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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XF540

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the Biorka Island Dock Replacement Project

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments.

SUMMARY: NMFS has received a request from the Federal Aviation Administration (FAA) for authorization to take marine mammals incidental to construction activities as part of its Biorka Island Dock Replacement Project. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting public comment on its proposal to issue an incidental harassment authorization (IHA) to the FAA to incidentally take marine mammals, by Level A and Level B harassment, during the specified activity. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Comments on this proposal should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries

Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910, and electronic comments should be sent to *ITP.mccue@noaa.gov*.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted online at *www.nmfs.noaa.gov/pr/permits/incidental/construction.html* without change. All personal identifying information (*e.g.*, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Laura McCue, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the applications and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *www.nmfs.noaa.gov/pr/permits/incidental/construction.htm*. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An Incidental Take Authorization (ITA) shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS has defined "negligible impact" in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The MMPA states that the term "take" means to harass, hunt, capture, kill or attempt to harass, hunt, capture, or kill any marine mammal.

Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

National Environmental Policy Act

To comply with the National Environmental Policy Act (NEPA) of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an incidental harassment authorization) with respect to environmental consequences on the human environment.

This action is consistent with categories of activities identified in CE B4 of the Companion Manual for NOAA Administrative Order 216-6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On March 31, 2017, NMFS received a request from the FAA for an IHA to take marine mammals incidental to pile driving and removal and down the hole (DTH) drilling in association with the Biorka Island Dock Replacement Project (Project) in Symonds Bay, Alaska. The FAA's request is for take of five species by Level A and Level B harassment. Neither the FAA nor NMFS expect mortality to result from this activity and, therefore, an IHA is appropriate.

In-water work associated with the in-water construction is expected to be completed within 70 days. This proposed IHA is for the 2018 construction window (May 1, 2018 through September 30, 2018). This IHA would be valid from May 1, 2018, through April 30, 2019.

Description of the Specified Activity

Overview

The FAA is constructing a replacement dock on Biorka Island in Symonds Bay near Sitka, Alaska. The purpose of the Project is to improve and maintain the sole point of access to Biorka Island and the navigational and weather facilities located on the Island. The existing dock is deteriorated and has reached the end of its useful life. Regular and repetitive heavy surging seas, along with constant use have destroyed the face of the existing floating marine dock, and have broken cleats making it difficult to tie a vessel to the existing dock. In its present condition, small vessels cannot use the dock to provide supplies to facilities on the Island. The existing barge landing area is reinforced seasonally by adding fill to the landing at the shoreline, which is periodically washed away by storms and wave action. The Project would reconstruct the deteriorated existing dock and construct an improved barge landing area.

Dates and Duration

The total Project is expected to require a maximum of 70 days of in-water construction activities. In-water activities are limited to occurring between May 1 and September 30 of any year to minimize impacts to special-status and commercially and biologically important fish species. This proposed authorization would be effective from May 1, 2018 through April 30, 2019.

Specific Geographic Region

The Project is located approximately 15 miles (24 kilometers (km)) southwest of Sitka on the northern shore of Biorka Island on land owned by the FAA (see Figure 1-1 of the FAA's application). Biorka Island is the most westerly and largest of the Necker Island group on the west coast of Baranof Island.

Symonds Bay is approximately 0.4 miles wide (east to west direction). Water depths are less than 66 feet (ft) within 1,300 ft of the dock (see Figure 1-2 of the FAA's application). The outer dolphin (see Figure 1-4 of the application) would be located in about 20 ft of water at mean high water. This is the deepest water depth for all piles and, as a precautionary measure, was used as the water depth input for acoustic modeling described later in this document.

On shore at the Project site, bedrock is exposed in many places. The overburden varies from zero to about 15 ft deep and consists of highly fractured weathered bedrock and includes seams of very soft rock or soil. Due to the fractures and seams, it is possible to drive piles into this top layer “Category 1 intensely fractured bedrock.” Beneath the top layer, the rock becomes more intact “Category II intensely to moderately fractured bedrock.” The seabed composition is important in this Project because it determines the pile-driving methods needed to achieve the required pile penetration.

Detailed Description of Activities

The Project consists of removing the existing dock and associated infrastructure and constructing a new, modern structure to provide continued safe access to Biorka Island facilities. The existing dock is a T-shaped, pile-supported structure consisting of a 170-ft long by 16-ft wide approach trestle with a 51-ft wide by 35-ft long end section. The existing infrastructure also includes a 30-ft by 32-ft floating dock that is accessed by a 5-ft wide by 50-ft long steel gangway, a small 10-ft by10-ft pre-fabricated building, and an electric hydraulic pedestal crane.

A total of 46 existing piles would be removed (Table 1). The steel and timber piles would be pulled out of the substrate directly with a crane and sling, by using a vibratory hammer, or with a clamshell bucket. The three concrete piles that are located above the high tide were cast in place. The concrete piles are set in bedrock and will be removed at low tide using standard excavation equipment. Therefore, removal of these piles will not produce underwater noise. The construction contractor would determine the exact method for concrete pile removal.

The existing deck and other associated infrastructure would also be disassembled and removed. The existing 4-ton pedestal crane would be salvaged for relocation on the new dock.

