Request for an Incidental Harassment Authorization

Under the Marine Mammal Protection Act

for the

Erickson Residence Marine Access Project

Juneau, Alaska

Revised June 2019

Submitted to:

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ACRONYMS AND ABBREVIATIONS

- ADEC Alaska Department of Environmental Conservation
- ADF&G Alaska Department of Fish and Game
- BMP best management practice
- D&H Docks and Harbors Department
- CM cubic meters
- CWA Clean Water Act
- CV coefficient of variation
- CY cubic yards
- dB decibel
- DPS distinct population segment
- EA each
- eDPS Eastern Distinct Population Segment
- ESCA Endangered Species Conservation Act
- ESA Endangered Species Act
- FR Federal Register
- HTL high tide line
- Hz hertz
- IHA Incidental Harassment Authorization
- mDPS Mexico Distinct Population Segment
- MHW mean high water
- MLLW mean lower low water
- MMMP Marine Mammal Monitoring Plan
- MMPA Marine Mammal Protection Act
- NMFS National Marine Fisheries Service
- NOAA National Oceanic and Atmospheric Administration
- PND PND Engineers, Inc.
- PTS permanent threshold shift
- RMS root mean square
- SEL Sound Exposure Level
- SEL_{CUM} Cumulative Sound Exposure Level
- SFT square feet
- SPAR Spill Protection and Response
- SPL sound pressure level
- SQM square meter
- SSL Steller Sea Lion
- TTS temporary threshold shift
- USACE United States Army Corps of Engineers
- USFWS United States Fish and Wildlife Service
- wDPS Western Distinct Population Segment
- WFA Weighting Factor Adjustment

1 Description of the Activity

1.1 Introduction

Jim Erickson is proposing to replace his private, deteriorated moorage facility within Auke Bay in Juneau, Alaska to provide a safer, more accessible and secure dock for the resident owner. The proposed project will occur in marine waters that support several marine mammal species. The Marine Mammal Protection Act of 1972 (MMPA) prohibits the taking of all marine mammals, which is defined as to "harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill," except under certain situations. Section 101(a)(5)(D) of the MMPA allows for the issuance of an Incidental Harassment Authorization (IHA), provided an activity results in negligible impacts to marine mammals and would not adversely affect subsistence use of these animals. The project may result in marine mammals protected under the MMPA being exposed to sound levels above allowable noise harassment or non-serious injury thresholds.

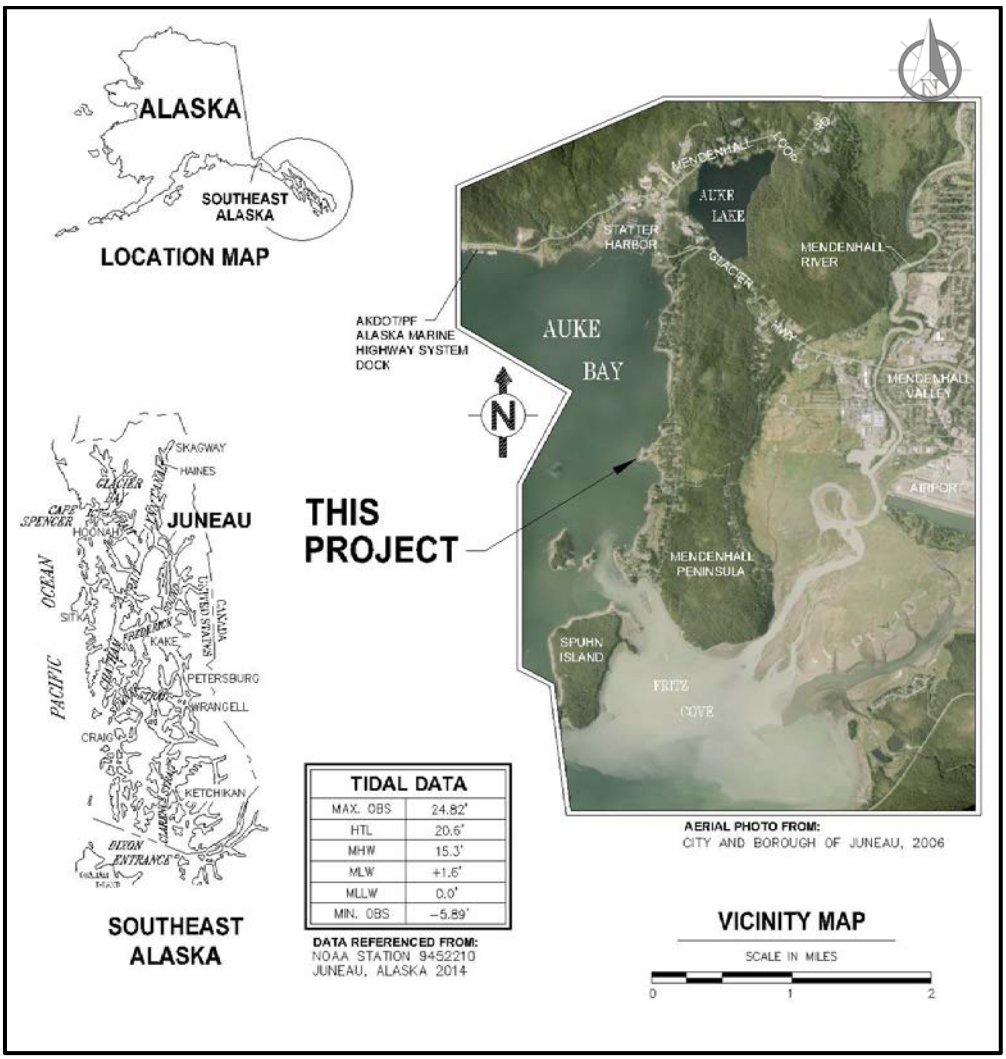

Figure 1. Vicinity Map

1.2 Project Purpose and Need

The purpose of the proposed Erickson Residence Marine Access project is to improve safety, security and accessibility for the owner. This can be achieved through replacing the old, deteriorated facility with a new, modern moorage facility.

1.3 Project Description

The Erickson Residence Marine Access project generally consists of demolishing an existing private moorage facility and replacing it with a new, modern facility consisting of a concrete retaining wall, an aluminum truss approach structure and steel gangway leading to a new timber moorage float equipped with utilities. Project quantities are listed in Table 1.

Demolition of the existing moorage facility will be performed with cranes, a barge, vibratory hammer (for pile removal), various hand tools and labor forces. Vibratory pile removal will generally consist of clamping the vibratory hammer to the pile and vibrating the hammer while extracting to a point where the pile is temporarily secured and removal can be completed with crane line rigging under tension. The pile is then completely removed from the water by hoisting with crane line rigging and placing on the uplands or deck of the barge.

Materials and equipment for the project will be transported by barge to the site, with the exception of concrete and fill materials, which will be transported over the highway. Concrete for the retaining wall will be poured in the dry when the site is dewatered. An anchor on each corner of the barge will be deployed for position control during pile driving/removal and overnight securing. The barge will be accompanied by a tug boat at all times. Removed materials will be secured alongside the barge, with the exception of the removed pilings which will be placed on the barge. After construction is complete, the demolition debris will be loaded on the barge and the Contractor will be required to dispose of demolished items in accordance with all federal, state, and local regulations.

It is anticipated that all pile driving will be done with a vibratory hammer, with a possibility of drilling due to a rock outcropping in the project vicinity. The vibratory hammer proposed is a High Pressure Systems Incorporated Model 200 with a rated energy of 2,000 in-lbs, 1,600 vibrations per minute and a hammer force of 73 tons. Pile driving will be conducted from a stationary barge platform, utilizing a drill if necessary to install rock sockets and a vibratory hammer to install piles. Impact hammers shall only be allowed for piles that encounter soils too dense to penetrate with the vibratory equipment. The floats will be unloaded from a barge and placed in the water. Vibratory pile driving equipment will be specified as the primary installation method for the project.

Should rock be encountered before the required penetration is achieved, drilling of rock sockets may be required for the two larger 20-inch (51-cm) float pilings as they require more embedment to reach the necessary capacity to withstand the high lateral loads on the float. No drilling is anticipated for the four 12.75-inch (32.5-cm) steel approach bearing piles. The existing wood pilings (to be removed) are sufficient indicators that vibratory driving in the intertidal zone above MLLW is practical and drilling will not be required for the 12.75-inch (32.5-cm) piles. Table 2 provides an overview of pile driving activities, sound source levels and calculated impact isopleths are discussed in detail in Section 5.

Table 1. Erickson Residence Marine Access Project Quantities

Construction Type	Project Component	Total Below HTL El. = 20.6 ft (6.3 m)
Demolition and Disposal	10' x 36' (3 m x 11 m) Timber Approach	360 SF (33.5 SM)
	30' (9.1 m) aluminum gangway	30 LF (9.1-meters)
	135' (41.1 m) of sectional hinged beach floats	135 LF (41.2-meters)
	10' x 40' (3 m x 12.2 m) mooring float	400 SF (37.2 SM)
	12" to 16" (31- to 41-cm) Timber Piles	6 EA
New Construction	Concrete Retaining Wall	0.58 cubic yards (0.44 CM) of concrete 0.29 cubic yards (0.22 CM) of armor rock side slope material
	107' (32.6 m) Aluminum Truss Approach Structure	107 LF (32.6-meters)
	6' x 60' (1.8 m x 18.3 m) Steel Gangway	360 SF (33.5 SM)
	20' x 60' (6.1 m x 18.3 m) Timber Deck Float	1,200 SF (111.5 SM)
	12.75" (32.5-cm) Diameter Steel Piles	4 EA
	20" (51-cm) Diameter Steel Piles	2 EA

Table 2. Pile Driving Summary

Activity	# piles	Pile Size	Method	Average Piles/day	Driving Days	Strike/pile or seconds/pile)
Timber Pile Removal	6	12- to 16-inch (31- to 41-cm)	Vibratory	3-6	1-2	900 (15 min)
Steel Pipe Piles	4	12.75-inch (32.5-cm)	Vibratory	2-4	1-2	1,800 (30 min)
			Impact	2-4	1-2	150
	2	20-inch (51-cm)	Vibratory	1-2	1-2	7,200 (2 hours)
			Impact	1-2	1-2	150
			Drilling	1-2	1-2	18,000 (5 hours)

2 Dates, Duration, and Region of Activity

2.1 Dates

The Erickson Residence Marine Access project is scheduled to occur between September 1, 2019 and August 30, 2020. The following general construction sequence is anticipated, subject to adjustment by the construction contractor's means and methods:

Construction Phase III B (2020-2021):

- Float/steel fabrication
- Mobilization of equipment
- Demolition
- Concrete retaining wall construction
- Approach/gangway installation
- Pile driving and float installation
- Utility Installation
- Demobilization of equipment

2.2 Duration

Work is expected to occur between September 1, 2019 and August 30, 2020. During the winter months, shorter 8-hour to 10-hour workdays in available daylight are anticipated. The daily construction window for pile driving will begin no sooner than 15 minutes after sunrise to allow for initial marine mammal monitoring to take place and will end 15 minutes before sunset to allow for pre-activity monitoring. (These protocols are discussed in detail in Section 11).

2.3 Region of Activity

The project site is located within Section 35, Township 40 South, Range 65 East of the Copper River Meridian; USGS Quad Map Juneau B-2; Latitude 58° 21' 23" North, 134° 38' 49" West; CBJ Tax Parcel ID 4B1801030131, Legal Description USS 1547 TR 1A; in Juneau, Alaska.

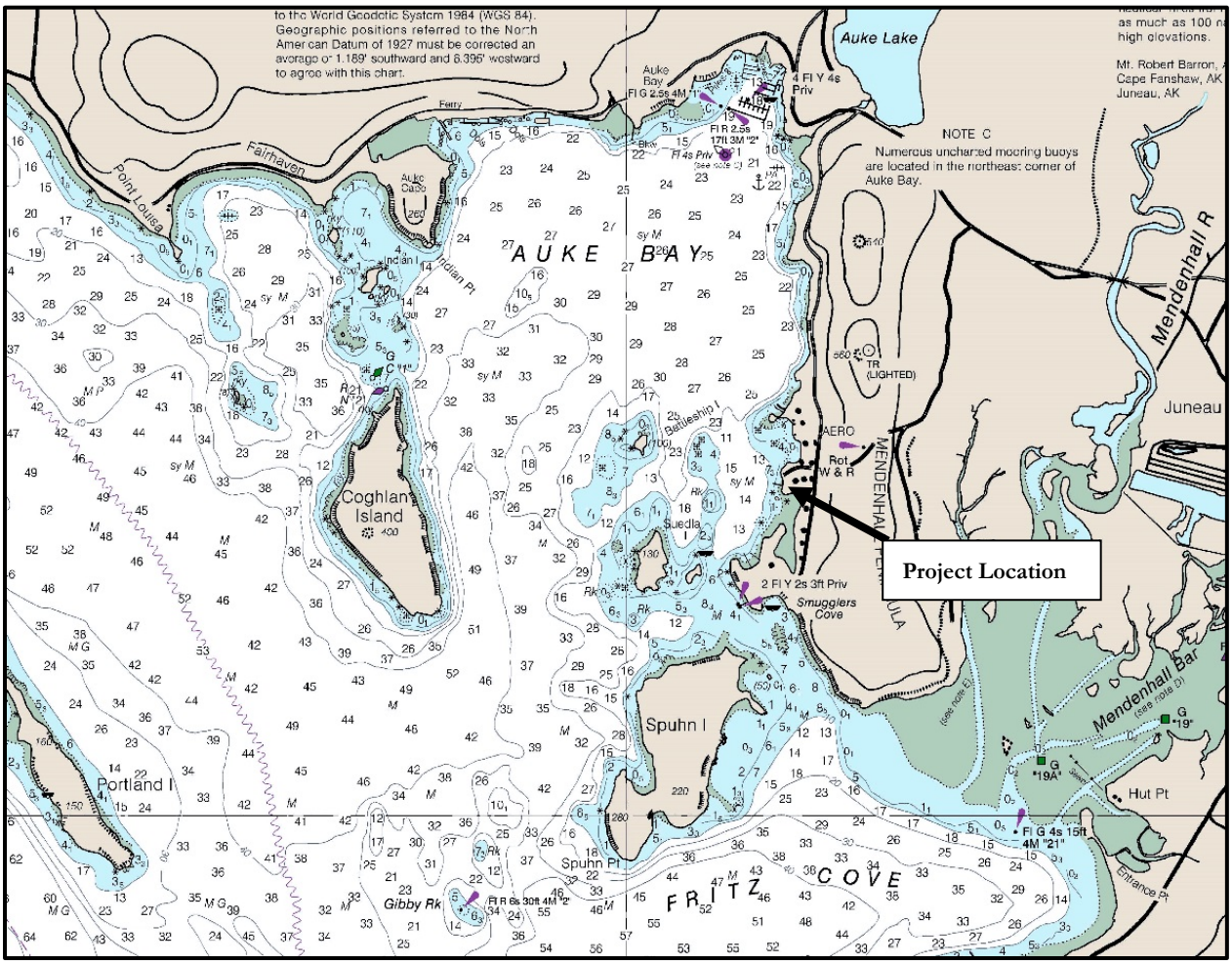

Figure 2. Project Location

3 Species and Number of Marine Mammals

Known distribution ranges of a number of marine mammal species, subspecies, or distinct population segments (DPSs) encompass the portion of Auke Bay in which the proposed project will occur. The species are listed in Table 3 along with their stock or population, their occurrence in the project area, and their estimated abundance.

