled. However, there was strong variability in source diversity, loudness, distribution, and seasonal occurrence of noise, which reflects the many different activities within the Inlet. Anthropogenic sources of noise were detected in excess of 120 dB rms in many occasions, locations and months. Based on received levels and spatial and temporal prevalence, anthropogenic noise in Cook Inlet has the potential to mask beluga communication and hearing in most of the locations and periods sampled (Castellote *et al.* 2016).

Blackwell (2005) and URS (2008) reported that background noise at the Port of Anchorage (physical environment and maritime operations) contributed more to received levels than did pile driving at distances greater than 1,300 m (4,900 ft) from the source. Castellote *et al.* (2016) results further indicated that noise from commercial ships was widespread and at elevated levels (i.e., above heavy traffic noise reported by Richardson *et al.* (1995) and above Level B thresholds), indicating such noise may have a negative effect on beluga communication. They suggested their results are sufficient to highlight the potential for masking beluga communication at a wide temporal and spatial scale within their critical habitat. Due to activities at the Port of Anchorage, Cairn Point was the location where commercial ship noise events were most concentrated (in terms of level and duration), with highest levels in August. Blackwell (2005) further suggested beluga whales and other marine mammals in the Port of Anchorage area have likely become habituated to increased noise levels in Cook Inlet.

Masking from vessel noise generated during this Project could possibly rise to Level B harassment under the MMPA. However, these events would occur concurrently with existing background noise throughout the Action Area because of existing vessel traffic. Any sounds from the Project that could result in masking have already been taken into account in the exposure analysis and take calculations. However, in order for the effects of masking to occur, a whale would have to be within close proximity to the specific sound source to result in a Level B impact. The probability that the noise producing activities associated with the proposed Project would result in masking acoustic signals important to the behavior and survival of marine mammal species in the Action Area is low.

7.3. Disturbance Reactions

The takes from Level B harassment would likely be due to potential behavioral disturbance. Temporary short-term changes in an animal's typical behavior or avoidance of the affected area is the most common response of marine mammals to increased noise levels (Richardson *et al.* 1995). Elevated noise levels could potentially displace marine mammals from the immediate proximity of the sound source. Due to the distance from the Action Area, this would be unlikely for beluga whales that are foraging at the mouths of streams in Critical Habitat Area 1. The most probable scenario is that beluga whales may be exposed to increased noise thresholds as they move from one area or river to another following predictable runs of forage fish.

Injury is not expected for any species given distances at which noise from the Project exceeds PTS threshold levels, considering the small ensonified areas described in Section 6. Other potential effects might be an increased swimming speed or increased surfacing time. Most individuals would simply move through or away from the sound source and be temporarily displaced from the area. Repeated exposures of individuals to levels of sound that may cause Level B harassment would be unlikely to result in hearing impairment or to significantly disrupt foraging behavior.

Elevated noise levels could potentially displace marine mammals from the immediate proximity of the sound source. However, marine mammals will likely return as demonstrated by a variety of studies regarding temporary displacement of marine mammals by industrial activity. There is evidence that beluga whales remain in upper Cook Inlet and are not displaced by industrial activity (reviewed in Richardson *et al.* 1995). Beluga whales in Cook Inlet have continued to utilize the habitat in the vicinity of the Port of Anchorage and Knik Arm despite disturbance from maritime operations, maintenance dredging, and aircraft on a daily basis (HDR 2015; Castellote *et al.* 2016). Although the Port of Anchorage area is highly industrialized and supports a large amount of ship traffic, beluga whales are present nearby almost year-round. Despite increased shipping traffic and upkeep operations (e.g., dredging) beluga whales continue to utilize waters within and surrounding the Port of Anchorage where there is frequent tug and cargo ship traffic (Markowitz and McGuire 2007; NMFS 2008a; HDR 2015). Although there could be some behavioral disturbance from vessel traffic, it is apparent that this area is critical for beluga foraging efforts and calving activities from which they are not displaced.

7.4. Small Numbers Consideration

Table 6-8 presents the number of animals potentially exposed to elevated noise levels from the Project that could result in a Level B take by harassment. The 29 estimated Level B takes for beluga whales represents 8.8 percent of the DPS abundance (Table 6-9). This estimate is consistent with Apache's estimate of Level B takes in upper Cook Inlet (21.5) calculated for their seismic surveys (ASRC 2013). For the Apache authorization, NMFS determined that a total of 30 beluga whales could potentially be taken by Level B harassment during the seismic surveys and still be consistent with small number requirements (Table 2 in ASRC 2013). The projected Level B takes of all other marine mammal species are all less than 1% of the best estimate of abundance for each stock or DPS, with most approaching zero.

The numbers of animals authorized to be taken for all species is considered ‘small’ pursuant to NMFS guidance. Further, unmitigated potential take at these levels would not have any effect on populations, population recruitment or survival, and the effect of such take would be considered insignificant. With mitigation as described in Chapter 11, potential impacts or takes should be further reduced from these levels.

7.5. Negligible Impact Consideration

Negligible impact is “an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival”[33]. A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level A or Level B harassment takes alone is generally not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be “taken” through behavioral harassment, other factors were considered including: the nature of responses (intensity and duration); the context of responses (critical reproductive time or location, migration, etc.); number and nature of estimated Level A takes; number of estimated mortalities; effects on habitat; and the status of the species. These considerations apply to the six species listed in Table 3-1.

Most of the noise produced in this Project is from vessel activity along the pipeline corridor. Several of the activities associated with the proposed Project have the potential to temporarily disturb or displace marine mammals. The specified activities may result in Level B harassment (behavioral disturbance) from underwater noise generated from movements of different classes and sizes of vessels. Potential exposures could occur if individuals of these species are present in the ensonified areas when Project activities are underway.