As necessary, portions of the existing rubble mound/breakwater would be removed to provide enough clearance for construction and then replaced once the dock has been constructed.

Table 1. Existing Piles to be Removed.

Pile Type	Quantity	Size inches (in)
Concrete	**3**	**24**
Steel	**14**	**8**
	8	**10**
	14	**12.75**
Timber	**7**	**14 tapering to 8**
Total	**46**	

Facilities for the new dock consist of three main structures: a barge landing platform, a dock/trestle, and two dolphin fenders located near the dock outer corners (Figure 1-4 of the FAA’s application). For these structures, temporary piles would be installed to form a scaffold system (*i.e.*, a template) that permits the permanent piles to be aligned and controlled. With the exception of the temporary piles, which are driven exclusively by vibratory pile driving, the installation of all permanent piles requires a combination of pile driving methods.

Construction of the new dock would begin with the erection of a temporary template. The construction contractor would determine the specific type and size of template piles based on site conditions and availability of materials. The template piles would be driven into the overburden by vibratory hammer and removed after the permanent piles are installed. Table 2 shows the anticipated number of template piles for the Project.

The new trestle approach would be up to 25 ft wide. An 80-ft aluminum gangway connecting to a 15-ft wide by 32-ft long small craft berthing float would also be constructed (see Figure 1-4 of the FAA’s application). The face of the dock would be approximately 54-ft long and 35-ft wide. Similar to the trestle, steel pipe pilings would support a precast concrete deck. Two berthing dolphin fenders would be installed, one at each end section of the new dock. These dolphins each consist of one 30-in diameter plumb pile and two 18-in diameter batter piles. Some piles would require internal tension anchors for increased support. A wave barrier, consisting of Z-sheet piles in between steel H piles, would be installed at the face of the dock. Pile counts, sizes, and other details are shown in Table 2.

All permanent pipe piles would be installed using a combination of vibratory and impact hammering methods to drive the pile into the overburden. Pipe piles would then be drilled and socketed into the underlying bedrock using DTH hammering/drilling techniques. DTH equipment breaks up the rock below the pile while simultaneously installing the pile through rock formation. The pile is then set/confirmed with a few strikes of an impact hammer. Sheet piles would be driven into the overburden and set into the top layer of bedrock using a combination of vibratory and impact hammering.

Certain piles would require internal tension anchors. Up to eight of the dock piles and all six piles for the dolphins would require these internal tension anchors. Each pile with a tension anchor would first be drilled, socketed into bedrock, and proof driven with an impact hammer as described above for permanent piles. Then a separate smaller drill would be used to complete an approximately 5-in diameter hole extending about 30 to 40 ft into bedrock below the tip of the pile. A steel bar would be grouted into this hole. Once the grout sets, a jack would be applied to the top of the bar and the tensioned rod would be locked off to plates at the top of the pile.

The wave barrier consisting of steel H piles with Z sheets in between is located at the face of the dock. The H piles and Z sheets would be initially driven through overlying sediment with a vibratory hammer, and set into the bedrock with an impact hammer. The wave barrier sheet piling would be driven either singly or in preassembled pairs.

The current barge landing is located northwest of the existing dock and is comprised of gravel and cobbles with no formal structure. The uplands area on the west end of the trestle would be slightly graded into the existing terrestrial approach. The existing barge landing would be upgraded to a 30-ft by 90-ft precast concrete plank landing placed over fill, with a perimeter constructed of concrete, sheet piles, and 18-in steel piles (see Table 2). Similar to the wave barrier, the sequence for installing the permanent barge ramp pipe piles would begin with advancement through overlying sediment with a vibratory hammer, followed by use of an impact hammer to drive the piles into bedrock.

Table 2. Temporary and Permanent Pile Details.

Component	**Stage**	**Type**	**Quantity**	**Size**
Dock[1,2]	Template[3]	Steel H or pipe	60	12 in
	Permanent	Steel pipe	43	18 in
Wave Barrier	Permanent	Sheet	32	NZ 26
	Permanent	Steel H	16	W40 x 199
Dolphin Fenders[4]	Template[3]	Steel H or pipe	4	12 in
	Permanent	Steel pipe	4	18 in
	Permanent	Steel pipe	2	30 in
Barge Landing	Template[3]	Steel H or pipe	20	12 in
	Permanent	Steel pipe	35	18 in
	Permanent	Sheet	34	NZ 26
Total	Template[3]		84	
	Permanent		166	

[1] Includes piles for the approach, end section, platform, and floating dock.
[2] Number of piles for dock is based on 25-ft approach trestle width.
[3]Noise from installation and removal of the template piles is considered in the analysis, therefore template pile count equates to two times 84 or 168 but the actual number of piles to be installed is 84. Template piles were assumed to be 12-in. diameter for modeling.
[4]For two dolphin fender systems

Vibratory hammers are commonly used in steel pile driving or removal where sediments allow. Generally, the pile is placed into position using a choker and crane, and then vibrated between 1,200 and 2,400 vibrations per minute. The vibrations liquefy the sediment surrounding the pile allowing it to penetrate to the required seating depth, or to be removed.