The Alaska Protected Resources Division Species Distribution mapper lists the humpback whale, Steller sea lion, harbor seal, Dall's porpoise, harbor porpoise, killer whale, pacific white sided dolphin and minke whale as species with a range which may extend into the action area. However there are no know sightings of pacific white sided dolphins or minke whales in the action area. Further, surveys conducted between 1991 and 2007 did not see any pacific white sided dolphins in the Juneau area, sightings were further south and along coastal waters (Dahlheim *et al.* 2009). Minke whales were encountered infrequently throughout the surveys, sighted only 31 times, scattered throughout inland waters, with the highest concentrations found near Glacier Bay (Dahlheim *et al.* 2009). The closest sightings were a significant distance from the action area in Stephen's Passage, one in spring and one in summer. There are no known sightings in the action area. Due to the extremely low likelihood of sightings of minke whale and pacific white sided dolphin at the project site and within applicable B harassment zones; these species are not included under this request and are not discussed further. Shutdown zones will be implemented should one of these species be present in the action area. While California Sea Lions are not listed as having a range extending into this area, one hauled-out in Statter Harbor in 2017 and are thus included in this application.

Descriptions of the humpback whale, Steller sea lion, harbor seal, Dall's porpoise, harbor porpoise, killer whale and California sea lion are provided in Section 4.

Two marine mammal species that are listed under the ESA and could potentially occur in the action area; the humpback whale and the Steller sea lion. There are two recently defined DPSs of humpback whales that may be in the project area during construction, but only the Mexico DPS is listed as threatened. The Hawaiian DPS is not listed as threatened or endangered. Both the eastern and western DPSs of Steller sea lions may be located within the project area. The eastern DPS (eDPS) is not listed and the western DPS (wDPS) is listed as endangered. The wDPS is less likely to be present in the project area during the proposed action construction season. The proposed project is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of habitat for these species. Critical habitat has not been designated in the action area.

Table 3. Species with ranges extending into the project site

Species	Estimated Abundance[1]/ Stock	MMPA Status	ESA Status	Occurrence In/Near Project During Winter
Humpback whale[2] *(Megaptera novaeangliae)*	10,103 (Entire Central North Pacific Stock) [2]	Depleted, Strategic Stock	Threatened (Mexico DPS) & not listed	Intermittent
Steller sea lion[2] *(Eumetopias jubatus)*	41,638 (Eastern U.S. Stock)	Protected, Nonstrategic Stock	Delisted in 2013	Intermittent
	54,267 (Western U.S. Stock)	Depleted, Strategic Stock	Endangered	Rare
Harbor seal *(Phoca vitulina)*	9,478 (Lynn Canal/ Stephens Passage)	Protected, Nonstrategic Stock	NO	Common/Always present
Dall's porpoise *(Phocoenoides dalli)*	83,400 (Entire Alaska Stock)	Protected, Nonstrategic Stock	NO	Infrequent/Rare
Harbor porpoise *(Phocoena phocoena)*	975 (Southeast Alaska)	Protected, Strategic Stock	NO	Infrequent/Rare
Killer whale *(Orcinus orca)*	261 (Eastern North Pacific, Northern Residents)	Protected, Nonstrategic Stock	NO	Infrequent
	2,347 (Eastern North Pacific, Alaska Residents)			
	243 (West Coast Transients)			
Minke Whale	Unknown	Protected, Nonstrategic Stock	NO	Very Rare
California sea lion *(Zalophus californianus)*	296,750 (U.S. Stock)	Protected	NO	Very Rare

[1] Abundance estimates are from the most recent draft 2018 Alaska stock report (Muto *et al.* 2018) with the exception of the California Sea lion which is from the most recent Pacific Marine Mammals stock report (Carretta *et al* 2018).
[2] Humpback whales and Steller sea lions are discussed in terms of the Distinct Population Segments in the following sections to better quantify the effects to the endangered population segments.

4 Affected Species Status and Distribution

This section describes the status, distribution, behavior, and critical habitat (ESA listed species only) for the affected species/stocks of marine mammals likely to be affected by the proposed project. Species prevalence within the project area is discussed in Section 6.

4.1 Humpback Whale (Megaptera novaeangliae)

4.1.1 Status

In 1970, the humpback whale was listed as endangered under the Endangered Species Conservation Act (ESCA) (35 FR 18319). In 1973 Congress replaced the ESCA with the Endangered Species Act (ESA), and humpback whales continued to be listed as endangered. Because humpback numbers subsequently increased across much of their range, NMFS conducted a global status review and reassessed the status of humpback whales under the ESA (Bettridge *et al.* 2015). Based on that review, 14 DPSs of humpback whales were identified, and listings revised as appropriate (81 FR 62260).

In the North Pacific, five DPSs that breed in subtropical and tropical waters from Asia to Central America then migrate north to feed in highly productive North Pacific feeding grounds were identified (Bettridge *et al.* 2015). Whales from three of these DPSs migrate to Alaskan waters: the Mexico DPS (ESA-listed as threatened), the Western North Pacific DPS (ESA-listed as endangered), and the Hawaii DPS (delisted) (81 FR 62260). These DPSs equate to the California/Oregon/Washington, Western North Pacific, and Central North Pacific stocks, respectively.

4.1.2 Distribution

The humpback whale is distributed worldwide in all ocean basins. Relatively high densities of humpback whales are found in feeding grounds in Southeast Alaska and northern British Columbia, particularly during summer months. Based on extensive photo identification data, NMFS has determined that individual humpback whales encountered in Southeast Alaska and northern British Columbia have a 93.9 percent probability of being from the recovered (delisted) Hawaii DPS (CV= 0.17) and a 6.1 percent probability of being from the currently threatened (ESA-listed) Mexico DPS (CV= 0.03) (Wade *et al.* 2016). There is a 0 percent probability that humpback whales in Southeast Alaska are from the endangered Western North Pacific DPS (Wade *et al.* 2016). Intermixed DPSs are not visually distinguishable; their identity can only be determined by DNA or photo identification. Therefore, we will use Wade *et al.* (2016) estimates that assume 93.9 percent of humpbacks in Southeast Alaska are from the Hawaii DPS and 6.1 percent are from the Mexico DPS.

Humpbacks migrate to Alaska to feed after months of fasting in low latitude breeding grounds. The timing of migration varies among individuals: most humpbacks begin returning to Alaska in spring and most depart Alaska for southern breeding grounds in fall or winter. Peak numbers of humpbacks in Southeast Alaska occur during late summer to early fall, but because there is significant overlap between departing and returning whales, humpbacks can be found in Alaska feeding grounds in every month of the year (Baker *et al.* 1985, Straley 1990, Witteveen and Wynne 2009). There is also an apparent increase in the number of humpbacks overwintering in feeding grounds in Alaska (Straley *et al.* 2017).

Humpback whale individuals of different DPS (natal) origin are indistinguishable from one another (unless fluke patterns are linked to the individual in both feeding and breeding ground). The frequency of occurrence of

animals by DPS provided in this IHA application is only an *estimate,* and is based on the DPS ratio and the assumption that the ratio is consistent throughout the Southeast Alaska region (Wade *et al.* 2016).

4.1.2.1 Hawaii Distinct Population Segment Humpback Whale (Hawaii DPS)

Humpbacks that breed around the main Hawaiian Islands have been observed in summer feeding grounds throughout the North Pacific. Most of the Hawaii DPS migrates to feeding grounds in Southeast Alaska and northern British Columbia (Bettridge *et al.* 2015). Mark-recapture analysis of identification photographs suggests the Hawaii DPS numbers approximately 10,103 individuals and is increasing (Calambokidis *et al.* 2008). A multi-strata analysis estimated the abundance of the Hawaii DPS as 11,398 individuals (CV=0.04) (81 FR 62260). As mentioned above, Wade *et al.* (2016) estimated that 93.9 percent of the humpbacks encountered in Southeast Alaska and Northern British Columbia are from the Hawaii DPS.

4.1.2.2 Mexico Distinct Population Segment Humpback Whale (mDPS)

Whales in the Mexico DPS typically breed off the Revillagigedo Islands in Mexico and migrate to northern feeding grounds ranging from British Columbia to the western Gulf of Alaska. Given their widespread range and their opportunistic foraging strategies, Mexico DPS humpback whales may be in the vicinity during the proposed project activities. In the final rule changing the status of humpback whales under the ESA (81 FR 62260), the abundance of the Mexico DPS was estimated to be 3,264 individuals (CV= 0.06) with an unknown trend. Note that only a portion of the Mexico DPS migrates to Alaska for feeding; the probability that a whale encountered in Southeast Alaska and northern British Columbia is from the Mexico DPS is, again, 6.1 percent (Wade *et al.* 2016).

4.1.2.3 Critical Habitat

No critical habitat has been designated for the Humpback whale in Alaskan waters.

4.1.3 Reproduction and Breeding

During the winter months most humpback whales make a long annual migration to the low-latitude subtropical and tropical waters to breed and calve. Humpback whales do not breed or calve in Alaska waters and individuals of the Hawaii DPS (North Central Pacific stock) primarily migrate to Hawaii for breeding and calving (Muto *et al.* 2018), while Mexico DPS (California/Oregon/Washington stock) whales breed in Mexican waters.

4.1.4 Foraging

While in their Alaskan feeding grounds, humpback whales prey on a variety of euphausiids and small schooling fishes including Pacific herring (*Clupea pallasii*), longfin smelt (*Spirinchus thaleichthys*), capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes hexapterus*), juvenile walleye pollock (*Theragra chalcogramma*), and salmon (*Oncorhynchus* spp.) smolts (Nemoto 1957, Kawamura 1980, Krieger and Wing 1986, Witteveen *et al.* 2008, Straley *et al.* 2017, Chenoweth *et al.* 2017). Herring targeted by Southeast Alaska whales in Lynn Canal were lipid-rich, with energy content ranging from 7.3 to 10.0 kJ/gram (Vollenweider *et al.* 2011). The local distribution of humpbacks in Southeast Alaska appears to be correlated with the density and seasonal availability of prey, particularly herring and euphausiids (Moran *et al.* 2017). Important feeding areas include Glacier Bay and adjacent portions of Icy Strait, Stephens Passage/Frederick Sound, Seymour Canal, Lynn Canal, and Sitka Sound. During autumn and winter, the non-breeding season, humpbacks remaining in Southeast Alaska target areas where herring and eulachon (*Thaleichthys pacificus*) are abundant, such as Seymour Canal, Berners Bay, Auke Bay, Lynn Canal, and Stephens Passage (Krieger and Wing 1986, Moran *et al.* 2017). Over 2,940 and 2,019 humpback whale

foraging-days were documented in Lynn Canal alone in the 2007-2008 and 2008-2009 winter seasons, respectively (Moran *et al.* 2017).

4.1.5 Hearing Ability

Humpback whales live in an acoustic world. Humpbacks produce a variety of vocalizations ranging from 20 Hz to 10 kHz to locate prey, coordinate communal feeding efforts, attract mates, and for mother-calf communication (Au *et al.* 2006, Vu *et al.* 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (NMFS 2016). Depending on its strength and duration, anthropogenic noise can result in social disturbance, physical discomfort, and masking of intraspecific humpback communication. Although difficult to detect visually, evidence that individual humpbacks are responding to elevated noise levels has been inferred by whales leaving/avoiding ensonified areas and reducing the duration and frequency of intraspecific vocalizations (NRC 2005, Nowacek *et al.* 2007). Humpback whales use singing as a form of underwater communication at their wintering grounds for mating and seasonally at feeding grounds, like the Aleutian Islands (Fleming and Jackson 2011). Loud underwater noises, such as those from seismic surveys and pile driving, can result in humpback whales adjusting their acoustic behavior in ways like altering song length (Fleming and Jackson 2011).

4.2 Steller Sea Lion (*Eumetopias jubatus*)

4.2.1 Status

The Steller sea lion was listed as a threatened species under the ESA in 1990 following declines of 63% on certain rookeries since 1985 and declines of 82% since 1960 (55 FR 12645). In 1997, two DPSs of Steller sea lion were identified based on differences in genetics, distribution, phenotypic traits, and population trends (Fritz *et al.* 2013, 62 FR 24345).

In 2014 Steller sea lions had a worldwide population estimated at 142,360-157,498 animals (Allen and Angliss 2014). The Eastern DPS (eDPS) population counts continued to increase during the same period and was removed from ESA listing in 2013 (78 FR 66140). The eDPS of Steller Sea Lions is protected under the MMPA but is not a strategic or depleted species. The Western DPS (wDPS) is listed as endangered under the ESA and is a depleted, strategic stock under the MMPA (Muto *et al.* 2017).

4.2.1.1 Eastern DPS

The eDPS stock is commonly found in the project area waters and were most recently surveyed in Southeast Alaska in June-July of 2015. The current population estimate for the US eDPS stock is 41,638 individuals. In Southeast Alaska the estimated total abundance is 28,594 individuals of which 20,756 are non-pups and 7,838 are pups. The eDPS has been increasing between 1990 to 2015 with an estimated annual increase of 4.76% for pups and 2.84% for non-pups (Muto *et al.* 2017).

4.2.1.2 Western DPS

The wDPS stock is found infrequently in the project area waters, however do occur rarely. The estimated overlap of the wDPS is discussed further in Section 6.2. The current abundance estimate for the US portion of the wDPS is 50,983. The overall trend for the wDPS in Alaska is an annual increase of 1.94% for non-pups and 1.87% for pups (Muto *et al.* 2017).

4.2.2 Distribution

Steller sea lions range throughout the North Pacific Ocean from Japan, east to Alaska, and south to central California (Muto *et al.* 2018). They range north to the Bering Strait, with significant numbers at haulouts on St. Lawrence Island, Alaska in the spring and fall. Their range extends around the North Pacific Ocean rim, with most sea lions occupying either rookeries or haulouts, depending on the season. Male sea lions are more likely to disperse beyond their typical habitat, but this primarily occurs after the breeding season (NMFS 2019a).

The wDPS generally occurs west of Cape Suckling (144° W longitude), and the eDPS) generally occurs east of the Cape. The centers of abundance and distribution for the wDPS are in the Gulf of Alaska and Aleutian Islands.

The geographic and genetic interplay between the wDPS and the eDPS needs to be understood to gauge potential project impacts in the action area on the endangered wDPS. Large movements by individual Steller sea lions on either side of the 144° W demarcation have occurred, and wDPS individuals have been documented in Southeast Alaska, especially north of Sumner Strait (Jemison *et al.* 2013, Fritz pers. comm. 2017). Most Steller sea lions in the action area are expected to be from the eDPS but small numbers of wDPS animals also inhabit these waters (Jemison *et al.* 2013). However, it is not possible to visually distinguish between the two DPSs without brandings.

Members of this species are not known to migrate, but individuals disperse widely outside of the breeding season (late May to early July). At sea, Steller sea lions commonly occur near the 656-foot (200-meter) depth contour but have been found from nearshore to well beyond the continental shelf (Kajimura and Loughlin 1988). Sea lions move on and offshore to pelagic waters for feeding excursions. They are also capable of traveling long distances in a season. Sea lions may make semi-permanent or permanent one-way movements from one site to another (Chumbley *et al.* 1997, Burkanov and Loughlin 2005). Round trip transit of greater than 4,040 miles (6,500 km) by individual Steller sea lions has been documented (Jemison *et al.* 2013).

Land sites used by Steller sea lions are referred to as rookeries and haulouts. Rookeries are used by adult sea lions for pupping, nursing, and mating during the reproductive season (generally from late May to early July). Haulouts are used by all age classes of both genders but are generally not where sea lions reproduce. At sea, they are seen alone or in small groups, but may gather in large "rafts" at the surface near rookeries and haulouts or foraging sites.

4.2.2.1 Critical Habitat

There is no critical habitat designated for Steller sea lions within the action area. The action area is located approximately 12 nautical miles (22.22 kilometers) from around Benjamin Island, well outside of the 3,000-foot (914.4-meter) designated critical habitat (Figure 3).

4.2.3 Reproduction and Breeding

The breeding range extends along the northern edge of the Pacific Ocean from the Kuril Islands, Japan, through the Aleutian Islands and Southeast Alaska, south to California (Loughlin *et al.* 1984).

4.2.4 Foraging

Steller sea lions are opportunistic predators, feeding primarily on a wide variety of fishes and cephalopods (e.g., capelin, cod, herring, mackerel, pollock, rockfish, salmon, sand lance, etc.), bivalves, cephalopods (e.g., squid and octopus) and gastropods (Pitcher 1981; Merrick *et al.* 1997). On rare occasions, Steller sea lions prey on seals and possibly sea otter pups.