7.6. Conclusions Regarding Impacts to Species, DPSs or Stocks

Individual marine mammals may be exposed to elevated noise levels during this Project that may result in Level B harassment. Any marine mammals that are taken (i.e., harassed) may change their normal behavior patterns such as swimming speed, foraging habits, etc., or be temporarily displaced from the area. However, any exposures would likely have only a minor effect on individuals due to the short-term, temporary nature of the Project. No effects on harbor seals, Steller sea lions, killer whales, humpback whales or harbor porpoise populations are anticipated from increased noise levels due to vessel traffic from this Project. However, the Action Area occurs within designated critical habitat for beluga whales; therefore, elevated noise levels from the Project may affect but would not likely adversely affect beluga whales. Implementation of mitigation measures proposed in Chapter 11 is likely to avoid most potential adverse impacts to marine mammals from underwater noise producing activities along the pipeline corridor.

In summary, the takes requested for this activity would result in no more than a negligible impact to harbor seals, Steller sea lions, humpback whales, killer whales or harbor porpoise during this Project. Beluga whales may be affected but the impact is not likely to adversely affect this DPS by reducing survival or reproduction. This is based on: 1) no Level A takes and minimized Level B effects to the

[33] Definition at 50 CFR 216.103

extent possible; 2) the near-zero likelihood of serious injury or mortality to species; and 3) the anticipated incidents of Level B harassment likely consisting of, at worst, temporary modifications in behavior. Further, the results of recent studies at the Port of Anchorage suggest that marine mammals that occupy the highly ensonified waters of upper Cook Inlet, especially beluga whales, have continued to utilize habitat in the vicinity despite it being heavily disturbed from maritime operations, maintenance dredging, and aircraft (HDR 2015). Despite the upper Inlet being a highly-industrialized area supporting a large amount of ship traffic, beluga whales are present almost year-round and continue to utilize waters within and surrounding the Port of Anchorage area (Markowitz and McGuire 2007; NMFS 2008a; HDR 2015). Therefore, the specified activities at the pipeline corridor are not expected to impact rates of recruitment or survival and would therefore not result in population-level impacts.

8. ANTICIPATED IMPACTS ON SUBSISTENCE USE

The villages of Tyonek, Ninilchik, Anchor Point, and Kenai use the upper Cook Inlet area for subsistence activities (HDR 2015). These villages regularly harvest harbor seals (Wolfe *et al.* 2009). Based on subsistence harvest data, Kenai hunters harvested an about 13 harbor seals on average per year, between 1992 and 2008, while Tyonek hunters only harvested about 1 seal per year (Wolfe *et al.* 2009). Traditionally Tyonek hunters harvest seals at the Susitna River mouth, incidental to salmon netting, or during boat-based moose hunting trips (Fall *et al.* 1984). Alaska Natives are permitted to harvest Steller ever though they are listed under the ESA. Steller sea lions are rare in mid- and upper Cook Inlet, as is reflected in the subsistence harvest data. For example, between 1992 and 2008, Kenai hunters reported only two sea lions harvested and none were reported by Tyonek hunters (Wolfe *et al.* 2008). Sea lions are more common in lower Cook Inlet and are regularly harvested by villages south of the proposed Project Area, such as Seldovia, Port Graham, and Nanwalek (HDR 2015).

Cook Inlet beluga subsistence harvest has been placed under a series of moratoriums beginning 1999, due to severe harvest pressure in the mid-1990s, when annual removals of 10 to 15 percent of the population were common (Mahoney and Shelden 2000). Only five beluga whales have been harvested since 1999, but the population has continued to decline (Hobbs *et al.* 2008, Allen and Angliss 2014). Future subsistence harvests are not planned until after the 5-year population average has grown to at least 350 whales. Based on the most recent population estimates, no beluga harvest will be authorized in 2018.

Harvest's planned pipeline construction activities would not impact the availability of harbor seals or Steller sea lions for subsistence harvest in Cook Inlet. Harbor seals are generally harvested at nearshore areas but not likely near the Project Area. Steller sea lions are not an important subsistence resource in the Project Area due to naturally low numbers. The impact of Project activities is unlikely to affect either harbor seal or sea lion populations sufficient to render them unavailable for subsistence harvest in the future. Beluga subsistence harvest is currently under moratorium.

9. ANTICIPATED IMPACT ON HABITAT

Construction activity primarily along the pipeline corridor could generate temporary impacts on marine mammal habitat due to increased in-water sound pressure levels. Other potential temporary impacts on habitat include changes in water quality (increases in turbidity levels) and disturbance to prey species.

9.1. Underwater Noise Disturbance

There are several short-term effects from exposure to Project noises that may occur to marine mammals, including potential effects on movements of prey resulting in energetic expenditures, and TTS shifts due to noise (Southall *et al.* 2007). Effects of increased noise levels have been addressed in Section 7.

9.2. Water and Sediment Quality

Short-term turbidity increases could likely occur during in-water pipe laying construction work. The physical suspension of sediments could produce localized turbidity plumes that could last from a few minutes to several hours. Considering local currents and tidal action, any suspension of sediments would likely be temporary and highly localized. The local tides and currents would disperse suspended sediments at a moderate to rapid rate depending on tidal stage.

Contaminated sediments are not expected at the Project site; hydrocarbon concentrations in Cook Inlet sediments are comparable to values reported for background hydrocarbons in Alaska offshore coastal waters, and studies have found no evidence of heavy metal pollution in lower Cook Inlet (BOEM 2116). Because of the relatively small work area along a narrow corridor, any increase in turbidity would be limited to the immediate vicinity of the Project site. Therefore, exposure to re-suspended contaminants is expected to be negligible.

Water quality impacts due to pipeline leaks would be minimized by standard leak protection and detection procedures. As described in Section 1.3.8, USDOT-regulated COTPs are regulated for leak detection through the ODPCPs. Pipeline cathodic protection, monitoring and leak detection procedures are also described in Section 1.3.8

9.3. Passage Obstructions

The project would not obstruct movements of marine mammals (see Section 10, PCE #4).

9.4. Construction Effects on Potential Prey

Construction activities would produce continuous sounds. Fish react to sounds that are especially loud or are intermittent, low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Popper (2003) found that the process of hearing across fishes is quite variable, ranging from species that only hear up to 100 or 200 Hz to others that hear well over 180 kHz. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of noise on fish, although several are based on studies in support of large, multiyear construction projects (Scholik and Yan 2001, 2002; Popper and Hastings 2009).