Impact hammers are used to install plastic/steel core, wood, concrete, or steel piles. An impact hammer is a steel device that works like a piston. The pile is first moved into position and set in the proper location using a choker cable or vibratory hammer. The impact hammer is held in place by a guide (lead) that aligns the hammer with the pile. A heavy piston moves up and down, striking the top of the pile and driving it into the substrate. Once the pile is set in place, pile installation with an impact hammer can take less than 15 minutes under good substrate conditions. However, under poor conditions, such as glacial till and bedrock or exceptionally loose material, piles can take longer to set.

The DTH drill/hammer acts on a shoe at the bottom of the pile and uses a pulsing mechanism to break up rock below the pile while simultaneously installing the pile through the rock formation. Rotating bit wings extend below the pile and remove the broken rock fragments as the pile advances. The pulsing sounds produced by the DTH hydro-hammer method reduces sound attenuation because the noise is primarily contained within the steel pile and below ground rather than impact hammer driving methods which occur at the top of the pile (R&M 2016). Therefore, the pulsing sounds produced by this method are considered less harmful than those produced by impact hammer driving. Table 3 provides a summary of the six methods of construction (“scenarios”) used in the modeling of the zone of influence (ZOI)s for the Biorka Project.

Table 3. Pile Driving Modeling Scenarios for the Biorka Project.

Scenario	Description	Piles installed per day	Vibratory		DTH		Impact		Shift (hr)
			Hrs per pile	Total hours per day	Hours per pile	Total hours per day	Hours per pile	Total strikes per day	
S1	Removal of existing piles and installation/removal of temporary piles	21	0.33	6.93	NA[1]		NA		6.93
S2	Installation of 18-inch pipe piles (dock and dolphin)	3		0.99	2	6	0.17	15	7.49
S3	Installation of 18-inch pipe piles (barge	4		1.32	NA		0.33	2720	2.65
S4	Installation of 30-inch pipe piles (dolphins)	2		0.66	2	4	0.17	10	4.99
S5	Installation of H piles (dock wave barrier)	8		2.64	NA		0.33	5440	5.31
S6	Installation of sheet piles (dock wave barrier and barge landing)	12		3.96	NA		0.25	6120	6.96

[1]NA indicates when a pile driving method was not required in a given scenario.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see *Proposed Mitigation* and *Proposed Monitoring and Reporting*).

Description of Marine Mammals in the Area of the Specified Activity

There are five marine mammal species that may likely transit through the waters nearby the Project area, and are expected to potentially be taken by the specified activity. These include the Steller sea lion (*Eumetopias jubatus*), harbor seal (*Phoca vitulina*), harbor porpoise (*Phocoena phocoena*), killer whale (*Orcinus orca*), and humpback whale (*Megaptera noviaeangliae*). Multiple additional marine mammal species may occasionally enter Sitka sound but would not be expected to occur in shallow nearshore waters of the action area.

Sections 3 and 4 of the FAA's application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SAR; *www.nmfs.noaa.gov/pr/sars/*) and more general information about these species (*e.g.*, physical and behavioral descriptions) may be found on NMFS's website (*www.nmfs.noaa.gov/pr/species/mammals/*).

Table 4 lists all species with expected potential for occurrence in Symonds Bay and Sitka Sound and summarizes information related to the population or stock, including potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2016). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality are included here as gross indicators of the status of the species and other threats.

Species that could potentially occur in the proposed survey areas, but are not expected to have reasonable potential to be harassed by in-water construction, are described briefly but omitted from further analysis. These include extralimital species, which are species that do not normally occur in a given area but for which there are one or more occurrence records that are considered beyond the normal range of the species. Gray whales are observed in and outside of

Sitka Sound during their northward spring migration; however, they occur generally north and west of the Project area in outer shelf waters of Sitka Sound near Kruzof Island during the construction window. Dall's porpoise are observed in mid- to outer- shelf coastal waters of Sitka Sound ranging to the Gulf of Alaska and are not expected to occur in the Project area during the construction window. Pacific white-sided dolphins occur in the outer shelf-slope in the Gulf of Alaska, which is outside of the Project area. During the construction window, they are considered rare in Sitka Sound. Sperm whales generally occur in deeper waters in the Gulf of Alaska, which is outside of the Project area. We do not anticipate gray whales, Dall's porpoise, Pacific white-sided dolphins, or sperm whales to be affected by Project activities; therefore, we do not discuss these species further. For status of species, we provide information regarding U.S. regulatory status under the MMPA and Endangered Species Act (ESA).

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS's U.S. Pacific SARs (Muto *et al.*, 2017). All values presented in Table 4 are the most recent available at the time of publication and are available in the 2016 SARs (Muto *et al.*, 2017)

Table 4. Marine Mammals Potentially Present in the Vicinity of Biorka Island.