Their diet may vary seasonally depending on the abundance and distribution of prey. Womble *et al.* (2009) found that "a reasonable annual foraging strategy for Steller sea lions is to forage on herring (*Clupea pallasii*) aggregations in winter, spawning aggregations of forage fish in spring, salmon (*Oncorhynchus spp.*) in summer and autumn, and pollock (*Theragra chalcogramma*) and Pacific hake (*Merluccius productus*) throughout the year." They may disperse and range great distances to find aggregated prey but are not known to migrate. Steller sea lions can dive to approximately 1,300 feet (400 meters) in depth to exploit deep prey resources.

4.2.5 Hearing Ability

Steller sea lion's hearing sensitivity is similar to that of other otariids. Steller sea lion aerial hearing ability ranges from approximately 0.25-30 kHz; however, hearing of one individual was found to be most sensitive to noise from 5-14.1 kHz (Muslow and Reichmuth 2010). Underwater, Steller sea lion best hearing range has been measured at from 1-16 kHz in a male individual and maximum hearing sensitivity of a female individual at 25 kHz, showing a marked sexual dimorphism (though hearing characteristics may also vary based on age or size of the individual). Steller sea lions use both aerial and underwater vocalizations during breading, territorial disputes, and rearing of pups (Kastelein *et al.* 2005).

NMFS categorizes Steller sea lions in the Otariid Pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz (NMFS 2016).

4.2.6 Steller Sea Lion Critical Habitat

There is no critical habitat designated for Steller sea lions within the action area. The action area is located approximately 12 nautical miles (22.22 kilometers) from around Benjamin Island, well outside of the 3,000-foot (914.4-meter) designated critical habitat (Figure 3).

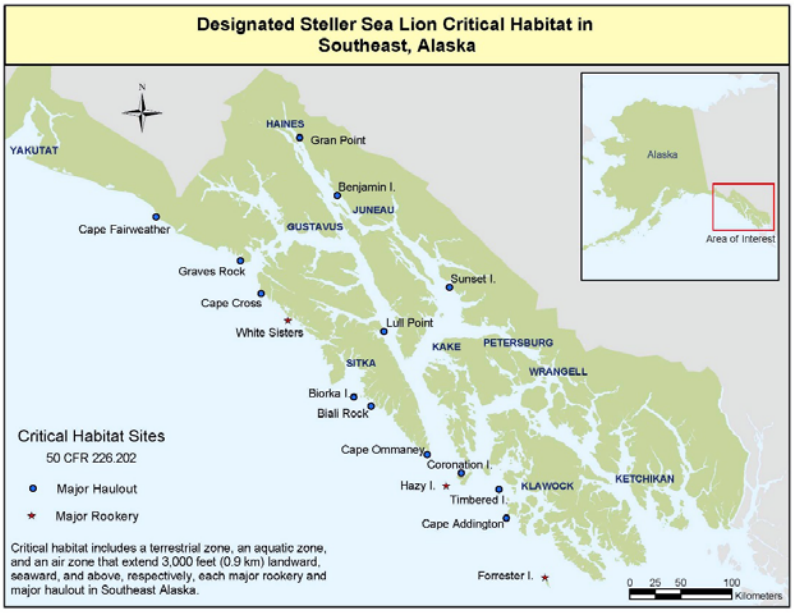

Figure 3. Steller Sea Lion Critical Habitat Sites in Southeast Alaska

4.3 Harbor Seal (*Phoca vitulina*)

4.3.1 Status

The harbor seal is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA (Muto *et al.* 2017). The Harbor seal is not listed as threatened or endangered under the ESA.

The total statewide abundance estimate is 205,090 seals based on surveys taken between 1998 and 2011 (Muto *et al.* 2017). In the northeast Pacific, twelve stocks of harbor seals have been identified by NMFS, ranging from Baja California to the Aleutians and north to Cape Newman and the Pribilof Islands (Allen and Angliss 2014). Within Alaska there are a total of 12 stocks of harbor seals ranging along the coastal waters from the eastern coast of the Aleutian Islands to Cape Muzon in Southeast Alaska.

The Lynn Canal/Stephens Passage stock is found in the project area waters. The current population estimate for the Lynn Canal/Stephens Passage stock is 9,478 individuals, and the five-year trend estimate is -176. The probability of decrease of this stock is 0.71, suggesting that the stock is declining, however 9 of the 11 Alaska harbor seal stocks are showing a trend of increasing populations (Muto *et al.* 2017). Only the Lynn Canal/Stephens Passage stock is considered in this application as it is the only stock present within the project area.

4.3.2 Distribution

Harbor seals are found in coastal and estuarine waters ranging from Baja California to the eastern Aleutian Islands of Alaska. Harbor seals often inhabit nearshore coastal waters and are considered non-migratory, typically staying within 15 to 31 miles of their home. Typically harbor seals will stay within 16 miles (25 km) of shore, but they have been found up to 62 miles (100 km) from the shore (Klinkhart *et al.* 2008). Harbor seal movement is highly variable, with no seasonal patterns identified.

Up to 44% of their time is spent hauled out, with hauling out occurring more often during the summer (Pitcher and Calkins 1979; Klinkhart *et al.* 2008). Harbor seals haul out in groups of 30 or less but have been known to rarely haul out in numbers of several hundred. There are no defined haulout locations for harbor seals as harbor seals will haul out where conditions are preferable to rest, give birth, and/or molt (Sease 1992).

Harbor seals use a variety of terrestrial sites to haul out for resting (year-round), pupping (May-July), and molting (August-September) including tidal and intertidal reefs, beaches, sand bars, and glacial/sea ice (Sease 1992; Klinkhart *et al.* 2008). Some sites have traditional/historic value for pupping and molting while others are used as temporary resting sites during seasonal foraging trips.

4.3.3 Reproduction and Breeding

In Alaska harbor seals typically give birth to single pups between May and mid-July (Klinkhart *et al.* 2008). Pupping and weaning coincide with the summer haulout and the weaning process is completed by July (Sease 1992). The birthing location of harbor seal pups occurs at many different haul-out sites and is not restricted to a few major rookeries (Klinkhart *et al.* 2008).

4.3.4 Diving and Foraging

Harbor seals commonly dive to depths that are less than 20 meters but are capable of reaching depths of up to 1640 feet (500 meters). Harbor seals can remain submerged for over 20 minutes, although most dives are less than 4 minutes long (Klinkhart *et al.* 2008) with approximately 90% of dives being less than seven minutes

(Gjertz *et al.* 2001; Eguchi and Harvey 2005). The maximum recorded dive time is 32 minutes (Eguchi and Harvey 2005)

Harbor seals commonly eat walleye pollock (*Theragra chalcogramma*), octopus (*Octopus spp.*), capelin (*Mallotus villosus*), herring (*Clupea pallasii*), and pacific cod (*Gadus macrocephalus*). Pups usually eat small fishes (Pitcher and Calkins 1979).

4.3.5 Hearing Ability

The hearing range of harbor seals extends above 60 kHz (Jacobs and Terhune 2002) although their hearing is most acute below 60 kHz (Kastelein *et al.* 2009). Harbor seals are more sensitive to lower frequency sounds with the highest sensitivity occurring at 32 kHz in water and 12 kHz in air (Terhune and Turnball 1995, Kastak and Schusterman 1998, Wolski *et al.* 2003). Harbor seals are considered part of the Phocid Pinniped hearing group (NMFS 2016).

4.4 Dall's Porpoise (*Phocoenoides dalli*)

4.4.1 Status

The Dall's porpoise is not designated as depleted or classified as strategic under the MMPA, nor are they listed under the ESA. Only one stock of Dall's porpoise is currently recognized in Alaskan waters – the Alaska stock – with an estimated abundance of 83,400, although this estimate is outdated (Muto *et al.* 2018). While the Dall's porpoise is generally considered abundant, there is insufficient data on population trends to determine whether the population is stable, increasing or decreasing (NMFS 2019b).

4.4.2 Distribution

Dall's porpoises are widely distributed in the North Pacific Ocean, usually in deep oceanic waters (>600 ft/183 m), over the continental shelf or along slopes (NMFS 2019b, Muto *et al.* 2018). They can be found along the west coast of the United States ranging from California to the Bering Sea in Alaska (NMFS 2019b).

4.4.3 Reproduction and Breeding

Dall's porpoises can be found in Alaskan waters year-round (Muto *et al.* 2018) and typically give birth between June and September to single calves (NMFS 2019b).

4.4.4 Foraging

Dall's porpoises feed on small schooling fish, mid- and deep-water fish, cephalopods, and crustaceans. Their prey includes anchovies, herring, hake, mytophids, smelts, squid, octopus, crabs, and shrimp (NMFS 2019b).

4.4.5 Hearing Ability

Dall's porpoises communicate through generation of clicks at the 165 to 175 kHz range and have a general hearing range between 275 Hz and 160 kHz (NMFS 2016). They are considered part of the high-frequency cetacean hearing group.

4.5 Harbor Porpoise (*Phocoena phocoena*)

4.5.1 Status

The Southeast Alaska stock of harbor porpoise is not designated as depleted under the MMPA nor listed under the ESA but is considered Strategic due to human-induced mortality (Muto *et al.* 2018).

4.5.2 Distribution

In the eastern North Pacific Ocean, the harbor porpoise ranges from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California. NMFS currently acknowledges three stocks of harbor porpoise within this range (Muto *et al.* 2018), with the one encompassing the action area – the Southeast Alaska stock – ranging from Dixon Entrance to Cape Suckling. This stock is estimated to include 975 individuals based on 2010-2012 surveys (Muto *et al.* 2018).

The harbor porpoise frequents nearshore waters and coastal embayments throughout their range, including bays, harbors, estuaries, and fjords less than 650 feet (198 m) deep (NMFS 2019c).

4.5.3 Reproduction and Breeding

Harbor porpoises are believed to typically mate during summer months and give birth between May and July, however very little is known about their reproduction and breeding (NMFS 2019c)

4.5.4 Foraging

Harbor porpoises forage primarily on Pacific herring, other small schooling fish, and cephalopods and will occasionally feed on squid and octopus (NMFS 2019c). In Southeast Alaska, large numbers of harbor porpoise may form temporary feeding aggregations in areas of localized prey concentration, such as Icy Strait and Sumner Strait (Muto *et al.* 2018).

4.5.5 Hearing Ability

Based on their hearing capacity, Harbor porpoise are considered to be in the high frequency functional hearing group, with assumed sensitivity matching sound they generate (NMFS 2016). Harbor porpoise' best estimated hearing ranges from 16 to 140 kHz with maximum sensitivity occurring between 100 and 140 kHz (Kastelein et al. 2005b). The peak frequency produced by harbor porpoises for echolocation is 120 to 130 kHz, which corresponds with the maximum sensitivity range.

4.6 Killer Whale (Orcinus orca)

4.6.1 Status

NMFS considers three stocks of killer whales to occur in southeast Alaskan waters, which may occur separately or concurrently within the project area. These stocks are the Eastern North Pacific/Alaska Resident stock (2,347 individuals), Eastern North Pacific/Northern Resident stock (261 individuals), the West Coast Transient stock (243 individuals) (Muto *et al.* 2018). These stocks represent two of the three ecotypes of killer whales occurring within the North Pacific Ocean – resident (forages on fish) and transient (forages primarily on marine mammals). However, NMFS is evaluating new genetic information that will likely result in a revision of the above stock

structure (Muto *et al.* 2018). The killer whale is protected under the MMPA, but none of these stocks are listed as a strategic or depleted species under the MMPA nor is it listed as threatened or endangered under the ESA.

4.6.2 Distribution

Killer whales are found in every ocean of the world (NMFS 2019d) and are the most widely distributed marine mammal (Allen and Angliss 2014).

4.6.3 Reproduction and Breeding

Killer whales do not have a distinct breeding season and their birthing rate is not well understood, however it is estimated that killer whales will give birth once every five years (NMFS 2019d).

4.6.4 Foraging

Killer whales have no natural predators and are known as the top carnivores currently living on the Earth (Pitman 2011). The species has the most varied diet of all cetaceans; however, the transient populations typically hunt marine mammals while the resident populations feed on fish, particularly salmon and Atka mackerel (Barrett-Lennard *et al.* 2011, Parsons *et al.* 2013). Residents often travel in much larger and closer groups than transients and have been observed sharing fish they catch. Transient killer whales feed on other marine mammals including Steller sea lions, harbor seals, and various species of cetaceans. They are also more likely to rely on stealth, making less frequent and less conspicuous calls and skirting "along shorelines and around headlands" in order to hunt their prey in highly coordinated attacks (Barrett-Lennard *et al.* 2011).

4.6.5 Hearing Ability

Killer whales rely on underwater sound for a variety of reasons including navigation, feeding, and communication. Killer whales use echolocation to assist with food gathering — transient killer whales use it rarely and most likely for hunting, while resident whales use it to locate salmon (Au *et al.* 2004). Killer whale social signals resemble the sound of mid-range tactical sonar (Southall *et al.* 2007), with signals commonly occurring as pulsed calls, whistles, and clicks (Szymanski *et al.* 1999). Increases in noise levels near killer whale habitat, like that associated with increasing vessel traffic, have been found to result in an increase in the duration of killer whale calls (Foote *et al.* 2004 as cited in Southall *et al.* 2007). Killer whales are part of the mid-frequency cetacean functional hearing group, with their estimated auditory bandwidth between 150 Hz and 160 kHz (Southall *et al.* 2007).

4.7 Minke Whale (*Balaenoptera acutorostra*)

4.7.1 Status

The minke whale is protected under the MMPA but is not listed as a strategic or depleted species. Minke whales are also not listed as threatened or endangered under the ESA, although no abundance estimates are available for minke whales (Muto *et al.* 2018). The minke whales population status is considered stable and they are the most abundant rorqual, or "great whale", in the world (NMFS 2019e)

4.7.2 Distribution

Minke whales are widely distributed throughout the northern hemisphere and are found in both the Pacific and Atlantic oceans. Minke whales in Alaska are considered migratory and during summer months are typically found in the Arctic and during winter months are found near the equator (NMFS 2019e).

4.7.2.1 Presence, Abundance, and Seasonality in the Action Area

A lone minke whale was observed in the inlet in 2015 (K. Gross, Never Monday Charters, personal communication; R. Ford, Taiya Inlet Watershed Council, both personal communications cited in MOS 2016), and is the only known record for the inlet. There is no quantifiable information on abundance or seasonality. It is assumed that minkes whales do not occur in the inlet numbers reasonable to request take authorization.

4.7.3 Reproduction and Breeding

Minke whales are believed to calve in the winter months (NMFS 2019e), however little is known about their breeding areas.

4.7.4 Foraging

Minke whales feed by side-lunging through schools of prey and are opportunistic predators feeding on a variety of crustaceans, plankton, and small school fish (NMFS 2019e).

4.7.5 Acoustic Ecology

Minke whales have a generalized hearing range of 7 Hz to 35 kHz and fall under the Low-frequency Cetacean hearing group (NMFS 2019e).

4.8 California Sea Lion (*Zalophus californianus*)

4.8.1 Status

The California Sea Lion is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA (NMFS 2019d). The California sea lion is not listed as threatened or endangered under the ESA. The California sea lion U.S. stock population is estimated at 296,750 animals (Carretta et al. 2017) and has grown by 6.2 percent on average since 1983 (NMFS 2019f).

4.8.2 Distribution

The U.S. stock of California sea lions have a wide range, typically from the border of the United States and Mexico (NMFS 2019d). During the winter males commonly migrate to feeding grounds off California, Oregon, Washington, British Columbia and recently Southeast Alaska. Females and pups on the other hand stay close to breeding colonies until the pups have weened. The furthest north females have been observed is off the coast of Washington and Oregon during warm water years (NMFS 2019f).

4.8.3 Reproduction and Breeding

California sea lions typically breed on islands in southern California, western Baja California and the Gulf of California (Carretta *et al* 2017).