Generally, the most likely impact to fish from vessel noise activities in the Project Area would be temporary behavioral avoidance of the area. However, there are no salmon spawning streams in the immediate vicinity of the pipeline corridor. No impacts to marine mammal prey species are expected from this Project.

Increased turbidity could occur along the pipeline corridor, or down-current from it. Suspended sediments and particulates would dissipate quickly within a single tidal cycle. Given the limited area affected, existing high levels of background turbidity, and high tidal dilution rates, any effects on fish due to increased turbidity would be negligible to minor.

9.5. Conclusions Regarding Impacts on Habitat

The greatest impact on marine mammals associated with the proposed Project would be a temporary loss of habitat because of elevated noise levels. Displacement of marine mammals by noise would not be permanent. The proposed activities would not result in a significant adverse or permanent loss or modification of habitat for marine mammals or their prey. The most likely effects on marine mammal habitat due to the proposed Project would be temporary, short duration in-water noise, temporary prey (fish) disturbance, and localized, temporary water quality effects. Because of the relatively small area of the habitat that may be affected, the impacts to marine mammal habitat would not be expected to cause significant or long-term negative consequences. Additionally, no physical damage to habitat is anticipated as a result of Project activities within the Action Area. Therefore, the potential impacts to marine mammal habitat are expected to be negligible.

The Project is not anticipated to result in adverse modification or result in harm to any PCEs identified as critical habitat for beluga whales in Cook Inlet (see Section 10).

10. ANTICIPATED IMPACT OF LOSS OR MODIFICATION OF MARINE MAMMAL HABITAT

The pipeline project occurs in Critical Habitat Area 2 (wintering habitat) for Cook Inlet beluga whales. The following is a summary of the potential effects of the Project on each of the five critical habitat PCEs:

- PCE #1 (Intertidal and Subtidal Waters of Cook Inlet): The pipeline corridor extends from onshore/intertidal waters to the Tyonek Platform located within Cook Inlet waters. The amount of time construction activities would occur in waters less than 30 ft (9 m) deep would be 4 to 6 weeks. During this period, the primary impact to marine mammals including beluga whales would be from disturbed sediment along the immediate Project pipeline corridor. Suspended sediments would be transported and re-deposited downstream of the pipe. The majority of material is expected to be re-deposited quickly near the pipeline site; therefore, impacts would be localized. The turbidity resulting from construction activities is expected to be short-term, localized, and would be masked by the level of ambient suspended sediment in the water column (see Section 4.2). Therefore, it is not expected that any of these impacts would be measureable or result in a loss of habitat available to marine mammals or prey species. Also, the corridor does not occur within 8 km (5 miles) of a major 'high and medium flow anadromous fish stream' highlighted in Critical Habitat Area 1. Therefore, the Project would not have any adverse impacts on critical habitat PCE # 1.
- PCE # 2 (Primary Prey Species): Fish are a primary dietary component of Cook Inlet beluga whales and are considered a PCE of critical habitat. Fish can be physiologically and behaviorally affected by noise. However, the Project would not generate underwater sound at levels at or exceeding the NMFS threshold criteria for injury to fish. Therefore, the Project should not result in harm or injury to fish (Popper *et al*. 2004).
- PCE # 3 (Waters Free of Toxins): The Project would not result in the introduction of harmful toxins to Cook Inlet that could result in harm to beluga whales or their prey. The Project would comply with all state and federal regulatory requirements and safety procedures to minimize potential releases (i.e., fuel spills); therefore, it is not expected that there would be any adverse impacts on marine mammals, prey species, or habitat.
- PCE # 4 (Unrestricted Passage): The scale of the Project is very small compared to the overall size of Cook Inlet. All work would occur within a narrow corridor and vessels would move at slow speeds (estimated maximum pulling velocity is 20 ft (6 m) per minute. Project activities would not restrict passage of beluga whales or their prey species to major spawning streams, or on the ability of beluga whales to forage successfully on available salmonid prey.
- PCE #5: (In-water Noise) Noise source levels generated at the Project site would not exceed PTS threshold levels. However, behavioral harassment levels would be exceeded during short intervals depending on vessel activity (see Section 6).

While the proposed pipeline Project occurs entirely within waters designated as Critical Habitat Area 2, consideration of the proposed construction activities and the mitigation measures described in Section 11, there would not likely be permanent loss or long-term adverse modification of beluga critical habitat.

11. MITIGATION MEASURES

Harvest Alaska's activities are subject to federal, state and local permit regulations, and would employ the best guidance available (e.g., Best Management Practices and mitigation measures) to avoid and minimize (to the greatest extent practicable) impacts on the environment, ESA species, designated critical habitats and species protected under the MMPA. Potential mitigation measures include consideration of: 1) the degree to which the successful implementation of the measure is expected to minimize adverse impacts to marine mammals; 2) the proven efficacy of the specific measure to minimize adverse impacts as planned based on monitoring plans from previous, similar IHA applications; and 3) the practicability of the measure for implementation. Based on these factors, the mitigation measures being considered accomplish the following required objectives:

- Avoidance of PTS or Level A takes of marine mammals;
- Avoidance or minimization of adverse effects to marine mammal habitat paying particular attention to the prey base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during the biologically important winter foraging; and
- Monitoring directly related to mitigation—an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Mitigation measures typically used in industry programs include powering or shutting down activities if a marine mammal is in or approaching an established zone (based on distances to Level A criteria). A complete shutting down of activities during this Project may not be possible or practical at all times. The majority of the noise that would be generated is from vessel engines, which cannot always be easily stopped or shut down. Harvest would initiate a complete or partial shutdown if necessary due to close proximity of marine mammals. However, during pipe-pulling it is not safe to stop the process until the pipe is secured. Should a marine mammal be observed during pipe-pulling, it would be monitored and its behavior would be recorded until the pipe is secure. No new operational activities would be started until the animal leaves the area. All vessel engines would be placed in idle when not working. However, to maintain control of the vessel in the currents and tides of Cook Inlet, the engine cannot ever be completely shut-down. The noise impacts from a ship engine in idle should be minimal to non-existent. Finally, vessels would be secured to each other if practical (i.e., dive boat tied to barge) further minimizing noise-producing activities in the water.