Species	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR[3]	Annual M/SI[4]	Relative occurrence in Symonds Bay and Sitka Sound; season of occurrence
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Phocoenidae (porpoises)						
Harbor porpoise (*Phocoena phocoena*)	Southeast Alaska	-; Y	11,146 (0.242; n/a; 1997)	Undet.	34	Common
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae (dolphins)						
Killer whale (*Orcinus orca*)	Eastern North pacific Gulf of Alaska, Aleutian Island, and Bering Sea Transient	-; N	587 (n/a; 587; 2012)	0	0	Infrequent
	West Coast Transient	-; N	243 (n/a; 243; 2009)	2.4	0	
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Balaenopteridae						
Humpback whale[5] (*Megaptera novaeangliae*)	Central North Pacific stock	-; Y	10,103 (0.300; 7,890; 2006)	83	24	Likely
Order Carnivora – Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions)						
Steller sea lion (*Eumetopias jubatus)*	Western	E; Y	49,497 (n/a; 49,497; 2014)	297	236	Common
	Eastern	-; N	60,131 (n/a; 36,551; 2013)	1,645	108	
Family Phocidae (earless seals)						
Harbor seal (*Phoca vitulina*)	Sitka/Chatham	-; N	14,855 (n/a; 13,212; 2011)	155	77	Common

[1]Endangered Species Act (ESA) status: Yes (Y), No (N), Endangered (E), Threatened (T)/ Marine Mammal Protection Act (MMPA) status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR (see footnote 3) or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2]CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For certain stocks, abundance estimates are actual counts of animals and there is no associated CV. The most recent abundance survey that is reflected in the abundance estimate is presented; there may be more recent surveys that have not yet been incorporated into the estimate.

[3]Potential biological removal, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (OSP).

[4]These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (e.g., commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

[5]The humpback whales considered under the MMPA to be part of this stock could be from any of two different DPSs. In Alaska, it would be expected to primarily be whales from the Hawaii DPS but could also be whales from Mexico DPS.

Below, for those species that are likely to be taken by the activities described, we offer a brief introduction to the species and relevant stock. We also provide information regarding population trends and threats, and describe any information regarding local occurrence.

In Southeast Alaska, marine mammal distributions and seasonal increases in their abundance are strongly influenced by seasonal pre-spawning and spawning aggregations of forage fish, particularly Pacific herring (*Clupea pallasii*), eulachon (*Thaleichthys pacificus*) and Pacific salmon (*Onchorynchus spp.*) (Marston *et al.,* 2002, Sigler *et al.,* 2004, Womble *et al.,* 2005; USACE 2013). All five species of salmon are found in Sitka Sound and are preyed upon by Steller sea lions, harbor seals, and killer whales. However, there are no salmon spawning streams in the vicinity of the Project or presence of eulachon or herring during the construction time period that would tend to aggregate foraging marine mammals.

Herring are the keystone species in Southeast Alaska, especially Sitka Sound, serving as a vital link between lower trophic levels, including crustaceans and small fish, and higher trophic levels (NMFS 2014a). Foraging studies of Steller sea lions suggest that during their non-breeding season, they forage on seasonally densely aggregated prey (Sinclair and Zepplin 2002). In southeast Alaska, Pacific herring typically spawn from March to May and attract large numbers of predators (Marston *et al.*, 2002, Womble 2003). The relationship between humpback whales and Steller sea lions and these ephemeral fish runs is so strong in Sitka Sound that the seasonal abundance and distribution of marine mammals reflects the distribution of pre-spawning and spawning herring, and overwintering aggregations of adult herring in Sitka Sound. The largest aggregations of several species of marine mammals in the Action Area target Pacific herring during spring and again in late fall through the winter. Pacific herring are largely absent from Sitka Sound and the Action Area from May, following spawning season, until at least October, prior to adult overwintering in Sitka Sound (NMFS 2014a).

Steller sea lion

Steller sea lions are divided in to two distinct population segments (DPSs): the western DPS (wDPS) and the eastern DPS (eDPS). The wDPS is listed as endangered under the ESA. The wDPS breeds on rookeries located west of 144°W in Alaska and Russia, whereas the eDPS breeds on rookeries in southeast Alaska through California. The majority of Steller sea lions are part of the non-listed eDPS. The best available information indicates the eDPS has increased at a rate of 4.18 percent per year between 1979 and 2010 (Allen and Angliss 2014). Steller sea lions range from the North Pacific Rim from northern Japan to California, with centers of abundance located in the Gulf of Alaska and Aleutian Islands. Large numbers of individuals disperse widely outside of the breeding season (late May to early July), thus potentially intermixing with animals from other areas to access seasonally important prey resources (Allen and Angliss 2014). The distinction between western and eastern DPS individuals cannot be confirmed unless an animal has been marked, and since guidance on how to otherwise distinguish between the two DPSs is not available, for this IHA it is assumed that 50 percent of the Steller sea lions observed in the Project area are from each DPS.

Critical habitat for Steller sea lions includes designated haulouts within the range of the eDPS, and all marine waters within 20 nautical miles of rookeries and haulouts within the breeding range of the wDPS and within three special aquatic foraging areas in Alaska (NMFS 1993). In identifying aquatic habitats as part of critical habitat, NMFS specifically highlighted several components of such habitats: nearshore waters around rookeries and haulouts; traditional rafting sites; food resources; and foraging habitats. Adequate food resources are an essential feature of the Steller sea lion's aquatic habitat (NMFS 1993). The closest haulout/rookery to the Project area that has been designated as a Steller sea lion critical habitat is listed as "Biorka Island" in the critical habitat descriptions. However, the haulout is actually on Kaiuchali Island, a three-acre rocky islet located slightly less than one mile southwest of Biorka Island, outside of the ZOI for this project.