4.8.4 Foraging

California sea lions feed primarily offshore in coastal waters. They are opportunistic predators and eat a variety of prey including squid, anchovies, mackerel, rockfish and sardines (NMFS 2019f).

4.8.5 Hearing Ability

Based on their hearing capacity, California sea lions are considered to be in the Otariid Pinniped functional hearing group, with assumed sensitivity matching sound they generate (NMFS 2016). The general hearing range is from 60 Hz to 39 kHz.

5 Type of Incidental Take Authorization Requested

Under Section 101(a)(5)(D) of the MMPA, Mr. Erickson requests an IHA for takes by Level B harassment (i.e., behavioral disturbance or temporary [hearing] threshold shift) (NMFS 2019b) during certain operations associated with the construction of the proposed project. Mr. Erickson requests an IHA for one year with an effective date of September 1, 2019. If work included is not completed at the end of that period, an IHA renewal will be requested.

Take is requested for the following activities;

- Vibratory pile driving/removal, drilling and impact pile driving activities (as described in Section 1.3 and combined with the mitigation measures described in Section 11) have the potential to take permitted marine mammals by Level B harassment resulting in behavioral disturbance or temporary hearing threshold shift (TTS) due to the effects of increased underwater noise levels.
- During impact and vibratory pile driving activities the project has the potential to increase airborne noise levels for pinnipeds hauled out along the shoreline of Auke Bay. Airborne impact isopleths are substantially smaller than underwater impact isopleths for the same activities, so it is likely that any takes from airborne noise would already be accounted for in estimates for underwater noise impacts.

The noise levels and potential impact isopleths that are expected to result from the construction of this project are described in detail in the sections below. Mitigation measures (including operational shutdown and monitoring zones) will be incorporated into the project to minimize the potential for unauthorized injury or harassment. Protocols for observations and mitigation methods are discussed in Section 11 and in the Marine Mammal Monitoring Plan (MMMP) (Appendix B). Takes of non-permitted species will be prevented by the mitigation measures described in Section 11.

5.1 Method of Incidental Taking

The Erickson Residence Marine Access project includes vibratory pile driving and potential drilling in an area where Steller sea lions, humpback whales, and harbor seals are commonly observed. Impact pile driving is not anticipated, however is included in the event soils are encountered that are too dense to penetrate with a vibratory hammer. Planned construction methodologies will temporarily increase the underwater and airborne noise within the project area. This increase in noise has the potential to result in the behavioral disturbance, temporary hearing threshold shifts, or non-serious injury of marine mammals in the vicinity of the construction project.

5.2 Regulatory Thresholds for Marine Mammal Take

Unless otherwise noted, the following notations will be used to express thresholds:

- Peak Sound Pressure Level (SPL_{PK}): The maximum absolute value of the instantaneous sound pressure that occurs during a specified time interval, measured in dB re: 1 µPa (e.g., 198 dB_{PEAK}) (Caltrans 2015).
- Average Root Mean Square Sound Pressure Level (SPL_{RMS}): A decibel measure of the square root of mean square pressure. For pulses, the average of the squared pressures over the time that comprises that portion of the wave form containing 90 percent of the sound energy of the impulse in dB re: 1 µPa (for underwater) and in dB re: 20 µPa is used (e.g., 185 dB_{RMS}) (Caltrans 2015).
- Sound Exposure Level (SEL): The integral over time of the squared pressure of a transient waveform, in dB re: 1 μPa^2–sec. (e.g., 173 dB_{SEL}). This approximates sound energy in the pulse (Caltrans 2015).
- Cumulative Sound Exposure Level (SEL_{CUM}): Cumulative exposure over the duration of the activity within a 24-hr period (NMFS 2018).

5.2.1 Updated Cumulative Sound Threshold Guidance, PTS

Determination of the cumulative underwater sound exposure levels (SEL_{CUM}) required to cause PTS in marine mammals within the project area was based on the technical guidelines published by NMFS on August 03, 2016 and revised in April, 2018. This guidance considers the duration of the activity, the sound exposure level produced by the source during one working day, and the effective hearing range of the receiving species. Regulatory thresholds for potentially affected species, measured in one-day SEL_{CUM}, are summarized below.

Table 4. SEL_{CUM} PTS Onset Thresholds. (NMFS 2018)

UNDERWATER - (dB re: 1 μPa² s)					
Source	**Low-Frequency (LF) Cetaceans[1]**	**Mid-Frequency (MF) Cetaceans[2]**	**High-Frequency (HF) Cetaceans[3]**	**Phocid Pinnipeds (PW)[4]**	**Otariid Pinnipeds (OW)[5]**
Non-impulsive Noise	199	198	173	201	219
Impulsive Noise	183	185	155	185	203

Calculation of impact isopleths under the new guidance utilized the methods presented in Appendix D of the *2018 Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* and the most recent version of the associated User Spreadsheet Tool (NMFS 2018). The spreadsheet accounts for effective hearing ranges using Weighting Factor Adjustments (WFAs), and this application uses the recommended values therein. Activity durations were estimated based on similar project experience.

5.2.2 Updated Peak Sound Threshold Guidance, TTS and PTS

In addition to thresholds for cumulative noise exposure, onset thresholds for peak sound pressures must be considered for impulsive sources. Peak sound pressure level (SPL_{PK}) is defined as "the greatest absolute instantaneous sound pressure within a specified time interval and frequency band" (NMFS 2018).

Table 5. SPL_{PK} Thresholds for Impulsive Noise. (NMFS 2018)

UNDERWATER - (dB re: 1 μPa)					
Source	**Low-Frequency (LF) Cetaceans**	**Mid-Frequency (MF) Cetaceans**	**High-Frequency (HF) Cetaceans**	**Phocid Pinnipeds (PW)**	**Otariid Pinnipeds (OW)**
TTS Onset	213	224	196	212	226
PTS Onset	219	230	202	218	232

[1] LF Cetaceans include the humpback whale
[2] MF Cetaceans include the killer whale
[3] HF Cetaceans include the Dall's porpoise and harbor porpoise
[4] PW pinnipeds include the harbor seal
[5] OW Pinnipeds include the Steller sea lion and California sea lion

5.2.3 Interim Sound Threshold Guidance

The updated guidance described above does not address behavioral disturbance from underwater or airborne noise. The interim sound threshold guidance, previously published by NMFS and summarized in Table 6, will be used for estimating exposure behavioral disturbance isopleths (NMFS 2015).

Airborne noise thresholds have not been established for cetaceans (NMFS 2015), and no adverse impacts are anticipated from airborne noise to cetaceans in the project area.

Table 6. Behavioral Disturbance Thresholds. (NMFS 2015b)

UNDERWATER - (dB re: 1 μPa)		
Source	**Cetaceans & Pinnipeds**	
Non-impulsive Noise	120	
Impulsive Noise	160	
AIRBORNE - (dB re: 20 μPa)		
Source	**Harbor Seals**	**Other Pinnipeds**
All Source Types	90	100

Per the interim guidance, the practical spreading loss model was used to determine the zones in which pinnipeds and cetaceans have the potential to face disturbance.

The formula for calculating practical spreading loss in *underwater noise* is:

$$TL=GL \times \log \frac{R_1}{R_0}$$

Where TL is the transmission loss (dB), GL is the geometric loss coefficient (15 is the only valued allowed without real-time sound source verification), R_1 is the range to the target sound pressure level (m), and R_0 is the distance from the source of the initial measurement (m).

Per the interim guidance, the spherical spreading loss model was used to determine the zones in which pinnipeds and cetaceans have the potential to face behavioral disturbance from airborne noise.

The formula for calculating spherical spreading loss in *airborne noise* is:

$$TL=GL \times \log \frac{R_1}{R_0}$$

Where TL is the transmission loss (dB), GL is the geometric loss coefficient (standard value=20), R_1 is the range to the target sound pressure level (m), and R_0 is the distance from the source of the initial measurement (m).

5.3 Sources of Anthropogenic Sound

In the Technical Guidance (NMFS 2018), sound sources are divided as;

- Impulsive: produce sounds that are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay.
- Non-impulsive: produce sounds that can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent) and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do.

5.3.1 Underwater Sources

5.3.1.1 Non-Impulsive Sources - Vibratory Pile Driving/Removal

The closest known measurements of sound source levels for vibratory pile installation of 12.75-inch (32.5-cm) steel piles are from the vibratory installation of 12-inch (31-cm) steel pipe piles as reported in the n the Caltrans Compendium of Pile Driving Sound Data. Sound source levels were found to be 155 dB_{RMS} at 33 feet (10 m) for 12-inch piles (Caltrans 2015).

The closest known measurements of sound levels for vibratory pile installation of 20-inch (51-cm) steel piles are from the vibratory installation of 36-inch (92-cm) piles measured in the U.S. Navy sound source study in Puget Sound. Sound source levels were found to be 161 dB_{RMS} at 33 feet (10 m) for 36-inch piles (U.S. Navy 2015).

Vibratory extraction of timber piles was measured during the Seattle Pier 62 project at an average of 152 dB_{RMS} at 33 feet (10 meters) (Greenbusch Group 2018).

Table 7. Parameters for Vibratory Pile Driving Noise Calculations

Source	Source Type	Pile Size	RMS Sound Pressure Level	Weighting Factor Adjustment	Estimated Duration	
					Hours per Day[1]	Ant. Days of Effort[2]
Vibratory Hammer	Non-impulsive, continuous	12.75-inch (32.5-cm) Steel Piles	155 dB_{RMS}[a] at 33 ft (10 m)	2.5 kHz	2-4 (1 hour/pile)	1-2
		20-inch (51-cm) Steel Piles	161 dB_{RMS}[b] at 33 ft (10m)	2.5 kHz	1-2 (2 hours/pile)	1-2
		Varies 12-inch to 16-inch (31-cm to 41-cm)	152 dB_{RMS}[c] at 33 ft (10 m)	2.5 kHz	0.75-1.5 (15 min/pile)	1-2

([a]Caltrans 2015; [b]U.S. Navy 2015; [c]Greenbusch Group 2018)

Pile driving noise is conservatively anticipated to be 15 minutes per pile for timber pile removal, 30 minutes per pile for 12.75-inch (32.5-cm) piles and 1 hour per pile for 20-inch (51-cm) piles. The (2) 20-inch (51-cm) piles may additionally require the drilling of rock sockets as discussed in Section 5.3.1.2. The total duration of pile driving activities, including drilling (Section 5.3.1.2) is 5-8 days.

Underwater harassment zones associated with pile driving activities are summarized in Section 5.4. Permitted pinnipeds and cetaceans that enter the Level B harassment zone for pile driving activities will be recorded as potential exposures. If a non-permitted marine mammal is observed approaching the Level B harassment zone, pile driving activities will shut down.

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[1] To be conservative during isopleth calculations it is assumed all 12.75-inch (32.5-cm) piles will be driven/removed in a single day and both 20-inch (51-cm) piles will be driven in a single day, however field conditions may result in the need to conduct pile driving over a total of 4-8 work days.

[2] Use of impact hammers is not anticipated, and will only be used for piles that encounter soils too dense to penetrate with the vibratory equipment. Should impact hammers be required both vibratory and impact hammers may be used during a work day.

5.3.1.2 Down the Hole Drilling

Denes *et al.* (2016) measured sound emanating from the drilling of 24-in (61-cm) piles at Kodiak and calculated a median sound source level SPL of 166.2 dB at 33 feet (10 meters) which was used to calculate the PTS onset isopleths. Denes *et al.* (2016) also noted a transmission loss coefficient of 18.9 for drilling suggesting high attenuation when drilling below the seafloor.

Table 8. Parameters for Underwater Noise Calculations

Source	Source Type	Mean SPL_{RMS} (dB re 1 µPa @ 1 m)	Weighting Factor Adjustment	Estimated Duration	
				Hours per Day	Days
Drilling Installation	Non-impulsive, continuous	166.2 dB[a] at 33 feet (10 m)	2.5 kHz	5-10 hours (5 hours/pile)	1-2

([a]*Denes et al. 2016*)

5.3.1.3 Impact Pile Driving

Impact hammers are not anticipated to be necessary, however they are included in the event that soils too dense to penetrate with a vibratory hammer are encountered in the field.

The closest known measurements of sound levels for impact pile installation of 12.75-inch (32.5-cm) steel piles are from the installation of 12-inch (31-cm) piles as reported in the Caltrans Compendium of Pile Driving Sound Data. Sound source levels were found to be 177 dB_{RMS} at 33 feet (10 m) for 12-inch piles with a peak of 192 dB (Caltrans 2015). The closest known measurements of sound levels for impact installation of 20-inch (51-cm) steel piles are from the impact installation of 20-inch (51-cm) piles driven in the Columbia River, in similar water depths, with a diesel impact hammer. Sound source levels were found to be 190 dB_{RMS} at 33 feet (10 m) with a peak of 203 dB (Yurk *et al.* 2016).

Table 9. Parameters for Impulsive Underwater Noise Calculations

Source	Source Type	Pile Size	Sound Pressure Level	Peak Level	Single Strike SEL	Weighting Factor Adjustment	Estimated Duration		
							Piles per Day	Strikes Per Pile	Ant. Days of Effort
Impact Hammer	Impulsive	12.75-inch (32.5-cm)	177 dB_{RMS}[a] at 33 ft (10 m)	192 dB	Not Reported	2 kHz	0-4	150	0-2
		20-inch (51-cm)	190 dB_{RMS}[b] at 33 ft (10 m)	205 dB	175 B[a] at 33 ft (10 m)	2 kHz	0-2	150	0-2

([a]*Caltrans 2015;* [b]*Yurk et al. 2013)*

5.3.2 Airborne Sources

Data for airborne sound source levels associated with vibratory pile driving were obtained from the U.S. Navy sound source study in Puget Sound. The RMS L_{eq} value for 18-inch (46-cm) steel pipe piles was chosen as the proxy source value for vibratory installation or removal of piles less than 24-inches (61-cm) regardless of pile type due to limited data for other pile sizes (U.S. Navy 2015).

Data for 24-inch piles was used to estimate sound source levels for impact driving of both 12.75-inch (32.5-cm) and 20-inch (51-cm) piles as data for smaller piles was not available (U.S. Navy 2015).

Table 10. Parameters for Airborne Noise Calculations

Source	Source Type	Pile Size	Sound Pressure Level
Vibratory Hammer	Non-impulsive, continuous	12.75-inch (32.5-cm) and 20-inch (51-cm)	88 dB_{L5EQ} at 50 feet (15 m)[a]
Impact Hammer	Impulsive	12.75-inch (32.5-cm) and 20-inch (51-cm)	110 dB_{RMS} at 15 feet (15 m)[a]

([a]U.S. Navy 2015)

5.4 Calculated Impact Isopleths

Table 11. Calculated Isopleths – Underwater Sources

Source	Source Level (RMS)	PTS Onset Isopleth					Behavioral Disturbance Isopleth[1]
		(LF) Low-Frequency Cetaceans	(MF) Mid-Frequency Cetaceans	(HF) High-Frequency Cetaceans	Phocid Pinnipeds (PW)	Otariid Pinnipeds (OW)	Cetaceans & Pinnipeds
Vibratory Timber Pile Removal	152 dB_{RMS}[a] at 33 ft (10 m)	7.2 ft (2.2 m)	0.7 ft (0.2 m)	ft (3.3 m)	10.8 ft (1.4 m)	0.3 ft (0.1 m)	4,458.7 ft (1,359 m)
Vibratory Pile Driving 12.75-inch (32.5-cm)	155 dB_{RMS} at 33 ft (10 m)[b]	22.6 ft (6.9 m)	2.0 ft (0.6 m)	33.1 ft (10.1 m)	13.8 ft (4.2 m)	1.0 ft (0.3 m)	7,066.9 ft (2,154 m)
Vibratory Pile Driving 20-Inch (51-cm)	161 dB_{RMS}[c] at 31 ft (9.5 m)[c]	56.4 ft (17.2 m)	4.9 ft (1.5 m)	83.3 ft (25.4 m)	34.4 ft (10.5 m)	2.3 ft (0.7 m)	3.55 miles (5.41 km)
Drilling	166.2 dB_{RMS} at 33 ft (10 m)[d]	231.0 ft (70.4 m)	20.3 ft (6.2 m)	341.5 ft (104.1 m)	140.4 ft (42.8 m)	9.8 ft (3.0 m)	7.5 miles (12.1 km)
Impact Pile Driving (12.75-inch Steel)	177 dB_{RMS}[b] at 33 ft (10 m)	32.8 ft (38.4 m)	4.6 ft (1.4 m)	149.9 ft (45.7 m)	67.3 ft (20.5 m)	4.9 ft (1.5 m)	446.2 ft (136 m)
Impact Pile Driving (20-inch Steel)	190 dB_{RMS}[e] at 33 ft (10 m)	430.1 ft (131.1 m)	15.4 ft (4.7 m)	512.1 ft (156.1 m)	230.0 ft (70.1 m)	16.7 ft (5.1 m)	3280.8 ft (1,000 m)

([a] Greenbusch Group 2018; [b]Caltrans 2015; [c]U.S. Navy 2015; [d]Denes et al. 2016;[e]Yurk et. al 2015)

[1] Isopleths are calculated isopleths, however most large areas are significantly smaller due the presence of land masses.