11.1. Best Management Practices

Harvest would perform construction in accordance with the following BMPs to avoid and minimize (to the greatest extent possible) impacts on the environment, ESA species, designated critical habitats and species protected under the MMPA:

- All platforms (barges, workboats, Tyonek Platform) would be maintained in a manner that does not introduce any pollutants or debris into the water or cause a migration barrier for fish;
- Fuels, lubricants, and other hazardous substances would not be stored below the ordinary high water mark;
- All chemicals and petroleum products would be properly stored to prevent spills; and

- No petroleum products, cement, chemicals, or other deleterious materials would be allowed to enter surface waters.

11.2. Marine Mammal Monitoring

Marine mammal monitoring would be employed during all Project activities as described in more detail in the attached proposed Marine Mammal Monitoring and Mitigation Plan (4MP) (see Appendix A). Current NMFS guidelines recommend that noise-producing activities should be shut down prior to reaching the PTS threshold (NMFS 2016b). As described in Section 6.2, Level A takes are not anticipated because the estimated distances from the various sources to the PTS noise thresholds are exceedingly small (many within a few meters of the sound source; see Table 6-5).

Harvest recognizes that completely eliminating the potential for Level B takes by monitoring for individual animals that may enter the ensonified areas is unlikely. The estimated linear distance to behavioral threshold levels (from Table 6-6) occur out to 2,200 m (1.35 miles) for tug and dive boat activities. Due to safety concerns and tidal conditions in Cook Inlet, it will not always be possible to stop work in the event that a marine mammal is observed within the Level B Zone. PSOs placed on tug or vessel working within the pipeline corridor would be able to observe marine mammals in the Level B zone and record any observed marine mammals in that zone as a Level B take and note behavior. PSO protocols and requirements are described in Section 13.1 and Appendix A.

12. ARCTIC PLAN OF COOPERATION

This section is not applicable to this application. The proposed activity would take place in Cook Inlet in southcentral Alaska. Therefore, no activities would take place in or near a traditional Arctic subsistence hunting area. As stated in Section 8, based on the information provided in this application, the proposed activities at the Project site would have no impact on the abundance or availability of marine mammals to subsistence hunters in the region. Therefore, no further measures to reduce impacts to subsistence are being considered.

13. MONITORING AND REPORTING

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for incidental take authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that would result in increased knowledge of the species and the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed Action Area. This section briefly describes the proposed monitoring program during Project activities while additional detail is attached as Appendix A, Marine Mammal Monitoring and Mitigation Plan (4MP).

Harvest recognizes that monitoring requirements should be designed that improve the understanding of one or more of the following:

- Occurrence of marine mammal species in the Action Area (e.g., presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic) through better understanding of: 1) action or environment (e.g., source characterization, propagation, ambient noise); 2) affected species (e.g., life history, dive patterns); 3) co-occurrence of marine mammal species with the action; or 4) biological or behavioral context of exposure (e.g., age, calving or feeding areas);
- Individual responses to acute stressors or impacts of chronic exposures (behavioral or physiological);
- How anticipated responses to stressors impact either: 1) long-term fitness and survival of an individual; or 2) population, species, or stock;
- Effects on marine mammal habitat and resultant impacts to marine mammals; and
- Mitigation and monitoring effectiveness.

13.1. Visual Marine Mammal Observation

Harvest will collect marine mammal behavioral response and other observation data related to pipe laying procedures for species observed in the region of activity during the construction period. All PSOs will be trained in marine mammal identification and behaviors, and will not have other construction-related tasks while conducting monitoring.

Harvest will implement the following procedures during all Project components:

- Vessel-based NMFS-approved PSOs would monitor for marine mammals during vessel use during all daytime hours. Two PSOs would be stationed on one of the Project vessels, either one of the tugs or the barge. The exact vessel is not known at this time, as it will be selected based on bunk availability and bridge height to maximize viewing distance for marine mammal sightings;
- Any marine mammal documented within the Level B harassment zones shown in Table 6-6 would be considered a Level B take (harassment), and will be recorded and reported;

- When the vessel is positioned on-site, the PSO will 'clear' the area by observing the safety zone (2,200 m) for 30 minutes; if no marine mammals are observed within those 30 minutes, activities will commence.
- If a marine mammal(s) is observed within the safety zone during the clearing, the PSO will continue to watch until the animal(s) is gone and has not returned for 15 minutes if the sighting was a pinniped, or 30 minutes if it was a cetacean.
- Once the PSO has cleared the area, operations may commence.
- Should a marine mammal be observed during pipe-pulling, the PSO will monitor and carefully record any reactions observed until the pipe is secure. No new operational activities would be started until the animal leaves the area. PSOs will also collect behavioral information on marine mammals beyond the safety zone. All vessel engines would be placed in idle when not working. However, to maintain control of the vessel in the currents and tides of Cook Inlet, the engine cannot ever be completely shut-down.;
- PSOs would scan the waters using binoculars, spotting scopes, and unaided visual observation;
- PSOs would use a hand-held GPS or range-finder device to verify that no marine mammals were in the areas ensonified as a result of activities at the Project Area;
- If poor environmental conditions restrict the PSOs' ability to see within the marine mammal shutdown zone (e.g. excessive wind or fog, high Beaufort state), pipe pulling would cease, if possible and safe to do so;
- The waters would be scanned 15 minutes prior to commencing work at the beginning of each day, and prior to re-starting work after any stoppage of 30 minutes or greater. If marine mammals enter or were observed within the designated safety zone during or 15 minutes prior to work, the monitors would notify the on-site construction manager to not begin until the animal has moved outside the designated radius; and
- The waters would continue to be scanned for at least 30 minutes after activities have been completed each day, and after each stoppage of 30 minutes or greater.

13.2. Unmanned Aerial Surveys

Harvest plans to augment this PSO program with the use of an unmanned aerial system (UAS), pending final Federal Aviation Administration (FAA) approval. These UAS operations will be managed by Harvest and executed by a third-party contractor, not yet identified. The UAS programs currently being evaluated are fixed-wing UAS platforms, such as the ScanEagle, Puma, or Flexrotor and a remotely-operated tethered balloon, such as the Aerostat. Depending on FAA approval, these would be operated by either land-based or vessel-based pilots. All platforms would provide increased viewing distances for detection of marine mammals for monitoring and mitigation purposes.