This species occurs in coastal and nearshore habitats of Sitka Sound, and forage on herring and salmon throughout the Sound. Both DPSs occur in the Project area on a year-round basis. Kaiuchali Island is used as a sea lion rookery in spring-summer and as a haulout during the non-breeding seasons (Fritz *et al*. 2016). Based on results of recent aerial surveys, there has been an increase of sea lions that use Kaiuchali Island during both the breeding and non-breeding seasons. In June 2013, Fritz *et al.*, (2016) documented 22 individuals, none of which were pups. In June 2015, the same study recorded 77 Steller sea lions, including one pup. This limited information shows an increase in the numbers of animals at this location and indicates that the site has become a recently-established eDPS rookery.

The breeding season for Steller sea lions does not overlap with proposed summer construction activity at the Project site, and the location of the rookery at Kaiuchali Island is outside the Project area, opposite Biorka Island. The late fall and overwintering aggregation of adult herring results in hundreds of animals using Kaiuchali Island as a haulout during this period; however, the construction period for the proposed Project would not overlap with the overwintering aggregations of sea lions. Steller sea lions are present in Sitka Sound in very low numbers over the summer months when construction is planned, during the interval between herring spawning and the return of adult herring to Sitka Sound. Prey availability for Steller sea lions in Sitka Sound is limited during this period as compared to other seasons, and they are generally only observed by the whale watch industry as individuals or in small groups of three to five animals. During this period, sea lions tend to forage in the vicinity of recreational and commercial fishing vessels, or scavenge in very shallow waters near the Sitka town docks when the vessels return from fishing.

Harbor seal

Harbor seals inhabit coastal and estuarine waters off Alaska. Harbor seals in Southeast Alaska are considered non-migratory with local movements attributed to factors such as prey availability, weather, and reproduction. In 2010, NMFS identified 12 stocks of harbor seals in Alaska based on genetic structure (Allen and Angliss 2015). The Sitka/Chatham (S/C) stock is genetically distinct and believed to be year-round residents of the region. Although generally solitary in the water, harbor seals congregate at haulouts to rest, socialize, breed, and molt. Habitats used as haul-out sites include tidal rocks, bayflats, sandbars, and sandy beaches (Zeiner *et al*., 1990).

Harbor seals are opportunistic feeders that forage on fish and invertebrates and often adjust their distribution to take advantage of locally and seasonally abundant prey. Aggregations of adult herring during spring pre-spawning and spawning runs, and again from October throughout the winter, are a very important seasonal prey species for harbor seals in Sitka Sound. The minimum count of harbor seals within Sitka Sound during the 2011 aerial survey was approximately 900 individuals occupying 25 haulout locations (unpublished data from MML dataset). The largest count of seals in Sitka Sound (n = 745) during the 2011 survey occurred at several adjacent rocky outcroppings and islands (Vitskari Rocks, Vitskari Island and Low Island) located approximately 15 miles (24 km) north of the Project site in northcentral Sitka Sound inside Kruzof Island. This is outside of the Project Area. Prey species moving into Sitka Sound from the Gulf of Alaska move past these islands so pinnipeds aggregate at these rocks to forage. There are six haulout locations identified in the extreme southern portion of the Sitka Sound, and potentially in the Project Area, including rocky outcroppings near Biorka Island, where seals have been observed in low numbers. Prey resources inside Symonds Bay are limited, particularly when compared to the northern coastal areas of Sitka Sound. While individual seals may occur in Symonds Bay, it is unlikely that seals would be attracted to Symonds Bay to forage. While their occurrence in the Action Area is possible, it is infrequent to uncommon and only small numbers of approximately five animals per day are expected to potentially be in the Project area during the construction window.

Harbor porpoise

In the Pacific, harbor porpoise are found in coastal and inland waters from Point Conception, California to Alaska and across to Kamchatka and Japan (Gaskin 1984). Harbor porpoise appear to have more restricted movements along the western coast of the continental

U.S. than along the eastern coast. In the Gulf of Alaska and Southeast Alaska they are observed most frequently in waters less than 350 ft (107 m) deep (Dahlheim *et al*., 2009). There are three harbor porpoise stocks in Alaska: the Bering Sea Stock; the Southeast Alaska Stock; and the Gulf of Alaska Stock (Angliss and Allen 2015). Only the Southeast Alaska stock occurs in the Project area. The mean group size of harbor porpoise in Southeast Alaska is estimated at two to three individuals (Dahlheim *et al.,* 2009).

This species can be found in Sitka Sound throughout the year but individuals are infrequently observed during the summer months by the whale watching industry. Harbor porpoise are infrequently observed in nearshore Sitka Sound areas in summer by hikers on the coastal trails that parallel the coastline near Sitka. At times throughout the year, they likely forage exclusively on herring and may be more abundant when herring are present. During surveys for seabirds, marine mammals and forage fish conducted in Sitka Sound during July 2000, relatively few marine mammals were observed during this period. However, one harbor porpoise was observed in coastal/shelf waters of northeast Sitka Sound (Piatt and Dragoo 2005).