Table 12. Calculated Isopleths – Airborne Sources

Airborne Noise			
Source	**Source Level**	**Level A Harassment Zone (m)**	**Level B Harassment Zone (m)**
			Pinnipeds
Vibratory Pile Driving	88 dB_{L5EQ} at 50 feet (15 m)[a]	N/A	39.4 feet (12 m)
Impact Pile Driving	110 dB_{RMS} at 50 feet (15 m)[a]	N/A	492 feet (150 m)

([a]U.S. Navy 2015)

Only impact pile driving has peak sound pressures above the PTS threshold. The distance to the peak threshold is outlined in Table 13. All of these zones are within all established impact pile driving shutdown zones for all marine mammals and thus are not further considered independently.

Table 13. Calculated Isopleths – Peak Sound Pressures for Impact Pile Driving

	Underwater Noise (dB re: 1 µPa)					
Source	**Source Level (Peak)**	**Low-Frequency (LF) Cetaceans**	**Mid-Frequency (MF) Cetaceans**	**High-Frequency (HF) Cetaceans**	**Phocid Pinnipeds (PW)**	**Otariid Pinnipeds (OW)**
Impact Pile Driving (12.75-inch Steel)	192 dB[a] at 33 ft (10 m)	N/A	N/A	7.2 feet (2.2 m)	N/A	N/A
Impact Pile Driving (20-inch Steel)	203 dB[b] at 33 ft (10 m)	N/A	N/A	38.4 feet (11.7 m)	N/A	N/A

([a]Caltrans 2015; [b]Yurk et al. 2015)

6 Number of Marine Mammals that May Be Affected

Mr. Erickson is requesting the issuance of an IHA for one year with an effective start date of September 1, 2019 for Level B (behavioral harassment) for MMPA-defined stocks that include animals in the endangered Steller sea lions wDPS and humpback whales from the threatened Mexico DPS. This IHA request covers these ESA-listed species in their respective MMPA-defined stocks and covers anticipated takes of non-ESA listed populations and harbor seals.

The number of marine mammals that may be exposed to harassment thresholds is calculated by estimating the likelihood of a marine mammal being present within a harassment zone during the associated activities. Expected marine mammal presence is determined by past observations and general abundance near the proposed project area during construction.

Based upon the actions described above, their anticipated effect on marine mammals, and number of animals in the project area, we anticipate that a number of animals will be taken by the proposed actions. Mr. Erickson is pursuing an IHA for these potential takes. The estimated number of takes are based upon conservative ranges from the best scientific data currently available for these species near the project area. We *do not* anticipate this many takes will occur, as our avoidance and minimization of impacts efforts on the grounds during the construction activity will be informed, deliberate, focused and integrated throughout all levels of project management and monitoring.

A take summary is provided in Table 14 and the basis for these take estimates for each species are provided in Sections 6.1 through 6.7.

Table 14. Take Summary

Species		Number of Takes	
		Level B	Level A
Humpback whale	Humpback Whale Hawaii DPS	30	N/A
	Humpback Whale Mexico DPS	2	N/A
Steller sea lion	Steller Sea Lion eDPS	793	N/A
	Steller Sea Lion wDPS	175	N/A
Harbor seal		416 (17,550 sightings)	16 (40 sightings)
Dall's porpoise		10	N/A
Harbor porpoise		48	8
Killer whale		25	N/A
California Sea Lion		8	N/A

6.1 Humpback Whale

Humpback whales occur in Auke Bay in winter on an intermittent basis, but their genetic and stock-designation identities are rarely known: individuals are indistinguishable unless the fluke or dorsal fin shape and pattern are observed and linked to the individual's breeding grounds. Data on their distribution suggests that both the mDPS and Hawaii DPS of humpback whales may be present in Auke Bay. No quantitative agency data or published reports on marine mammals in Auke Bay are available at the time of this writing.

For information on marine mammals in the project area, several long-standing researchers, naturalists and academic scientists were consulted regarding the presence and abundance of these species in Auke Bay, and their typical winter habitat use patterns in the broader Auke Bay region and Statter Harbor, specifically. Individuals consulted provided records consisting of written survey counts, recorded opportunistic observations, or date-linked imagery such as photographs and video clips from which positive species identifications and individual counts could be made. This data was previously compiled by Oceanus Alaska in 2017 for the City and Borough of Juneau's Statter Harbor Improvements project (Ridgway unpubl. data 2017).

In the Auke Bay vicinity, in waters including Stephens Passage, Saginaw Channel, Favorite Channel, and Lynn Canal, researchers have documented 4 to 18 humpback whales during the winter months (Krieger and Wing 1986, Moran *et al.* 2017). Residents immediately north of Tee Harbor (Quinn unpubl. data 2017) have maintained records of opportunistic whale observations since 1994. Winter records for months October through May were extracted from these data for analysis. During the 24-year observation period, a total of 483 observations were recorded of 709 individual humpback whales (Quinn unpubl. Data 2017). Of these, 483 sightings were of single whales, 96 observations were of two whales (pairs or two individuals), and 40 observations were of groups

ranging from 3 to 12 individuals each. Many presumed mother-calf pairs were noted. Whales in this area engaged in a wide range of activities, including feeding, browsing, trumpeting, vocalizing (a wide range of tones and rhythms), sleeping and transiting. This observation area is within 10 nm (~16 km) of the project area, and whales seen here are presumed to move in and out of Auke Bay throughout the winter months.

For the years 2013 through 2017, 117 observational records of humpback whales were taken during oceanographic surveys in Auke Bay from Statter Harbor breakwater, Auke Bay Marine Station dock, and by boat on a monthly or quarterly basis (Ridgway unpubl. data 2017). Additional records were taken from opportunistic surveys from the Auke Bay Marine Station observation pier on a more frequent basis during winter months. Typical numbers observed at any given time are 0-1 whales. Four whales in a single day have been seen every year in at least three winter months, and in one year up to seven individuals have been observed inside Auke Bay concurrently during at least one month. Carlson and Haight reported observing one to nine whales in Auke Bay from 1973-1984.

These data were compiled with University of Alaska Southeast student survey data from 2015-2016 (Pearson *et al.* unpubl. data 2017) and additional observation records from multiple sources to build a non-continuous time series of marine mammal occurrence in Auke Bay. Photographs, video, and media reports on mammal occurrences were used to augment written records. Thirteen individuals and agencies contributed data records or time-linked countable imagery. Images of individual animals were used to document presence/absence of a species in Auke Bay, and specific habitat was noted if recognized. Photographs and images of multiple animals were reviewed and individually counted twice by independent viewers, and the lower confirmed count was entered.

In the winter of 2015 and 2016, two whales slept in the harbor at night over a five-week period between the Statter Harbor headwalk float and the shore, often against a large wooden tugboat that winters in the harbor.

Humpback whales utilize habitats in the action area intermittently. The breakwater and other dock structures appear to serve as fish-attracting devices, where forage fish (herring, capelin, sandlance, pollock, and juvenile salmon) aggregate and are targeted by diving humpback whales. Two humpback whales in recent years have also targeted a shallow trough off the east end of the Statter harbor breakwater for deeper diving foraging excursions targeting herring and possibly juvenile pollock (Ridgway pers. observ.). Some individual whales enter Auke Bay through the north Coghlan Island entrance and conduct a pattern of exploitation or "browsing" in the bay and inner harbor. In this area some whales have been observed lunge feeding immediately adjacent to or rubbing against boats, docks and other structures in deep to shallow waters throughout the action area. These whales have been observed continuing a pattern search alongshore to Auke Creek and up Fritz Cove, where they have been seen lunge feeding in small coves and gullies in shallow water to aggregate schooling fish.

Because humpback whale individuals of different DPS (natal) origin are indistinguishable from one another (unless fluke patterns are linked to the individual in both feeding and breeding ground), the frequency of occurrence of animals by DPS is only estimated using the DPS ratio, based upon the assumption that the ratio is consistent throughout the Southeast Alaska region (Wade *et al.* 2016).

We believe that the proposed action will likely result in direct and indirect impacts to humpback whales through short-term harassment, possible alteration of transit or sleeping locations and temporary prey species displacement. For purposes of estimating effects and takes of the mDPS of humpback whales, we acknowledge that they cannot be readily distinguished from non-listed humpback whales in the project area and assume that some whales are from the mDPS.

While daily estimates for the immediate project area indicate up to 2 whales per day, the project ensonifies a large zone, it is estimated up to 4 whales could be taken per day based on the larger area and the larger are whale observations presented in the current Auke Bay Ferry Terminal IHA application. Work is expected to occur over 4-8 days and could involve a mixture of vibratory pile driving and drilling each day. Using a likely daily potential maximum rate of two humpback whales per day, the project could take up to four humpback whales each day of pile driving activities. No Level A takes are requested for humpback whales.

The Level B harassment potential from the proposed activities is **not likely** to result in significant adverse impacts to any humpback whales.

Table 15. Estimated number of takes of humpback whales[1]

Species	Pile Driving/Drilling Activities
	(8 days)
Humpback Whale Hawaii DPS	30
Humpback Whale Mexico DPS	2
	Total Takes **32**

6.2 Steller Sea Lion

Steller sea lions occur in Auke Bay in winter on an intermittent basis, but their genetic and stock-designation identities are rarely known: individuals are indistinguishable unless sea lions are branded (and the brand is observed). Satellite-tagged individual animals from the Benjamin Island haulout and Auke Bay were observed multiple times between November 2010 and January 2011 (Fadely 2011), and the Auke Bay boating community frequently observes Steller sea lions moving to and from the haulout complex into Auke Bay. No quantitative agency data or published reports on marine mammals in Auke Bay are available at the time of this writing.

From 2013-2017, Steller sea lion have been documented in Auke Bay travelling as individuals or in herds of 50 to an estimated 120+ animals, during every month of the winter season. During winter 2015-2016, Steller sea lions foraged aggressively on young herring and 1-2-year-old Walleye pollock for over 20 days, continuously. Some sea lions were also observed consuming small flatfish, likely yellowfin sole, harvested from the seafloor (depth 25-45 meters), during this period. Large rafts of 20-50 animals formed and rested in the outer area of Statter Harbor area between foraging bouts. Simultaneous surface counts of 121 individual sea lions suggests that likely upwards of 200 animals or more were targeting prey in Statter Harbor during herring aggregation events. These 121 to 200 animals comprise roughly 20 to 30% of the animals typically found at the Benjamin Island and Little Island haulout complexes during winter months (Ridgway pers. observ.).

1 Estimated number of total takes of mDPS humpback whales incidental to each activity with the potential to result in take. Basis for total take of humpback whales in Statter Harbor: likely daily counts of up to two humpback whales in Statter Harbor (of which 6.1% may be of the mDPS) X #days of activity.

Figure 4. Steller sea lions aggressively foraging on Auke Bay herring. December 2015. Photo: Jos Bakker

Since 1988, ADF&G has branded a sample of Steller sea lion pups born on Southeast Alaska rookeries as a means of studying the life history and movements of this population. Temporal and regional re-sights of branded SSLs have helped document a degree of mixing of eDPS and wDPS Steller sea lions in Southeast Alaska waters (Jemison *et al.* 2013).

Only three individual, branded wDPS Steller sea lions have been observed at Benjamin Island, the closest haulout, from 2003-2006 with a maximum of 3 sightings per individual. No branded wDPS individuals have been observed in the ADF&G surveys from 2007-2016. The 2007 ADF&G surveys offer the most abundant data for Steller sea lion counts at Benjamin Island. A total of 11 surveys were conducted between January and July 2017, ranging from 0-768 Steller sea lions, with an average count of 404 individuals. In 2007 no wDPS animals were observed. While it is possible an individual from the wDPS may be at the Benjamin Island haulout, it is rare, and none have been documented at this haulout for the last decade (Jemison pers. comm. 2017).

Although recent data in the northern part of the eastern DPS indicate movement of western sea lions east of the 144° line, the mixed part of the range remains small (Jemison *et al.* 2013) and the overall discreteness of the eDPS from the wDPS remains distinct. Based on observations by ADF&G over the last decade this project is unlikely to impact wDPS individuals. Recent studies indicate up to 18% of the Steller sea lions in Southeast Alaska, and at Benjamin Island may be from the wDPS (Hastings et. al 2019).

Using a potential daily maximum rate, the project could take up to 121 Steller sea lions each day of pile driving activities due to the large Level B harassment zones. It will be (conservatively) assumed that no more than 121 individual sea lions will enter the action area on a given day. The maximum daily count of 121 was used to make this determination as Steller sea lions have been observed in large herds within vicinity of the harbor in excess of seven days when prey is abundant and the Level B harassment zones are large and in relatively close proximity to Benjamin Island (~22 km from project site). Thus, during these times it is likely that the rate of taking would be higher as the animals will be counted more than once if they dive and/or leave and re-enter the monitoring zone. On other days when dense groups are not present, fewer takes will be encountered, and it is assumed the overall take levels will even out. While there are a small number of resident harbor seals within Statter Harbor, it is anticipated there will be larger numbers of Steller sea lion takes, due to the large herds they have been observed in, the large size of the Level B harassment zones (up to 5 km) and the relative proximity to the established Benjamin Island haul-out.

The Level B harassment potential from the proposed activities is **not likely** to result in significant adverse impacts to Steller sea lions.

Table 16. Estimated number of takes of Steller sea lions

Species	Pile Driving/Drilling Activities (8 days)
Steller Sea Lion eDPS	793
Steller Sea Lion wDPS	175
	Total Takes 968

6.3 Harbor Seal

Harbor seals are residents of the project area and observed within the harbor on a regular basis and can be found within the immediate project vicinity on a daily basis. Over the last three winters, a group of up to 12 harbor seals has been observed in inner Statter Harbor near the harbormaster building along with 1-2 dispersed seals near the Auke Creek shoreline (Wynne pers. observ.). Additionally, other counts from 2014-2016 recorded 2-16 animals within Statter Harbor. Because harbor seals are nearly always present in the harbor, the determination of estimated takes is on the conservative side; animals are likely to be recorded more than once each day as it is likely not possible to determine if they are the same individuals. Up to 52 individual seals have been photographed simultaneously hauled out on the nearby dock at Fishermen's Bend (Ridgway unpubl. data). Direct effects of construction noise in this area will be blocked by land masses, however this is a good indication of the number of harbor seals present in the action area. Seals are typically observed at or near the existing dock in numbers ranging from 1-4 and are typically only seen in this area from mid-September to mid-October (J. Erickson pers. comm. 2019).

While 52 animals have been observed in the area, many of these animals have been observed in the harbor, which is sheltered from elevated noise levels. It is assumed that each of these individuals may venture outside of the harbor into the ensofied area daily. We assume that the majority of animals are likely to go under water and resurface every 4 minutes, based on the average dive time (Klinkhart *et al.* 2008), throughout the duration of the project.