The purpose of the UAS monitoring program is for PSOs to monitor the safety zone. There are three important operational time periods for monitoring:

1) "clearing" the safety zone prior to start of operations

2) continuous monitoring during operations to confirm the area remains “clear”
3) continuous monitoring during operations to record any marine mammals that may occur in the area and characterize behavioral responses of those animals

The UAS program is designed to detect marine mammals during each of these periods. The UAS program does not supplement the existing PSO program but rather, has been designed to be a stand-alone monitoring and mitigation program which may be used in lieu of an on-water mitigation vessel in the future. Additional detailed information on the proposed unmanned aerial surveys including methods, potential type of aircraft and other operational considerations are described in more detail in Appendix A.

13.3. Data Collection

Harvest will require that PSOs use approved data forms developed for this Project. Among other pieces of information, the PSOs will record detailed information about any marine mammals that may occur in the Action Area, including the distance of animals to work, description of specific actions that ensued and resulting behavior of the animal, if any. In addition, the PSOs will attempt to distinguish between the number of individual animals taken and the number of incidents of take. At a minimum, the following information will be collected on the observer forms:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (e.g., percent cover, visibility);
- Water conditions (e.g., sea state, tide state);
- Species, numbers and if possible, sex and age class of marine mammals;
- Description of any marine mammal behavior patterns, including bearing and direction of travel and distance from activity;
- Distance from activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (e.g., shutdown or delay);
- Locations of all marine mammal observations; and
- Other human activity in the area.

Appendix A provides additional information about data collection during Project mitigation and monitoring activities.

13.4. Reporting

A draft report will be submitted to NMFS within 90 days of the completion of marine mammal monitoring, or 60 days prior to the requested date of issuance of any future IHAs for projects at the same location, whichever comes first. The report would include marine mammal observations pre-activity, during-activity, and post-activity, and would also provide descriptions of any behavioral responses to construction activities by marine mammals. It would include a complete description of any delays in Project work due to presence of marine mammals and an extrapolated total take estimate based on the number of marine mammals observed (if any) during construction. A final report would be submitted within 30 days following resolution of comments on the draft report. Immediate reports would be submitted to NMFS if 20 belugas are detected in the Action Area (cumulatively over the course of the Project) to evaluate and make necessary adjustments to monitoring and mitigation plans.

Should the Project clearly cause the take of a marine mammal in a manner prohibited by the IHA, such as serious injury or mortality (e.g., ship-strike), the PSO would immediately order the Project operator to cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS. The report would include:

- Time, date, and location (latitude/longitude) of the incident;
- Name and type of vessel involved;
- Vessel speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with the PSOs to determine actions necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The PSOs would not be able to resume activities until notified by NMFS via letter, email, or telephone.

In the event that the PSO discovers an injured or dead marine mammal, the cause of the injury or death is unknown, and the death is relatively recent (i.e., in less than a moderate state of decomposition), the PSO would immediately report the incident to the NMFS Chief of the Permits and Conservation Division, Office of Protected Resources in Silver Spring, Maryland and the Alaska Stranding Coordinator in Juneau, Alaska.

The report would include the same information identified in the paragraph above. Activities would be allowed to continue while NMFS reviews the circumstances of the incident. NMFS would work with the PSO to determine whether modifications in the activities are appropriate.

In the event that the PSO discovers an injured or dead marine mammal, and the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the PSO would report the incident to the NMFS Chief of the Permits and Conservation Division, Office of Protected Resources or by email to the Alaska Stranding Coordinator within 24 hours of the discovery. The PSO would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

14. SUGGESTED MEANS OF COORDINATION

Harvest would continue to cooperate with NMFS, other appropriate federal agencies, and the State of Alaska throughout all phases of the Project.

In addition, Harvest would cooperate with other marine mammal monitoring and research programs taking place in Cook Inlet to coordinate research opportunities when feasible, and would also assess mitigation measures that can be implemented to eliminate or minimize any impacts from these activities. Harvest would make available its field data and behavioral observations on marine mammals that occur in the Project area during construction activities.

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APPENDIX A

CIPL EXTENSION PROJECT

MARINE MAMMAL MONITORING AND MITIGATION PLAN

JANUARY 26, 2018

MARIME MAMMAL MONITORING AND MITIGATION PLAN

Harvest will implement a robust Marine Mammal Monitoring and Mitigation Plan (4MP) for these activities. This Plan includes only vessel-based observations by experienced Protected Species Observers (PSOs).

The objectives of the 4MP include:

- Establish real-time mitigation procedures as required by the IHA.
- Collect information needed to estimate the number of exposures of marine mammals to sound levels that may result in harassment, which must be reported to NMFS.
- Collect data on occurrence and activities of marine mammals in the area and timing of the Project activities.
- Provide an opportunity to collect information on behavioral responses of marine mammals to vessels.
- Provide a communication channel to coastal communities.

1. Vessel-Based Monitoring

Vessel-based NMFS-approved PSOs will monitor for marine mammals during vessel use during all daytime hours. Vessel-based marine mammal monitoring and mitigation methods were designed to meet the requirements and objectives specified in the IHA. Two PSOs will be stationed on one of the project vessels, either one of the tugs or the barge. The exact vessel is not known at this time, as it will be selected based on bunk availability and bridge height to maximize viewing distance for marine mammal sightings.

The main purposes of PSOs aboard the vessel are to conduct visual watches for marine mammals to serve as the basis for implementation of mitigation measures, document numbers of marine mammals present, record any reactions of marine mammals to project-related activities, and identify whether there was any possible effect on accessibility of marine mammals to subsistence hunters in Cook Inlet. These observations will provide the real-time data needed to implement some of the key measures.

For this program, it is not feasible to implement a power down or shut down procedure because once the activity has started, stopping or even slowing the process could have major safety consequences. Accordingly, once the activity is started, we will not be able to stop operations if a marine mammal enters the zone. The PSOs will observe for marine mammals out to the horizon; detectability will depend on environmental conditions, height on vessel, distance of the marine mammal, and species.

PSOs will monitor as long as daylight conditions allow which varies throughout the season.