Killer whale

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

Killer whales that are observed in Southeast Alaska could belong to one of three different stocks: Eastern North Pacific Northern Resident Stock (Northern residents); Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock (Gulf of Alaska transients); or West Coast Transient Stock. The Gulf of Alaska Transient Stock occupies a range that includes southeastern Alaska. Resident killer whales do not occur in Sitka Sound. However, transient killer whales from either the Gulf of Alaska transient group or West Coast Transient Stock have been observed in the sound. These whales are observed infrequently during summer months with five to six sightings noted throughout the summer by the whale-watching industry. Dahlheim *et al.* (2009) found that transient killer whale mean group size ranged from four to six individuals in Southeast Alaska. Generally, transient killer whales follow movements of, and prey on, Steller sea lions and harbor seals. Killer whales have been observed in the waters outside of Sitka Sound near the haulouts at Kaiuchali Island and outside of Kruzof Island when sea lions are present. This behavioral distribution is characteristic of killer whales and consistent with killer whale sightings around other Steller sea lion haul-out locations in southeast Alaska (Dahlheim *et al*., 2009). Given the low numbers of Steller sea lions in Sitka Sound during summer, it is consistent that transient killer whales would be considered infrequent to uncommon in the Project area during these months.

Humpback whale

Humpback whales were listed as endangered under the ESA in 1970. As a result of the ESA listing, the central North Pacific Stock of humpback whale was also designated as depleted under the MMPA. The humpback whale is also considered a strategic stock under the MMPA. NMFS proposed a revised species-wide listing of the humpback whale in 2015 and a revision to the status of humpback whale DPSs was finalized by NMFS on September 8, 2016 (NMFS 2016b), effective October 11, 2016. In the final decision, NMFS recognized the existence of 14 DPSs, classified four of those as endangered and one as threatened, and determined that the remaining nine DPSs do not warrant protection under the ESA. Three DPSs of humpback whales occur in waters off the coast of Alaska: the endangered Western North Pacific (WNP) DPS, the threatened Mexico DPS, and the Hawaii DPS, which is not listed under the ESA. Humpback whales in Southeast Alaska are most likely to be from the Hawaii DPS (93.9 percent probability) (Wade *et al*., 2016).

The humpback whales of Southeast Alaska and Northern British Columbia form a genetically discrete feeding aggregation and return to specific feeding locations in southeast Alaska including Sitka Sound. Humpback whale seasonal distribution varies from infrequent (very low in number during summer), to common (very abundant during late fall through spring). Humpback whales are most abundant in Sitka Sound from late fall through April when they forage on large densities of herring (Liddle *et al.*, 2015a). The seasonal increase in whale abundance corresponds to increases in Pacific herring biomass during pre-spawning, spawning and overwintering periods (Liddle *et al.*, 2015b). Whales feed on large schools of adult, over-wintering herring throughout winter, and on pre-spawning and spawning aggregations of herring in spring. Sitka Sound is believed to be a last feeding stop for humpback whales as they migrate to winter breeding and calving waters in Hawaii. During winter months, groups of 30 to 40 humpback whales have been observed by the whale watching industry from the coastline of Sitka Sound. However, humpback whales stagger their departure from the feeding grounds, suggesting they also stagger their return. This could create the impression that whales had been present throughout the entire winter in the sound when it is unlikely that any individual whale remains in Sitka Sound throughout the entire winter (Heintz *et al.*, 2010). The abundance of humpbacks in Sitka Sound changes by several orders of magnitude from one season to another in response to dense schools of herring in the sound (Liddle *et al*., 2015b). They are generally present in large numbers from late fall-early winter through mid- to late spring, but are infrequent to uncommon during the mid-summer months when herring are absent. During mid-summer, tour boat operators generally observe four to five whales per day near rocky islets in the middle of Sitka Sound.

Potential Effects of the Specified Activity on Marine Mammals and their Habitat

This section includes a summary and discussion of the ways that components of the specified activity (*e.g.*, sound produced by pile driving and removal) may impact marine mammals and their habitat. The *Estimated Take by Incidental Harassment* section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis* section will consider the content of this section, the *Estimated Take by Incidental Harassment* section and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Description of Sound Sources

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks of a sound wave; lower frequency sounds have longer wavelengths than higher frequency sounds. Amplitude is the height of the sound pressure wave or the ‘loudness’ of a sound and is typically measured using the decibel (dB) scale. A dB is the ratio between a measured pressure (with sound) and a reference pressure (sound at a constant pressure, established by scientific standards). It is a logarithmic unit that accounts for large variations in amplitude; therefore, relatively small changes in dB ratings correspond to large changes in sound pressure. When referring to sound pressure levels (SPLs; the sound force per unit area), sound is referenced in the context of underwater sound pressure to 1 microPascal (µPa). One pascal is the pressure resulting from a force of one newton exerted over an area of one square meter. The source level (SL) represents the sound level at a distance of 1 m from the source (referenced to 1 µPa). The received level is the sound level at the listener's position. Note that all underwater sound levels in this document are referenced to a pressure of 1 µPa and all airborne sound levels in this document are referenced to a pressure of 20 µPa.