Sightings can be estimated on the assumption seals dive and resurface every 4 minutes, with an exposure of 52 harbor seals every 4 minutes, or 15 sighting per seal per hour. The total duration of pile driving activities is 3 hours for pile removal, 4 hours for the installation of 12.75-inch (32.5-cm) piles, 4 hours for the installation of 20-inch (51-cm) piles, 10 hours for drilling and 1.5 hours maximum for impact pile driving for a total of 22.5 hours.

$$\mathbf{52}\ \boldsymbol{harbor}\frac{\boldsymbol{seals}}{\boldsymbol{hour}} * \mathbf{22.5}\ \boldsymbol{hours} * \mathbf{15}\frac{\boldsymbol{sightings}}{\boldsymbol{hour}} = \mathbf{17{,}550}\ \boldsymbol{sightings}$$

A rate of take of no more than 13 individual seals per day will be used for the project. This rate caps take at an assumed rate, though sighting rates will include multiple counts of the same individuals. It is assumed that no more than 13 individual seals will enter the action area daily. As it is anticipated that many more sightings and re-sightings may be recorded by observers, the project proponents will continue to consult closely with NMFS regarding number of takes incurred throughout the project.

Additionally, up to 4 harbor seals have been observed in the immediate project area, thus 4 level A takes are requested per day of impact pile driving. Strikes per minute varies with impact pile driving depending on the resistance. To be conservative the low end of strikes per minute of 30 strikes per minute is used to estimate the number of sightings. This results in a maximum of 10 minutes of pile driving per day.

$$\mathbf{4}\ \boldsymbol{harbor}\frac{\boldsymbol{seals}}{\boldsymbol{hour}} * \mathbf{0.17}\ \boldsymbol{hours} * \mathbf{15}\frac{\boldsymbol{sightings}}{\boldsymbol{hour}} = \mathbf{10}\ \boldsymbol{sightings/day}$$

The Level A and Level B harassment potential from the proposed activities is **not likely** to result in significant adverse impacts to harbor seals.

Table 17. Estimated number of takes of harbor seals

Species	Vibratory Pile Driving and Drilling (Level B)	Impact Pile Driving
	(8 days/22.5 hours)	(4 days/300 stikes)
Harbor Seal	416 (17,550 sightings)	4 (40 sightings)
	Total Takes 416 (Level B) / 4 (Level A)	

6.4 Dall's Porpoise

There is little data regarding Dall's porpoise presence in the project area. The best available data comes from a compilation of public sightings recorded by Oceanus Alaska. Dall's porpoises have been observed extremely infrequently within the project area. Only 18 recorded instances of Dall's porpoises have been recorded since 1994, although there is a strong possibility that sightings went unrecorded. The largest observation recoded was 10 animal is 1994. Dall's porpoises have been observed to be skittish and generally avoid boat traffic and thus are likely to avoid the immediate project area, however may be present in the larger harassment zones associated with drilling.

Using this as a worst case estimate, the project could take up to 10 Dall's porpoises during each year of the project, **resulting in up to 10 total Level B takes of Dall's porpoises.** The Level B harassment potential is not likely to result in death to any Dall's porpoises. Due to the small size of the exclusion zone for in-water fill placement and removal no takes are being requested for these activities. No Level A takes are requested for Dall's porpoises.

6.5 Harbor Porpoise

There is little data regarding harbor porpoise presence in the project area. The best available data comes from a compilation of public sightings recorded by Oceanus Alaska. Harbor porpoises have been observed infrequently within the project area. There are a total of 51 recorded observations of harbor porpoises between 2001 and 2016, although there is a strong possibility that sightings went unrecorded. The largest observation recoded was 28 animals in 2015. Harbor porpoises have been observed to be skittish and generally avoid boat traffic and thus are likely to avoid the immediate project area, however may be present in the larger harassment zones associated with drilling.

In the nearby area in Auke Bay known as Auke rec approximately 5-6 individuals are commonly seen (personal observation), however this area is just north of Statter Harbor and the Auke Bay Ferry terminal and thus is has less vessel noise. It is estimated that up to 6 harbor porpoises could be in the Level B harassment zone during each day of construction (8 days). Further, due the cryptic nature of harbor porpoises up to 2 Level A takes may occur during each day of possible impact pile driving activities (4 days). Dahlheim et. al (2009) found the mean group size of harbor porpoises to be two in Southeast Alaska, thus it is assumed that (2) harbor porpoises may be present in the larger Level A zones associated with pile driving.

Using this as a worst case estimate, the project could take up to 28 harbor porpoises during each year of the project from pile driving activities, **resulting in up to 48 total Level B takes and 8 Level A takes of harbor porpoises.** The limited Level A and Level B harassment potential is not likely to result in death to any harbor

porpoises. Due to the small size of the exclusion zone for in-water fill placement and removal no takes are being requested for these activities.

6.6 Killer Whale

Killer whales occur commonly within the waters of the project area and are observed within the project area several times annually. Occurrences could include members of one or more of the three designated stocks occurring in the project area: Eastern North Pacific, Northern Residents, (2) Eastern North Pacific, Alaska Residents, and (3) West Coast Transients. The best available data comes from a compilation of public sightings recorded by Oceanus Alaska. This compilation is believed to be fairly compressive as Juneau residents often report killer whale sightings. Killer whales are have been observed during all months, however less frequently in winter months. From 2010-2017 an average of 25 killer whales were recorded in the project area per year. Data did not make distinctions between the stocks and thus the ratio between stocks is unknown. However, the AG resident pod is one pod known to frequent the Juneau area and had 59 members recorded in 2017. This pod is seen in the area intermittently in groups of up to approximately 25 individuals (personal observation), consistent with the data for the area.

Using this as a worst case estimate, the project could take up to 25 killer whales during each year of the project from pile driving activities, **resulting in up to 25 total Level B takes of killer whales.** The level B harassment potential is not likely to result in death to any killer whales. Due to the small size of the exclusion zone for in-water fill placement and removal no takes are being requested for these activities. No Level A takes are requested for killer whales.

6.7 Minke Whale

There are no known occurrences of minke whales within the action area, however since their ranges extend into the project the project could result in up to **1 total Level B take of minke whales.** The level B harassment potential is not likely to result in death to any minke whales.

6.8 California Sea Lion

California sea lions are not typically found in the project area, however one hauled out on Statter Harbor boat launch ramp float in September of 2017. NOOA humanely hazed the aggressive sea lion off of the dock and there have been no reports of California sea lions in the area since. For take purposes it is estimated that one California sea lion may be present each day of in-water work

Using this as a worst case estimate, the project could take up to 1 California sea lion during each day of the project, **resulting in up to 8 total Level B takes of California sea lions.** The level B harassment potential is not likely to result in death to any California sea lions. Due to the small size of the exclusion zone for in-water fill placement and removal no takes are being requested for these activities. No Level A takes are requested for California sea lions.

7 Anticipated Impact on Species or Stocks

The proposed project has the potential to impact marine mammals by increasing noise in Auke Bay. Marine mammals which may be impacted include the humpback whale, Steller sea lion, harbor seal, Dall's porpoise, harbor porpoise, killer whale and California sea lion.

Likely effects may include temporary behavioral responses to non-injurious noise from in-water construction activities. Underwater sounds will likely disaggregate schools of forage fish in the action area. ESA-listed species may experience some energetic cost from short term dispersal of prey, resulting in short term expenditure of energy seeking other sources or waiting for prey to re-aggregate following noise effects. No long-term adverse impacts are anticipated as the new facility will replace an existing, deteriorated dock and the temporary nature of increased noise during construction.

7.1 Noise

Pinnipeds and cetaceans are sensitive to underwater and airborne noise. Studies have shown that even moderate levels of underwater noise can cause a temporary loss in hearing sensitivity in some marine mammals (Kastak *et al.* 2005). Increases in noise levels from in-water activities can reduce a marine mammal's capability to hear other noises, like background noise and noise created by their prey and predators, otherwise known as auditory masking (Southall *et al.* 2007). This results in difficulties with communication, predator avoidance, and prey capture, among others. Anthropogenic sounds can also result in behavioral modification, including changes in foraging and habitat use or separation of mother and infant pairs (Marine Mammal Commission 2007).

Marine mammals can also experience changes in sensitivity to sounds after exposure to intense sounds for long periods. These changes, called threshold shifts, can occur on a temporary or permanent level, depending on the intensity of the sound and length of time to which the animal is exposed to the sound. Typically, Temporary Threshold Shift (TTS) includes impacts to middle-ear muscular activity, increased blood flow, and general auditory fatigue (Southall *et al.* 2007). At the TTS level, the animals do not experience a permanent change in hearing sensitivity and exhibit no signs of physical injury. Permanent Threshold Shift (PTS) would occur if the animal subjected to the increased sound level did not return to pre-exposure conditions within an order of weeks or if the animal exhibited physical injuries (Southall *et al.* 2007).

The proposed project will have the possibility of resulting in Level B harassment of pinnipeds and cetaceans. Level B harassment is temporary in nature, and the impacts associated with the potential harassment resulting from this project will be temporary and will cease upon completion of constuction. Mitigation measures discussed in Section 11, such as soft start procedures, will be incorporated into the project to minimize the potential for noise related injuries.

8 Anticipated Impact on Subsistence

Alaska Native hunters in the north Juneau-Auke Bay vicinity do not traditionally harvest humpback whales. Steller sea lions have been traditionally hunted by Alaska Natives in Southeast Alaska for food and material products such as meat, skins, and whiskers (for art and regalia). Active hunting continues in the western Gulf of Alaska region of the wDPS range, but very few sea lions are harvested in Southeast Alaska in recent years (Wolfe *et al.* 2012, L. Sill pers. comm. 2017). Most sea lion harvests occur in winter months. In 2012, all nine of nine sea lions harvested in Southeast Alaska were male (Wolfe *et al.* 2012). Harbor seals, however, remain highly prized for rendering oil, fat, meat, and skins for cultural uses and are actively hunted in the Auke Bay project vicinity (K. Lindoff pers. comm. 2017, M. Miller pers. comm. 2017).

Records on Steller sea lion total subsistence takes includes kills plus struck and lost animals. Subsistence reports do not attribute the animals to eastern or western stocks of Steller sea lion. Impacts of subsistence hunting on the endangered western stock can only be coarsely inferred by applying the estimated percent of wDPS animals in northern Southeast Alaska (18%) to harvest numbers described below, but this estimate should not be construed as a take of endangered Steller sea lions without applying appropriate demographic, DNA and other parameters to the calculus.

The ADF&G subsistence data for Southeast Alaska shows that from 1992 through 2008, plus 2012, from zero to 19 animals were taken by Alaska Native hunters per year (Wolfe *et al.* 2012). The total subsistence sea lion take in these reporting years was an estimated 104 animals, averaging 8 sea lion takes per year (Wolfe *et al.* 2012). Of the total sea lions taken, two were reported taken from the Juneau area: one in 1994 and one in 2006 (Wolfe *et al.* 2012).

Subsequent to the 2012 reporting year through 2017, an estimated 12 or fewer Steller sea lion have been taken annually in all of Southeast Alaska (L. Sill pers. comm. 2017, M. Miller pers. comm. 2017). Up to ten Steller sea lions are taken annually in the Sitka Sound vicinity for meat and hides, and an estimated one to three sea lions are taken in Southeast Alaska communities outside Sitka Sound (L. Sill pers. comm. 2017, M. Miller pers. comm. 2017). There are no reported subsistence takes of sea lion in the Juneau vicinity or in the project area since 2006 (L. Sill 2006).

Harbor seals are hunted by Alaska Native subsistence hunters within about three miles (~5 km) of the project area (K. Lindoff pers. comm. 2017). The ADF&G, in partnership with the Alaska Native Harbor Seal Commission and hunters, compile information on subsistence seal harvest through household surveys. Based upon data for harvests in most hunting communities, hunters in Southeast Alaska took from 523 to 719 harbor seal in the years 1992-2008. In 2012 an estimated 595 harbor seals were taken for subsistence uses (Wolfe *et al.* 2012). Seals were harvested across the year, with peak harvests in March, May, and October. Lowest harvests were in December, January, and February.

Most recent reported data indicates that in 2012, an estimated 5 seals were struck and lost, and about 26 harbor seal were harvested for food (Wolfe *et al.* 2012). From 2013 through 2017, Juneau area harbor seal hunting has continued, with several cultural heritage programs teaching students how to harvest, cut and store seal meat.

8.1 Impact on Subsistence Hunting

Juneau area subsistence hunters do not target humpback whales, and very rarely target Steller sea lions; however, local Native communities hunt harbor seal for meat, oil, blubber, and skins. Oceanus Alaska consulted with ADF&G, the Douglas Indian Association, Sealaska Heritage Institute, and the Central Council of the Tlingit and Haida Indian Tribes of Alaska during November and December of 2017 to inquire whether any impacts

would be likely from the City and Borough of Juneau's Statter Harbor Improvements project, which encompassed essentially the same action area.

Chuck Smythe of Sealaska Heritage Institute stated that the primary concern in the project area would be impacts to herring fisheries, not to marine mammals (C. Smythe pers. comm. 2018). As discussed in Section 9.1.2, impacts to fish are anticipated to be localized and temporary in nature, so are not likely to impact herring fisheries further from town. Herring are not a subsistence fishery within the Juneau Nonsubsistence Area, which covers all waters within twenty to forty miles of the project area (5 AAC 99.015(a)(2)).

The proposed project will not result in the death or serious injury of any marine mammal. The project is likely to result only in short-term, temporary impacts to pinnipeds. The proposed project is not likely to adversely impact the availability of any marine mammal species or stocks that are commonly used for subsistence purposes.

8.1.1 Whale Subsistence Hunting in Juneau

Humpback whales may be temporarily displaced from Auke Bay due to Statter Harbor construction activities and barging operations associated with the project. Distances animals are likely to move in response to project activities are anticipated to be less than five kilometers, still a great distance away from any known active subsistence whale hunting regions. Thus, there is no impact to subsistence hunting in Juneau.

8.1.2 Steller Sea Lion Subsistence Hunting in Juneau

The proposed project is anticipated to have no long-term impact on Steller sea lion populations or their habitat. Since there is very little sea lion hunting in the Juneau area, short term displacement of animals from the project area is anticipated to have no effect on abundance or availability of Steller sea lions to subsistence hunters.

8.1.3 Harbor Seal Subsistence Hunting in Juneau

Neither the local population nor any individual seal are likely to be adversely impacted by the proposed action beyond noise-induced harassment or slight injury. Due to land masses, the resident harbor seals within Statter Harbor will be protected from noise impacts. This project is not likely to temporarily displace seals from haulout docks as they are protected, however they may be temporarily displaced from foraging areas in Auke Bay may increase their vulnerability to predators such as killer whales, potentially reducing the local seal population. This is considered a negligible impact on harbor seal subsistence hunting in the Juneau area (K. Lindoff pers. comm. 2017, C. Smythe pers. comm. 2017).

9 Anticipated Impact on Habitat

Critical habitat is defined as "specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations for protection" and "specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation." Critical habitat typically supports unique foraging, refugia, or reproductive habitat features.

The project area does not occur within critical habitat for Steller sea lions or humpback whales.

Effects are not anticipated to extend significantly beyond the construction phase of the project. The level of disturbance and habitat alteration in the project area will be insignificant and discountable, especially when considered in relation to activities already taking place in the project area and the apparent tolerance of marine mammals to these activities, in particular harbor seals, Steller sea lions and humpback whales. Best management practices and mitigation used to minimize potential environmental effects from project activities are described in Section 11

9.1.1 Direct Impacts

The primary reason that animals would leave habitats in the project area would be due to elevated noise levels.

Construction activities will likely have temporary impacts on marine mammal habitat through increases in underwater and airborne noise from pile driving. Project-related disturbances will not be detectable at the nearest known Steller sea lion haulouts.