2. Mitigation Measures

2.1 Shut Down Procedures

Mitigation measures typically used in industry programs include powering or shutting down activities if a marine mammal is in or approaching an established zone (based on distances to Level A criteria). Harvest proposes the following mitigation and monitoring scenarios prior to and during activities to reduce potential exposures of sound on marine mammals.

- When the vessel is positioned on-site, the PSO will 'clear' the area by observing the safety zone (2,200 m) for 30 minutes; if no marine mammals are observed within those 30 minutes, activities will commence.
- If a marine mammal(s) is observed within the safety zone during the clearing, the PSO will continue to watch until the animal(s) is gone and has not returned for 15 minutes if the sighting was a pinniped, or 30 minutes if it was a cetacean.
- Once the PSO has cleared the area, operations may commence.
- Should a marine mammal be observed during pipe-pulling, the PSO will monitor and carefully record any reactions observed until the pipe is secure. No new operational activities would be started until the animal leaves the area. PSOs will also collect behavioral information on marine mammals beyond the safety zone. All vessel engines would be placed in idle when not working. However, to maintain control of the vessel in the currents and tides of Cook Inlet, the engine cannot ever be completely shut-down.

2.2 Speed or Course Alteration

If a marine mammal is detected outside the safety zone for activities and, based on its position and the relative motion, is likely to enter those zones, the vessel's speed and/or direct course may, when practical and safe, be changed. The marine mammal activities and movements relative to the vessels will be closely monitored to ensure that the marine mammal does not approach within either zone.

3. Monitoring Methodology

One of the vessels will be staffed with two PSOs. PSOs will be on watch during all daylight periods. The observer(s) will watch for marine mammals from the best available vantage point on vessel. Ideally this vantage point is an elevated stable platform from which the PSO has an unobstructed 360° view of the water. The PSOs will scan systematically with the naked eye and 7 x 50 reticle binoculars. When a mammal sighting is made, the following information about the sighting will be carefully and accurately recorded:

- Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the PSO, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace.
- Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare.
- The positions of other vessel(s) in the vicinity of the PSO location.
- The vessel's position, speed, water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

Distances to nearby marine mammals will be estimated with binoculars (Fujinon 7x50 binoculars) containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Personnel on the bridge will also assist the PSOs in watching for marine mammals. PSOs are instructed to identify animals as unknown when appropriate rather than strive to identify an animal when there is significant uncertainty. Harvest also will ask that the PSOs provide any sightings cues they used and any distinguishable features of the animal even if they are not able to identify the animal and record it as unidentified. Emphasis is also placed on recording what was not seen, such as dorsal features. In addition to routine PSO duties, observers will be encouraged to record comments about their observations into the "comment" field in the database. Copies of these records will be available to the observers for reference if they wish to prepare a statement about their observations. If prepared, this statement would be included in the 90-day reports documenting the monitoring work. Throughout the program, the PSOs will prepare daily, weekly, and monthly reports as required summarizing the recent results of the monitoring program. The reports will summarize the species and numbers of marine mammals sighted. These reports will be provided to agencies as required and/or requested.

An electronic database will be used to record and collate data obtained from visual observations. The PSOs will enter the data into the data entry program installed on field laptops. The program automates the data entry process, reduces data entry errors, and maximizes PSO time spent looking at the water. PSOs also have voice recorders available to them that will allow PSOs to maximize time spent focused on the water. Quality control of the data will be facilitated by; (1) the start-of-season training session, (2) subsequent supervision by the onboard field crew leader, and (3) ongoing data checks during the field season. The data will be sent from the vessel to Anchorage regularly, and backed up regularly onto storage devices on the vessel.

3.1. Protected Species Observers

Vessel-based monitoring for marine mammals will be conducted by trained PSOs on vessels throughout the program to comply with mitigations contained in the IHA. The observers will monitor the occurrence and behavior of marine mammals near the project vessels during all daylight periods during the program, and during most periods when activities are not being conducted. PSO duties will include watching for and identifying marine mammals; recording their numbers, distances, and reactions to the activities; and documenting exposures to sound levels that may constitute harassment as defined by NMFS.

3.1.1. Number of Observers

A sufficient number of PSOs will be onboard to meet the following criteria

- 100 percent monitoring coverage during all periods of operations in daylight.
- Maximum of four consecutive hours on watch per PSO.
- Maximum of approximately 12 hours on watch per day per PSO.

3.1.2. Crew Rotation

Harvest anticipates that there will be provisions for crew rotation at least every three to six weeks to avoid observer fatigue. During crew rotations detailed notes will be provided to the incoming crew leader. Other communications such as email, fax, and/or phone communication between the current and oncoming crew leaders during each rotation will also occur when necessary. In the event of an unexpected crew change Harvest will facilitate such communications to ensure monitoring consistency among shifts.

3.1.3. Observer Qualifications and Training

Crew leaders serving as PSOs will have experience from one or more projects with operators in Alaska and Cook Inlet. Biologist-observers will have previous PSO experience, and crew leaders will be highly experienced with previous vessel-based marine mammal monitoring projects. All PSOs will be trained and familiar with the marine mammals of the area. A PSO handbook, adapted for the specifics of the planned program will be prepared and distributed beforehand to all PSOs. All observers will also complete a training session on marine mammal monitoring, to be conducted shortly before the anticipated start of the season. The training sessions will be conducted by marine mammalogists with extensive crew leader experience from previous vessel-based monitoring programs in Alaska.

Primary objectives of the training include:

- Review of the 4MP for this project, including any amendments adopted, or specified by the IHA.
- Review of marine mammal sighting, identification, (photographs and videos) and distance estimation methods, including any amendments specified by the IHA.
- Review operation of specialized equipment (e.g., reticle binoculars, big eye binoculars, night vision devices, Global Positioning System [GPS]).
- Review of data recording and data entry systems, including procedures for recording data on mammal sightings, exploration drilling and monitoring activities, environmental conditions, and entry error control. These procedures will be implemented through use of a customized computer database and laptop computers.