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Rms is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick 1983). Rms accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in all directions away from the source (similar to ripples on the surface of a pond), except in cases where the source is directional. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson *et al*., 1995), and the sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, waves, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic sound (*e.g.*, vessels, dredging, aircraft, construction). A number of sources contribute to ambient sound, including the following (Richardson *et al*., 1995):

- Wind and waves: The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient noise for frequencies between 200 Hz and 50 kilohertz (kHz) (Mitson 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf noise becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions.

- Precipitation: Sound from rain and hail impacting the water surface can become an important component of total noise at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times.

- Biological: Marine mammals can contribute significantly to ambient noise levels, as can some fish and shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz.

- Anthropogenic: Sources of ambient noise related to human activity include transportation (surface vessels and aircraft), dredging and construction, oil and gas drilling and production, seismic surveys, sonar, explosions, and ocean acoustic studies. Shipping noise typically dominates the total ambient noise for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly (Richardson *et al*., 1995). Sound from identifiable anthropogenic sources other than the activity of interest (*e.g.*, a passing vessel) is sometimes termed background sound, as opposed to ambient sound.

The sum of the various natural and anthropogenic sound sources at any given location and time – which comprise “ambient” or “background” sound – depends not only on the source levels (as determined by current weather conditions and levels of biological and shipping activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 dB from day to day (Richardson *et al*., 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

In-water construction activities associated with the Project would include impact pile driving, vibratory pile driving and removal, and DTH drilling. The sounds produced by these activities fall into one of two general sound types: pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.*, Ward 1997 in Southall *et al*., 2007). Please see Southall *et al*., (2007) for an in-depth discussion of these concepts.

Pulsed sound sources (*e.g*., explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI 1986; Harris 1998; NIOSH 1998; ISO 2003; ANSI 2005) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI 1995; NIOSH 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g*., rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Impact hammers operate by repeatedly dropping a heavy piston onto a pile to drive the pile into the substrate. Sound generated by impact hammers is characterized by rapid rise times and high peak levels, a potentially injurious combination (Hastings and Popper 2005). Vibratory hammers install piles by vibrating them and allowing the weight of the hammer to push them into the sediment. Vibratory hammers produce significantly less sound than impact hammers. Peak SPLs may be 180 dB or greater, but are generally 10 to 20 dB lower than SPLs generated during impact pile driving of the same-sized pile (Oestman *et al*., 2009). Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (Nedwell and Edwards 2002; Carlson *et al*., 2005).

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals, and exposure to sound can have deleterious effects. To appropriately assess these potential effects, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g*., Richardson *et al*., 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al*. (2007) recommended that marine mammals be divided into functional hearing groups based on measured or estimated hearing ranges on the basis of available behavioral data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. The lower and/or upper frequencies for some of these functional hearing groups have been modified from those designated by Southall *et al*. (2007). The marine mammal hearing groups and the associated frequencies are indicated below in Table 5 (note that these frequency ranges do not necessarily correspond to the range of best hearing, which varies by species).

Table 5. Marine mammal hearing groups and their generalized hearing range.

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz

Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz
***** Represents the generalized hearing range for the entire group as a composite (*i.e.*, all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al*., 2007) and PW pinniped (approximation).	

As mentioned previously in this document, five marine mammal species (three cetaceans and two pinnipeds) may occur in the Project area. Of these three cetaceans, one is classified as a low-frequency cetacean (*i.e*. humpback whale), one is classified as a mid-frequency cetacean (*i.e.*, killer whale), and one is classified as a high-frequency cetacean (*i.e*., harbor porpoise) (Southall *et al.*, 2007). Additionally, harbor seals are classified as members of the phocid pinnipeds in water functional hearing group, while Steller sea lions are grouped under the Otariid pinnipeds in water functional hearing group. A species' functional hearing group is a consideration when we analyze the effects of exposure to sound on marine mammals.

Acoustic Impacts

Please refer to the information given previously (*Description of Sound Sources*) regarding sound, characteristics of sound types, and metrics used in this document. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following; temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al*., 1995; Gordon *et al*., 2004; Nowacek *et al*., 2007; Southall *et al*., 2007; Gotz *et al*., 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. We first describe specific manifestations of acoustic effects before providing discussion specific to the FAA's construction activities.

Richardson *et al*. (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e*., when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e*., permanent hearing impairment, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that the FAA's activities may result in such effects (see below for further discussion). Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak *et al*., 1999; Schlundt *et al*., 2000; Finneran *et al*., 2002, 2005b). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al*., 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e*., tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al*., 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g*., Ward 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals – PTS data exists only for a single harbor seal (Kastak *et al*., 2008) – but are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several dB above a 40-dB threshold shift approximates PTS onset; *e.g*., Kryter *et al*., 1966; Miller, 1974) that inducing mild TTS (a 6-dB threshold shift approximates TTS onset; *e.g*., Southall *et al*., 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as impact pile driving pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al*., 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.*, change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al*., 2006; Southall *et al*., 2007; Zimmer and Tyack 2007). The FAA's activities do not involve the use of devices such as explosives or mid-frequency active sonar that are associated with these types of effects.