Effects will be short-term and are not anticipated to extend significantly beyond the construction phase of the project. The level of disturbance and habitat alteration in the project area will be insignificant and discountable, especially when considered in relation to activities already taking place in the project area and the apparent tolerance of marine mammals to these activities, in particular harbor seals, Steller sea lions and humpback whales. Best management practices and mitigation used to minimize potential environmental effects from project activities are described in Section 1.3.

While it is possible that pinnipeds and cetaceans may avoid the project area during construction, they are not likely to abandon the site altogether. Despite current background noise levels and facility activities, nearby dock facilities often attract pinnipeds and other marine mammals to Auke Bay due to the availability of prey. It is also not uncommon for commercial, subsistence, and sport fishermen to clean fish within the marine waters around Juneau, providing additional enticements.

9.1.2 Indirect Impacts

Indirect effects to marine mammals, such as noise-induced dispersal or disaggregation of prey, would be insignificant and discountable due to the temporary nature of the activity. After activities cease each day, it is expected that forage fish will re-aggregate and become more available.

9.1.3 Cumulative Impacts

The sum of these effects is not expected to adversely modify habitat or jeopardize the local populations of marine mammals. No critical habitat has been designated in the action area. Construction impacts relating to increased noise will be temporary in nature and will not have a lasting impact on marine mammals or their habitat in the area.

Other projects in the area include the City and Borough of Juneau's Statter Harbor Improvements project. Phase III A is scheduled for construction from October 2019 to May of 2020. This project results in only temporary impacts and this is not anticipated to contribute to long-term cumulative impacts in the action area.

10 Anticipated Impact of Loss or Modification of Habitat

The proposed project is not likely to result in the permanent loss or modification of Steller sea lion, humpback whale, harbor seal, Dall's porpoise, harbor porpoise, killer whale or California sea lion habitat.

11 Mitigation Measures

11.1 All Construction Activities

The proposed project avoids impacts to the extent practicable, but impacts cannot be avoided entirely as this project is dependent on maritime access by nature. Because of the projects proximity to Statter Harbor, an active recreational and commercial harbor with high levels of noise and boat traffic, there is already a higher level of ambient noise within the area than in natural conditions. The mitigation measures and best management practices (BMP) that will be implemented are expected to reduce the project's impacts within the action area.

The following measures and BMPs will be incorporated by the applicant in order to minimize potential impacts:

- The moorage improvements will be maintained in a manner that does not introduce any pollutants or debris into the harbor or cause a migration barrier for fish.
- The moorage improvement structures are designed to limit contaminant releases and will be maintained in a manner that manages pollutants and debris streams to avoid incidental introduction of deleterious materials into Auke Bay.
- Moorage improvement structures were designed to provide barrier-free migration and vertical movement for marine and estuarine fish in Auke Bay.
- Fuels, lubricants, chemicals and other hazardous substances will be stored above the high tide line to prevent spills.
- Oil booms will be readily available for containment should any releases occur.
- To prevent spills or leakage of hazardous material during construction, standard spill-prevention measures will be implemented during construction. The Contractor will provide and maintain a spill clean-up kit on-site at all times.
- The contractor will monitor equipment and gear storage areas for drips or leaks regularly, including inspection of fuel hoses, oil drums, oil or fuel transfer valves and fittings, and fuel storage that occurs at the project site. Equipment will be maintained and stored properly to prevent spills.
- If contaminated or hazardous materials are encountered during construction, all work in the vicinity of the contaminated site will be stopped until a corrective action plan is devised and implemented to minimize impacts on surface waters and organisms in the project area.
- To minimize impacts to pink and chum salmon fry and coho and Chinook salmon smolt, and DIPAC hatchery net pen species in Auke Bay, contractors will refrain from pile driving activities from May 1 through June 30.
- A minimum of 3 observers will monitor permitted pile driving and drilling activities in accordance with protocols reviewed and approved by NMFS. A detailed MMMP is found in Appendix B.

11.2 In-Water or Over-Water Construction Activities

During in-water or over-water construction activities having the potential to affect marine mammals, a shutdown zone of 10 meters will be monitored to ensure that marine mammals are not endangered by physical interaction with construction equipment.

11.3 Vessel Interactions

In order to minimize impacts from vessel interactions with marine mammals, the crews aboard project vessels will follow NMFS's marine mammal viewing guidelines and regulations as practicable. (https://alaskafisheries.noaa.gov/protectedresources/mmv/guide.htm).

11.4 Compensatory Habitat Mitigation

Mr. Erickson has requested a permit for the proposed project under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act from the USACE. To receive that permit, Mr. Erickson will be required to avoid, minimize, and mitigate impacts to intertidal habitat. For impacts that cannot be avoided or minimized, Mr. Erickson will coordinate compensatory mitigation with USACE.

12 Arctic Subsistence Uses, Plan of Cooperation

This section is not applicable to the proposed project. The project will take place in Juneau, which is located in waters south of the 60° North latitude demarcation. No activities will take place in or near a traditional Arctic subsistence hunting area.

13 Monitoring and Reporting Plans

13.1 Monitoring Plan

Monitoring measures for the potential impacts the project could have on marine mammals are discussed briefly in Section 11 and at length in the MMMP (Appendix B). Vessel based monitors are primarily proposed due to site specific considerations. Land based monitoring is extremely difficult and presents safety concerns in addition to visibility concerns. Much of the available mainland shore is private property and unavailable for stationing monitors and if stationed on small islands the monitors could be stranded if weather turns on small islands with no shelter, power or water. Swapping out monitors every 4 hours would also be extremely problematic and time consuming. Further, due to the large monitoring zones the coverage will not be as thorough as with vessel based observers due to limitations in how far a monitor stationed from land can viably see. Further, this project is locate just outside of the largest and most active harbor in Juneau with near constant boat traffic and having monitoring vessels will not be a significant impact or addition to sound levels in the area.

13.2 Reporting

The procedures for reporting are listed below and also in the MMMP (Appendix B).

13.2.1 Annual Report

A comprehensive annual marine mammal monitoring report documenting marine mammal observations will be submitted to NMFS at the end of the in-water work season. The draft comprehensive marine mammal monitoring report will be submitted to NMFS within 90 calendar days of the end of the in-water work period. The report will include marine mammal observations (pre-activity, during-activity, and post-activity) during pile driving and drilling days. A final comprehensive report will be prepared and submitted to NMFS within 30 calendar days following resolution of comments on the draft report from NMFS.

The reports shall include at a minimum:

- General data:
  - Date and time of activity
  - Water conditions (e.g., sea-state)
  - Weather conditions (e.g., percent cover, percent glare, visibility)
- Pre-activity observational survey-specific data:
  - Date and time survey is initiated and terminated
  - Description of any observable marine mammals and their behavior in the immediate area during monitoring
  - Times when in-water construction is delayed due to presence of marine mammals within shutdown zones.
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding the monitoring zones, including the following:
    - Distance from animal to sound source.
    - Reason why/why not shutdown implemented.

    - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown.
    - If a shutdown was implemented, the distance from animal to sound source at the time of the shutdown.
    - Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start.
    - Distance to the animal from the sound source during soft start.

- Post-activity observational survey-specific data:
    - Results, which include the detections and behavioral reactions of marine mammals, the species and numbers observed, sighting rates and distances,
    - Refined exposure estimate based on the number of marine mammals observed. This may be reported as a rate of take (number of marine mammals per hour or per day), or using some other appropriate metric.

14 Coordinating Research to Reduce and Evaluate Incidental Take

The data recorded during marine mammal monitoring for the proposed project will be provided to NMFS in monitoring reports. These reports will provide information on the usage of the site by humpback whales, Steller sea lions, harbor seals, harbor porpoises, Dall's porpoises, killer whales and California sea lions as observed during the project. The monitoring data will inform NMFS and future permit applicants about the behavior and adaptability of pinnipeds and cetaceans for future projects of a similar nature.

15 Conclusion

For the reasons described in this document, it has determined that the proposed project is likely to result in the Level B harassment of humpback whales, Steller sea lions, harbor seals, harbor porpoises, Dall's porpoises, killer whales and California sea lions. This project has implemented impact minimization measures, including a Marine Mammal Monitoring Plan, to reduce the potential for unauthorized harassment.

While the harassment has the potential to result in minor behavioral effects or minor injury to any marine mammals present during project activities, based on the analysis presented in this document, these individual impacts will have a negligible effect on the stocks of marine mammals described in this document or on their habitats.

16 Literature Cited

5 AAC 99.015(a)(2). Joint Board Nonsubsistence areas. Alaska Administrative Code. Effective 5/15/93, Amended as of 7/1/2016.

50 FR 22304. 2015. Federal Register Volume 80, Issue 79. Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Proposed Revision of Species-Wide Listing. NMFS, NOAA, U.S. Dept. of Commerce. Proposed rule.

55 FR 12645. 1990. Listing of Steller Sea Lions as Threatened Under Endangered Species Act with Protective Regulations. NMFS, NOAA, U.S. Dept. of Commerce. Emergency interim rule and request for comments. April 5, 1990

55 FR 49204. 1990. Endangered and Threatened Wildlife and Plants; Listing of the Steller Sea Lion as a Threatened Species. NMFS, NOAA, U.S. Dept. of Commerce. Final Rule. November 26, 1990

62 FR 24345. 1997. Federal Register Volume 62, Issue 108. Threatened Fish and Wildlife; Change in Listing Status of Steller Sea Lions Under the Endangered Species Act. NMFS, NOAA, U.S. Dept. of Commerce. Final Rule. Monday, May 5, 1997

78 FR 66140. 2013. Federal Register Volume 78, Issue 213. Endangered and Threatened Species; Delisting of the Eastern Distinct Population Segment of Steller Sea Lion Under the Endangered Species Act; Amendment to Special Protection Measures for Endangered Marine Mammals. NMFS, NOAA, U.S. Dept. of Commerce. Final Rule. Monday, November 4, 2013

81 FR 62260. 2016. Federal Register Volume 81, Issue 174. Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Revision of Species-Wide Listing. NMFS, NOAA, U.S. Dept. of Commerce. Final Rule. Thursday, September 8, 2016

Allen, B. M., and R. P. Angliss. 2014. Alaska marine mammal stock assessments, 2013. U.S.

Au, W.W.L., A.A. Pack, M.O. Lammers, L.M. Herman, M.H. Deakos, and K. Andrews. 2006. Acoustic properties of humpback whale songs. Journal of Acoustical Society of America 120 (2):1103-1110.

Baker, C.S., L.M. Herman, A. Perry, W.S. Lawton, JM Straley, JH Straley. 1985. Population characteristics and migration of summer and late-season humpback whales (*Megaptera novaeangliae)* in southeastern Alaska. Mar. Mamm. Sci. 1:304-323.

Baker, C. S., and L. M. Herman. 1989. Behavioral responses of summering humpback whales to vessel traffic: experiments and opportunistic observations, U.S. National Park Service, Alaska Regional Office, Anchorage, AK. 50 pp.

Barrett-Lennard, L.G., C.O. Matkin, J.W. Durban, E.L. Saulitis, and D. Ellifrit. 2011. Marine Ecology Progress Series: 421: 229-241.

Bettridge, S., C.S. Baker, J. Barlow, P.J. Clapham, M. Ford, D. Gouveia, D.K. Mattila, R.M. Pace, III, P.E. Rosel, G.K. Silber, P.R. Wade. 2015. Status Review of The Humpback Whale (*Megaptera novaeangliae*) Under the Endangered Species Act. March 2015. Department of Commerce, NOAA Technical Memo. NOAA-TM-NMFS-SWFSC-540

Bray, R.N, Bates, A.D., Land, J.M. 1997. *Dredging, A Handbook for Engineers.* 1997.

Burkanov, V and TR Loughlin. 2005. Distribution and abundance of Steller sea lions on the Asian coast, 1720's–2005. Mar. Fish. Rev. 67(2): 1-62.

Calambokidis, J., E. A. Falcone, T. J. Quinn, A. M. Burdin, P. J. Clapham, J. K. B. Ford, C. M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J. M. Straley, B. L. Taylor, J. Urbán R., D. Weller, B. H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North

Pacific. Final Report for Contract AB133F-03-RP-00078, U.S. Dep. Commer., Western Administrative Center, Seattle, WA. Available online: http://www.cascadiaresearch.org/files/Projects/Archived_projects/SPLASH/SPLASH-contract-Report-May08.pdf

[Caltrans, 2015]. Buehler, D., R. Oestman, J. Reyff, K. Pommerenck, B. Mitchell. 2015. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Written for the California Dept. of Transportation, Div. of Environmental Analysis, Environmental Engineering, Hazardous Waste, Air, Noise, Paleontology Office. Sacramento, CA.

Carretta, J.V., K.A. Forney, E.M. Oleson, D.W. Weller, A.R. Lang, J. Baker, M.M. Muto, B. Hanson, A.J. Orr, H. Huber, M.S. Lowry, J. Barlow, J.E. Moore, D. Lynch, L. Carswell, and R.L. Brownell, Jr. 2019. Draft U.S. Pacific Marine Mammal Stock Assessments: 2018. NOAA Technical Memorandum NMFS-SWFSC-XXX. https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports accessed 5/23/19.

Chenoweth EM, JM Straley, MV McPhee, S Atkinson, S Reifenstuhl. 2017 Humpback whales feed on hatchery released juvenile salmon. R. Soc. open sci. 4: 170180.

Chumbley, K, J Sease, M Strick, and R Towell. 1997. Field studies of Steller sea lions at Marmot Island Alaska 1979 through 1994. NOAA Tech Memo NMFS-AFSC-77. 111 pages.

Marilyn E. Dahlheim, Paula A. White, Janice M. Waite and Ginny Eckert. 2009. "Cetaceans of Southeast Alaska: Distribution and Seasonal Occurrence." Journal of Biogeography, Vol. 36, No. 3, Southeast Alaska Marine Ecology and Biogeography (Mar., 2009), pp. 410-426

Denes, S. L., G.J. Warner, M.E. Austin, and A.O. MacGillivray. 2016. Hydroacoustic Pile Driving Noise Study – Comprehensive Report. Document 001285, Version 2.0. Technical report by JASCO Applied Sciences for Alaska Department of Transportation & Public Facilities.

Dickerson, C., Reine, K. J., and Clarke, D. G. (2001). "Characterization of underwater sounds produced by bucket dredging operations," DOER Technical Notes Collection (ERDC TN-DOER-E14), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/dots/doer

Eguchi, T., & J. T. Harvey. 2005. Diving behavior of the Pacific harbor seal (*Phoca vitulina richardii*) in Monterey Bay, California. Marine Mammal Science, 21(2), 283-295.

Fadely, B. 2011. Benjamin Island Tagging AFSC online report https://www.afsc.noaa.gov/Quarterly/ond2010/divrptsNMML1.htm

Fleming, A. and J. Jackson. 2011. Global Review of Humpback Whales (*Megaptera novaeangliae*). U.S. Dept. of Commerce, NOAA, NMFS, Southwest Fisheries Science Center. Technical Memorandum. NOAA-TM-NMFS-SWFSC-474.

Fritz, L., K. Sweeney, D. Johnson, M. Lynn, T. Gelatt, and J. Gilpatrick. 2013. Aerial and ship-based surveys of Steller sea lions (*Eumetopias jubatus*) conducted in Alaska in June-July 2008 through 2012, and an update on the status and trend of the western distinct population segment in Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-251, 91 p.

Fritz, L. 2017. Unpublished appendices to NOAA-NMFS Critical Habitat Review Team report on ESA listed endangered western DPS of Steller sea lion abundance and seasonal occurrence in Southeast Alaska

Gabriele, CM, J. Neilson, JM Straley, CS Baker, JA Cedarleaf, and JF Saracco. 2017. Natural history, population dynamics, and habitat use of humpback whales over 30 years on an Alaska feeding ground. Ecosphere 8(1): e01641. 10.1002/ecs2.1641.

Gjertz, I., C. Lydersen, O. Wiig. 2001. Distribution and diving of harbour seals (*Phoca vitulina*) in Svalbard. Polar Biol (2001) 24: 209-214. Springer-Verlag.