3.1.4. PSO Handbook

A PSO Handbook will be prepared for Harvest monitoring program. The Handbook will contain maps, illustrations, and photographs as well as copies of important documents and descriptive text and are intended to provide guidance and reference information to trained individuals who will participate as PSOs. The following topics will be covered in the PSO Handbook:

- Summary overview descriptions of the project, marine mammals and underwater sound energy, the 4MP, the IHA, and other regulations/permits/agencies.
- Monitoring and mitigation objectives and procedures, including disturbance zones.
- Responsibilities of staff and crew regarding the 4MP.
- Instructions for staff and crew regarding the 4MP.
- Data recording procedures: codes and coding instructions, common coding mistakes, electronic database; navigational, vessel data recording, field data sheet.
- Use of specialized field equipment (e.g., reticle binoculars, laser rangefinders).
- Reticle binocular distance scale.
- Table of wind speed, Beaufort wind force, and sea state codes.
- Data storage and backup procedures.
- List of species that might be encountered: identification, natural history.
- Safety precautions while onboard.
- Crew and/or personnel discord; conflict resolution among PSOs and crew.

- Drug and alcohol policy and testing.
- Scheduling of cruises and watches.
- Communications.
- List of field gear provided.
- Suggested list of personal items to pack.
- Suggested literature, or literature cited.
- Field reporting requirements and procedures.
- Copies of the authorizations/permits.

4. Unmanned Aerial Surveys

Harvest plans to augment this PSO program with the use of an unmanned aerial system (UAS), pending final Federal Aviation Administration (FAA) approval. These UAS operations will be managed by Harvest and executed by a third-party contractor, not yet identified. The UAS programs currently being evaluated are fixed-wing UAS platforms, such as the ScanEagle, Puma, or Flexrotor and a remotely-operated tethered balloon, such as the Aerostat. Depending on FAA approval, these would be operated by either land-based or vessel-based pilots. All platforms would provide increased viewing distances for detection of marine mammals for monitoring and mitigation purposes.

The purpose of the UAS monitoring program is for PSOs to monitor the safety zone. There are three important operational time periods for monitoring:

1) “clearing” the safety zone prior to start of operations
2) continuous monitoring during operations to confirm the area remains “clear”
3) continuous monitoring during operations to characterize behavioral responses of marine mammals.

The UAS program is designed to detect marine mammals during each of these periods. The UAS program does not supplement the existing PSO program but rather, has been designed to be a stand-alone monitoring and mitigation program which may be used in lieu of an on-water mitigation vessel in the future.

4.1 Monitoring Procedures

The UAS and/or balloon will be collecting continuous high-resolution video during all flight operations. The pilots (land- or vessel-based) will be monitoring the video feed in real-time for the presence of marine mammals. A station on the bridge for the lead PSO with real-time video feed from the UAS will be set up (i.e., computer, monitor, connectivity), if possible. If a suspected marine mammal is identified by the UAS/balloon operators, the UAS will be flown in a circle over the sighting to maintain a constant view of the marine mammal at greater than 1,500 ft above ground level (AGL). The pilots will notify the lead PSO who will verify the sighting and distance relative to the vessels. If the PSO determines it is not a marine mammal, the PSO will communicate with the pilots to continue surveying. If the PSO determines it is a marine mammal of concern, the PSO will instruct the pilot to maintain visual contact or to continue surveying.

If the UAS pilots are land-based, the pilots will contact the lead PSO via radio or phone. The video feed of the sighting will be streamed to the lead PSO via the bridge UAS viewing station, if possible. If the UAS pilots are vessel-based, the pilots will coordinate with the lead PSO on the same vessel. The video feed provides an instant replay through the laptop interface so the PSO can verify the sighting if the real-time feed no longer shows the animal.

Prior to starting the activity, PSOs must “clear” the safety zone by observing for 30 minutes; if no marine mammals are observed within those 30 minutes, the activities may commence. The UAS will support this activity by launching approximately 1 hour prior to the planned start of the clearing (which is 30 minutes prior to the planned start). The UAS will fly over the planned survey line and 2200 m past the end of the line to determine if any marine mammals are in this general vicinity. It is imperative that the UAS pilots coordinate with the lead PSO for planned start times and area to be surveyed.

The UAS will support this activity by flying a circular pattern throughout the safety zone as much as possible to detect beluga whales and other marine mammals.

4.2. UAS Operational Considerations

- The UAS must maintain an elevation to be specified in coordination with NMFS that will not result in disturbance of marine mammals.
- Launch and recovery must be coordinated with the Harvest PM and lead PSO.
- Pilots must coordinate with other airspace operators to avoid collisions. Coordination includes but is not limited to FAA and local airports.
- Harvest will provide a flight plan detailing operational procedures, permit stipulations, loss-link, recovery in the event of a failure or unplanned water landing, and other safety procedures.

4.3. UAS Descriptions

Below are the aircraft descriptions for two candidate UAS for this monitoring program.

4.3.1. ScanEagle

The ScanEagle is a capable platform, with a zero-length catapult launch and snag line recovery system and a payload of ~3 kilogram (kg), loaded weight <50 pounds (lb), 1 kiloWatt (kW) power, 60-80 knots cruise/dash range, and endurance of up to 24 hours, depending upon configuration and flight conditions.

Figure 1. Photo Of ScanEagle

TABLE 1. SPECIFICATIONS OF SCANEAGLE

Specification	Description
Type of UAS	Fixed wing
Dimensions	5.3 feet (ft) x 10.2 ft wide
Average altitude	3000-5000 ft AGL, payload dependent; NMFS recommends 1000 ft AGL to avoid disturbance
Battery size	N/A
Internal combustion engines	Liquid C10 Racing fuel (i.e., two-stroke mixed gas)
Range from launch	~18 hrs with no check in required
# Pilots	2 per flight
Launch method	Catapult launch and cable from crane recovery SuperWedge is 10ft high, 4ft wide, and 21ft long when deployed Land specifics: 100x100ft launch and recovery area recommended
Recovery method	It weighs 1,558lbs and has a minimum safety radius of 30 ft in operation. Recovery system - SkyHook is a modified Genie TZ-34/20 trailer and is 44ft11in tall, 11ft5in wide, and 37ft long when deployed. It weighs 3,540lbs and has a mandatory 75ft safety radius in operation. Land specifics: 100x100ft launch and recovery area recommended
Sensors	Video EO, midwave infrared (MWIR) with live stream
Ground control station specifications	Three 18” monitors, 2x transportable 3x3x4 shockproofed computer rack, 110v DC power, add 6ft wide directional antenna
PSO Data Viewing station	Laptop, monitors, video encoder (in addition to ground control station)