Greenbusch Group. 2018. Pier 62 Project – Acoustic Monitoring Season 1 (2017/2018) Report (NWS-2016-WRD, WCR-2016-5583, 01EWF00-2016-F-1325). Prepared for the Seattle Department of Transportation. April 9, 2019.

Jacobs, S.R. and J.M. Terhune. 2002. The effectiveness of acoustic harassment devices in the Bay of Fundy, Canada: seal reactions and a noise exposure model. Aquatic Mammals, 28.2: 147-158.

Jemison L.A., Pendleton G.W., Fritz L.W., Hastings K.K., Maniscalco J.M., *et al.* 2013. Inter-population movements of Steller sea lions in Alaska with implications for population separation. PLoS ONE 8(8): e70167. doi:10.1371/journal.pone.0070167

Jemison, L. 2017. Eastern and Western Steller Sea Lion occurrences in northern Southeast Alaska. Unpublished count data and brand resight observations for Benjamin Island rookery and haulout complex.

Jemison L.A., Pendleton G.W., Fritz L.W., Hastings KK, Maniscalco JM, *et al.* 2013. Inter-Population Movements of Steller Sea Lions in Alaska with Implications for Population Separation. PLoS ONE 8(8): e70167. doi:10.1371/journal.pone.0070167

Kastak, D. and R.J. Schusterman. 1998. Low frequency amphibious hearing in pinnipeds: Methods, measurements, noise, and ecology. Journal of the Acoustical Society of America. 103(4): 2216-2228.

Kastak, D., B. L. Southall, R. J. Schusterman, and C. R. Kastak. 2005. Underwater Temporary Threshold Shift in Pinnipeds: Effects of Noise Level and Duration. Journal of the Acoustical Society of America. 118.5 (2005): 3154-163. Web.

Kastak, D. 2008. Effects of noise on seals and sea lions: laboratory approaches. Bioacoustics 17: 169-171

Kastelein, R.A., R. van Schie, W. Verboom, and D. Haan. 2005. Underwater hearing sensitivity of a male and a female Steller sea lion (*Eumetopias jubatus*). Journal of the Acoustical Society of America 118:1820-1829.

Kastelein, R.A., P.W. Wensveen, L. Hoek. 2009. Underwater hearing sensitivity of harbor seals (Phoca vitulina) for narrow noise bands between 0.2 and 80 kHz. The Journal of the Acoustical Society of America 126, 476. July 2009.

Kastelein, RA, M Horvers, L Helder-Hoek, S Van de Voorde, R ter Hofstede, & H van der Meij. 2017. Behavioral Responses of Harbor Seals (*Phoca vitulina*) to FaunaGuard Seal Module Sounds at Two Background Noise Levels. Aquatic Mammals, 43(4), 347-363, DOI 10.1578/AM.43.4.2017.347

Kajimura, H. and T.R. Loughlin. 1988. Marine Mammals in the Oceanic Food Web of the Eastern Subarctic Pacific. Bulletin of the Ocean Research Institute, University of Tokyo 26:187-223.

Kawamura A. 1980 A review of food of balaenopterid whales. *Sci. Reports Whales Res. Inst.* 32, 155–197.

Kennedy, A.S., A.N. Zerbini, B.K. Rone, P.J. Clapham. 2014. Individual variation in movements of satellite-tracked humpback whales Megaptera novaeangliae in the eastern Aleutian Islands and Bering Sea. Endang. Species Res. Vol. 23 187-195. doi: 10.3354/esr00570 . March 10, 2014. Retrieved from: https://www.int-res.com/articles/esr2014/23/n023p187.pdf

Klinkhart, E., K. Pitcher, G. Blundell. 2008. Harbor Seal. Alaska State Dept. of Fish and Game. Revised and reprinted 2008. Accessed from https://www.adfg.alaska.gov/static/education/wns/harbor_seal.pdf.

Krieger, KJ, BL Wing. 1986. Hydroacoustic monitoring of prey to determine humpback whale movements. NOAA Tech. Memo. 60 (NMFS-F/NWC-98).

Laughlin, J. 2010. Memorandum: Airborne Noise Measurements (A-weighted and un-weighted) during Vibratory Pile Installation – Technical Memorandum. Washington State Dept. of Transportation.

Loughlin, TR, DJ Rugh, and CH Fiscus. 1984. Northern sea lion distribution and abundance: 1956-1980. J. Wildl. Manage. 48:729-740.

Laughlin, J. 2011. Memorandum: Port Townsend Dolphin Timber Pile Removal – Vibratory Pile Monitoring Technical Memorandum. Washington State Dept. of Transportation.

Marine Mammal Commission. 2000. Annual report to Congress 1999. Bethesda, MD. 243 p.

Marine Mammal Commission. 2007. Marine Mammals and Noise. A Sound Approach to Research and Management. Report to Congress March 2007. Bethesda, MD. https://www.mmc.gov/wp-content/uploads/fullsoundreport.pdf

Merrick, R.L., M.K. Chumbley, and G.W. Byrd. 1997. Diet Diversity of Steller Sea Lions and Their Population Decline in Alaska: A Potential Relationship. Canadian Journal of Fisheries and Aquatic Science. 54(6):1342-1348.

Møhl, B. (1968). Auditory sensitivity of the common seal in air and water. Journal of Auditory Research, 8(1), 27-38.

Moran, JR. 2017. Deep-Sea Research Part II (2017), http://dx.doi.org/10.1016/j.dsr2.2017.07.010

Muto, M. M., V. T. Helker, R. P. Angliss, B. A. Allen, P. L. Boveng, J. M. Breiwick, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. London, S. A. Mizroch, R. R. Ream, E. L. Richmond, K. E. W. Shelden, R. G. Towell, P. R. Wade, J. M. Waite, and A. N. Zerbini. 2019. Draft Alaska Marine Mammal Stock Assessments: 2018. Marine Mammal Laboratory. Document available: https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports accessed 5/23/2019.

Muslow, J. and C. Reichmuth. 2010. Psychophysical and electrophysiological aerial audiograms of a Steller sea lion (Eumetopias jubatus). Journal of the Acoustical Society of America. 127:2692-2701.

Nemoto, T. 1957. Foods of the baleen whales of northern Pacific. Sci. Rep. Whal. Res. Inst. 12, 33–89.

National Marine Fisheries Service (NMFS). 2008. Recovery Plan for the Steller Sea Lion: Eastern and Western Distinct Population Segments (*Eumetopias jubatus*). NMFS, NOAA, U.S. Dept. of Commerce. Retrieved from: http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf.

NMFS. 2015 (accessed). Interim Sound Threshold Guidance. West Coast Region, NMFS, NOAA, U.S. Dept. of Commerce. Retrieved from: www.westcoast.fisheries.noaa.gov/protected_16species/marine_mammals/threshold_guidance.html

NMFS. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing. NMFS, NOAA, U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-OPR-55. July 2016. Retrieved from: www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/opr-55_acoustic_guidance_tech_memo.pdf

NMFS. 2018. 2018 Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing. NMFS, NOAA, U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-OPR-59. Retrieved from: https://www.fisheries.noaa.gov/webdam/download/75962998

NMF). 2019a. Fisheries Home » Protected Resources » Steller Sea Lion (Eumetopias jubatus). As viewed May 2019 at https://www.fisheries.noaa.gov/species/steller-sea-lion

NMFS. 2019b. Fisheries Home » Protected Resources » Dall's Porpoise (Phocoena phocoena). As viewed May 2019 at https://www.fisheries.noaa.gov/species/harbor-porpoise

NMFS. 2019c. Fisheries Home » Protected Resources » Harbor Porpoise (Phocoenoides dalli). As viewed May 2019 at https://www.fisheries.noaa.gov/species/dalls-porpoise

NMFS. 2019d. Fisheries Home » Protected Resources » Killer Whale (Orcinus Orca). As viewed May 2019 at https://www.fisheries.noaa.gov/species/killer-whale

NMF). 2019e. Fisheries Home » Protected Resources » Species Minke Whale (*Balaenoptera acutorostrata*). As viewed May 2019 at https://www.fisheries.noaa.gov/species/minke-whale#management

NMFS. 2019f. Fisheries Home » Protected Resources » California Sea Lion (Zalophus Californianus). As viewed May 2019 at https://www.fisheries.noaa.gov/species/california-sea-lion

Nemoto, T. 1957. Foods of the baleen whales of northern Pacific. Sci. Rep. Whal. Res. Inst. 12, 33–89.

Nowacek, DP, LH Thorne, D.W. Johnston, And PL Tyack. 2007. Responses of cetaceans to anthropogenic noise. Mammal Rev. 37(2):81–115.

NRC 2003. National Research Council, Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals. Washington (DC): National Academies Press (US).

NRC 2005. Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. THE NATIONAL ACADEMIES PRESS Washington, DC

Parsons, K. J.W. Durban, A. M. Burdin, V.N. Burkanov, R. L. Pitman, J. Barlow, L.G. Barrett-Lennard, R.G. LeDuc, K.M. Robertson, C.O. Matkin, and P.R. Wade. 2013. Geographic Patterns of Genetic Differentiation among Killer Whales in the Norther North Pacific. J. Hered: published online July 11, 2013 doi:10.1093/jhered/est037.

Pitcher, K.W. and D.G. Calkins. 1979. Biology of the Harbor Seal, *Phoca vitulina richardii*, in the Gulf of Alaska. Report for the Outer Continental Shelf Environmental Assessment Program. NOAA, U.S. Dept. of Commerce.

Pitcher, K.W. 1981. Prey of the Steller Sea Lion in the Gulf of Alaska. Fisheries Bulletin Seattle. 79:467-472.

Sease, J.L. 1992. Status Review: Harbor Seals (*Phoca vitulina*) in Alaska. Alaska Fisheries Science Center. NMFS, NOAA, U.S. Dept. of Commerce. December, 1992. Seattle, Washington.

Sheffield, G. G., and L. A. Jemison. 2012. Spanning the North Pacific: Steller sea lions at St. Lawrence Is., Nov-Dec 2011 [abstract]. Page 177 [In] J. Duffy-Anderson, editor. Abstracts of the 2012 Alaska Marine Science Symposium, 16-20 January 2012, Anchorage, Alaska.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, D. Kastak, D. R. Ketten, J.H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine Mammal Noise-Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals 33(4): 409-521. Retrieved from: http://thecre.com/pdf/Aquatic_Mammals_33_4_FINAL.pdf.

Straley, JM. 1990. Fall and winter occurrence of humpback whales (*Megaptera novaeangliae*) in southeastern Alaska. *pp* 319-323 in Hammond, PS, SA Mizroch, and GP Donovan (eds) Rept. Int. Whal. Commn. (Special Issue 12): Individual Recognition of Cetaceans: Use of Photo-Identification and Other Techniques to Estimate Population Parameters. International Whaling Commission.

Straley, J.M., J.R. Moran, K.M. Boswell, J.J. Vollenweider, R.A. Heintz, T.J. Quinn II, B.H. Witteveen, S D. Rice. 2017. Seasonal presence and potential influence of humpback whales on wintering Pacific herring populations in the Gulf of Alaska. Deep-Sea Research Part II: Topical Studies in Oceanography http://dx.doi.org/10.1016/j.dsr2.2017.08.008

Terhune, J. M. 1988. Detection thresholds of a harbor seal to repeated underwater high-frequency, short duration sinusoidal pulses Can. J. Zool. 66, 1578–1582.

Terhune JM, Turnbull S. Variation in the psychometric functions and hearing thresholds of a harbor seal. In: Kastelein RA, Thomas JA, Nachtigall PE, editors. Sensory systems of aquatic mammals. Woerden: DeSpil Publishers; 1995. pp. 81–93.

Teerlink. S.F. 2017. Humpback whales and humans: a multi-disciplinary approach to exploring the whale watching industry in Juneau, Alaska. University of Alaska Fairbanks.

U.S. Fish and Wildlife. 2012. Observer Protocols for Pile Driving, Dredging and Placement of Fill. Draft. Anchorage Field Office. USFWS. Dept. of Interior. August 7, 2012.

United States Navy. 2015. Proxy source sound levels and potential bubble curtain attenuation for acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound. Prepared by Michael Slater, Naval Surface Warfare Center, Carderock Division, and Sharon Rainsberry, Naval Facilities Engineering Command Northwest. Revised January 2015.

Vollenweider, J.J., Heintz, R.A., Schaufler, L., Bradshaw, R., 2011. Seasonal cycles in whole body proximate composition and energy content of forage fish vary with water depth. Mar Biol. 158, 413-42

Wade, P.R., T.J. Quinn II, J. Barlow, C.S. Baker, A.M. Burdin, J. Calambokidis, P.J. Clapham, E. Falcone, J.K.B. Ford, C.M. Gabriele, R. Leduc, D.K. Mattila, L. Rojas-Bracho, J. Straley, B.L. Taylor, J. Urbán, D. Weller, B.H. Witteveen, and M. Yamaguchi. 2016. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. Paper SC/66b/IA21 submitted to the Scientific Committee of the International Whaling Commission, June 2016, Bled, Slovenia. Available at www.iwcoffice.org.

Warner, G. and M. Austin. 2016. Alaska DOT Hydroacoustic Pile Driving Noise Study: Kodiak Monitoring Results. JASCO Document 01167, Version 2.0. Technical report by JASCO Applied Sciences for Alaska Department of Transportation and Public Facilities.

Winn, H. E., Perkins, P. J. & Poulter, T. C. (1970) Sound of the humpback whale. In Proceedings of the Seventh Annual Conference on Biological Sonar and Diving Mammals, pp. 39–52. Stanford Research Institute, Menlo Park.

Witteveen, B.H., R.J. Foy, K.M. Wynne, Y. Tremblay. 2008. Investigation of foraging habits and prey selection by humpback whales (*Megaptera novaeangliae*) using acoustic tags and concurrent fish surveys. Mar. Mamm. Sci. 24: 516–534.

Witteveen, B.H. and K.M. Wynne. 2017. Site fidelity and movement of humpback whales (*Megaptera novaeangliae*) in the western Gulf of Alaska as revealed by photo-identification. Can. J. Zool. 95: 169–175 dx.doi.org/10.1139/cjz-2016-0101

Wolfe, RJ, J Bryant, L Hutchinson-Scarborough, M Kookesh, and LA Sill. 2013. The Subsistence Harvest of Harbor Seals and Sea Lions in Southeast Alaska in 2012. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 383, Anchorage, Alaska

Wolski, L.F., R.C. Anderson, A.E. Bowles, P.K. Yochem. 2003. Measuring hearing in the harbor seal (Phoca vitulina): Comparison of behavioral and auditory brainstem response techniques. J. Acoust. Soc. Am. 113 (1), January 2003. [DOI: 10.1121/1.1527961]

Wynne, KM and BH Witteveen. 2009. GAP09: whales as sentinels in a changing environment. Final Rept NOAA Grant NA09NMF4390339, University of Alaska Fairbanks. Kodiak, AK 29pp.

Wynne, KM and BH Witteveen. 2017. Site fidelity and movement of humpback whales (Megaptera novaeangliae) in the western Gulf of Alaska as revealed by photo-identification. Canadian Journal of Zoology. 95. 10.1139/cjz-2016-0101.

Vu E.T., Risch D., Clark C., Gaylord S, Hatch L., *et al.* (2012) Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aquatic Biology 14: 175–183.

Yurk, H., A Schlesinger, and A. MacGillivray. 2015. *A Literature Review of Pile Driving Noise: Alaska Department of Transportation and Public Facilities Pile Driving Noise Study*. JASCO Document 1010, Version 2.0. Technical Report by JASCO Applied Sciences for Alaska Department of Transportation and Public Facilities.

16.1 Auke Bay Marine Mammal Observation Record Sources

No quantitative agency data or reports on marine mammals in Auke Bay are available at the time of this writing. Written observation data were provided by Oceanus Alaska. Additional observation records augmented the time series for every species. Photographs, video and time link data were used to augment written records. The following individuals and entities contributed to the Auke Bay marine mammal data summary provided by Oceanus herein:

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Appendix A. Project Permit Drawings

Appendix B. Marine Mammal Monitoring Plan