Scan Eagle Weather Limitations

1. Day Visual Flight Rules (VFR) in visual meteorological conditions (VMC)
2. Flight through visible moisture: ScanEagle can operate in light rain up to 30 minutes, operations may be restricted by Certificate of Authorization (COA).
3. Flight operations in icing conditions at assigned operational altitudes: ScanEagle- not allowed
4. Flight Pitch Altitude: ScanEagle - +/- 5 degrees
5. Flight Bank Angle: ScanEagle - +/- 20 degrees
6. Ambient Outside Air Temperature (OAT)
    a. Maximum OAT: ScanEagle - 130F
    b. Minimum OAT at Altitude: ScanEagle – No minimum
7. Wind.
    a. Ship launch wind over deck conditions:
        i. Wind over deck conditions shall be determined by shipboard wind measurement and indication system.
        ii. Max gusts for launch and recovery: 5 Kts (5.75 mph, 9.26 kph)
    b. Launches (including gusts):
        i. 20 Kts from ± 30° relative to the launcher centerline.
        ii. 35 Kts from ± 20° relative to the launcher centerline.
        iii. Launches with tailwinds: Not allowed
    c. Recoveries (including gusts):
        i. Port recoveries:
            1. 40 Kts from 320° to 350° relative to the ship centerline.
            2. 40 Kts from 320° to 330° relative to the ship centerline.
        ii. Starboard recoveries:
            1. 40 Kts from 10° to 40° relative to the ship centerline.
        iii. Recoveries with tailwinds: Not allowed
    d. Wind limitations during flight:
        i. Max winds (sustained plus gusts): 40 kts
        ii. Max gust component (gusts are considered any wind variations above the measured sustained value: No violent gust or shear conditions
    e. Flight Operations.
        i. For this operation only one ScanEagle can be airborne at any given time
    f. Open water operation: Limited to COA
    g. Over land operation: Limited to COA
    h. Operation with inoperative instruments and equipment: (dependent on safety of flight) possible, not recommended, unable.

4.3.2. Puma

Puma AE (AeroEnvironment) is a fully waterproof, small, UAS designed for land and maritime operations. Capable of landing in water or on land, the Puma AE empowers the operator with an operational flexibility never available in the small UAS class. The enhanced precision navigation system with secondary GPS provides greater positional accuracy and reliability of the Puma AE. AeroVironment's common ground control system allows the operator to control the aircraft manually or program it for GPS-based autonomous navigation.

FIGURE 2. PHOTO OF PUMA

TABLE 2. SPECIFICAIONS OF PUMA

Specification	Description
Type of UAS	Fixed wing
Dimensions	4.6 ft x 9.2 ft wide
Average altitude	200-400 ft AGL, payload dependent; 500ft AGL normal operating altitude
Battery size	Lithium Ion approximately 6” x 3” x 3” in size
Range from launch	2-4 hours; always within contact and monitoring in real-time; check-in would include battery change
Internal combustion engines	No
# Pilots	2 per flight
Launch method	Hand launch
Recovery method	Deep-stall auto-land (from water or on-deck)
Sensors	Video EO, midwave infrared (MWIR) with live stream
Ground control station specifications	Consists of a laptop, hand controller, Ground Data Terminal box with small antenna mast. 5x5ft area footprint
PSO Data Viewing station	Additional monitors and hand controllers may be used for video viewing.

Puma Weather Limitations

1. Day Visual Flight Rules (VFR) in visual meteorological conditions (VMC)
2. Flight through visible moisture: Yes; 1 inch/hr
3. Flight operations in icing conditions at assigned operational altitudes: No
4. Flight Pitch Altitude: Unknown
5. Flight Bank Angle: Unknown
6. Ambient OAT
    a. Maximum OAT: 120*F (49*C)
    b. Minimum OAT at Altitude: -20*F (-29*C)
7. Wind.
    a. Ship launch wind over deck conditions:
        i. Wind over deck conditions shall be determined by shipboard wind measurement and indication system.
        ii. Max gusts for launch and recovery: Unknown
    b. Launches (including gusts):
        i. Unknown; Is hand launched
        ii. Launches with tailwinds: Cannot launch with a tailwind.
    c. Recoveries (including gusts):
        i. Port recoveries:
            1. Unknown; will conduct a deep stall to belly land on the water
        ii. Starboard recoveries:
            1. Unknown; will conduct a deep stall to belly land on the water
        iii. Recoveries with tailwinds: Not recommended
    d. Wind limitations during flight:
        i. Max winds (sustained plus gusts): Unknown
        ii. Max gust component (gusts are considered any wind variations above the measured sustained value: Unknown
    e. Flight Operations.
        i. For this operation only one Puma can be airborne at any given time
    f. Open water operation: Limited to COA
    g. Over land operation: Limited to COA
    h. Operation with inoperative instruments and equipment: Dependent upon the inoperative equipment, but not recommended to not possible.

5. Reporting

The results of vessel-based monitoring, including estimates of exposure to key sound levels, will be presented in weekly, monthly, and 90-day reports. Reporting will address the requirements established by NMFS in the IHA. The technical report(s) will include:

- Summaries of monitoring effort: total hours, total distances, and distribution of marine mammals throughout the study period compared to sea state, and other factors affecting visibility and detectability of marine mammals;
- Analyses of the effects of various factors influencing detectability of marine mammals: sea state, number of observers, and fog/glare;

- Species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers, age/size/gender categories (when discernable), group sizes, and ice cover;
- Analyses of the effects of pipeline installation:
- Sighting rates of marine mammals during periods with and without installation activities (and other variables that could affect detectability),
- Initial sighting distances versus vessel location,
- Closest point of approach versus vessel location,
- Observed behaviors and types of movements versus vessel location,
- Numbers of sightings/individuals seen versus vessel location,
- Distribution around the vessels versus vessel location, and
- Estimates of "take by harassment".