When a live or dead marine mammal swims or floats onto shore and is incapable of returning to sea, the event is termed a "stranding" (16 U.S.C. 1421h(3)). Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series (*e.g.*, Geraci *et al*., 1999). However, the cause or causes of most strandings are unknown (*e.g.*, Best 1982). Combinations of dissimilar stressors may combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other would not be expected to produce the same outcome (*e.g.*, Sih *et al*., 2004). For further description of stranding events see, *e.g.*, Southall *et al*., 2006; Jepson *et al*., 2013; Wright *et al*., 2013.

1. *Temporary threshold shift* – TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture.

Depending on the degree (elevation of threshold in dB), duration (*i.e.*, recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during a time when communication is critical for successful mother/calf interactions could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin (*Tursiops truncatus*), beluga whale (*Delphinapterus leucas)*, harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis)*) and three species of pinnipeds (northern elephant seal, harbor seal, and California sea lion) exposed to a limited number of sound sources (*i.e.*, mostly tones and octave-band noise) in laboratory settings (*e.g.*, Finneran *et al*., 2002; Nachtigall *et al*., 2004; Kastak *et al*., 2005; Lucke *et al*., 2009; Popov *et al*., 2011). In general, harbor seals (Kastak *et al*., 2005; Kastelein *et al*., 2012a) and harbor porpoises (Lucke *et al*., 2009; Kastelein *et al*., 2012b) have a lower TTS onset than other measured pinniped or cetacean species. Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al*. (2007) and Finneran and Jenkins (2012).

2. *Behavioral effects* – Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific

and any reactions depend on numerous intrinsic and extrinsic factors (*e.g*., species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g*., Richardson *et al*., 1995; Wartzok *et al*., 2003; Southall *et al*., 2007; Weilgart, 2007; Archer *et al*., 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al*., 2012), and can vary depending on characteristics associated with the sound source (*e.g*., whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B-C of Southall *et al*. (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al*., 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a "progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial," rather than as, more generally, moderation in response to human disturbance (Bejder *et al*., 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al*., 1995; NRC 2003; Wartzok *et al*., 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al*., 1997; Finneran *et al*., 2003). Observed responses of wild marine mammals to loud-pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; see also Richardson *et al*., 1995; Nowacek *et al*., 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.*, Lusseau and Bejder 2007; Weilgart 2007; NRC 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.*, Frankel and Clark 2000; Costa *et al*., 2003; Ng and Leung 2003; Nowacek *et al*., 2004; Goldbogen *et al.*, 2013a,b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.*, foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.*, bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.*, Croll *et al.*, 2001; Nowacek *et al.*; 2004; Madsen *et al.*, 2006; Yazvenko *et al.*, 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.*, Kastelein *et al.*, 2001, 2005b, 2006; Gailey *et al.*, 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.*, 2000; Fristrup *et al.*, 2003; Foote *et al.*, 2004), while right whales (*Eubalaena glacialis*) have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al*., 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al*., 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al*., 1995). For example, gray whales (*Eschrictius robustus*) are known to change direction – deflecting from customary migratory paths – in order to avoid noise from seismic surveys (Malme *et al*., 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g*., Bowles *et al*., 1994; Goold, 1996; Stone *et al*., 2000; Morton and Symonds, 2002; Gailey *et al*., 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g*., Blackwell *et al*., 2004; Bejder *et al*., 2006; Teilmann *et al*., 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g*., directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e*., when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g*., Beauchamp and Livoreil 1997; Fritz *et al*., 2002; Purser and Radford 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g*., decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g*., Harrington and Veitch, 1992; Daan *et al*., 1996; Bradshaw *et al*., 1998). However, Ridgway *et al*. (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al*., 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al*., 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

3. *Stress responses* – An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.*, Seyle 1950; Moberg 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress – including immune competence, reproduction, metabolism, and behavior – are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.*, Moberg 1987; Blecha 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al*., 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and "distress" is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g*., Holberton *et al*., 1996; Hood *et al*., 1998; Jessop *et al*., 2003; Krausman *et al*., 2004; Lankford *et al*., 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker 2000; Romano *et al*., 2002b) and, more rarely, studied in wild populations (*e.g*., Romano *et al*., 2002a). For example, Rolland *et al*. (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as "distress." In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

4. *Auditory masking* – Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g*., those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al*., 1995). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g*., snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g*., shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g*., signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g*., sensitivity,

frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting or altering critical behaviors. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.*, Clark *et al*., 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.*, Miller *et al*., 2000; Foote *et al*., 2004; Parks *et al*., 2007b; Di Iorio and Clark 2009; Holt *et al*., 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al*., 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore 2014). Masking can be tested directly in captive species (*e.g.*, Erbe 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.*, Branstetter *et al*., 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g*., from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Acoustic Effects, Underwater

Potential Effects of DTH drilling and Pile Driving and Removal Sound – The effects of sounds from DTH drilling and pile driving and removal might include one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson *et al*., 1995; Gordon *et al*., 2003; Nowacek *et al*., 2007; Southall *et al*., 2007). The effects of pile driving and removal or drilling on marine mammals are dependent on several factors, including the type and depth of the animal; the pile size and type, and the intensity and duration of the pile driving/removal or drilling sound; the substrate; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving and removal and DTH drilling activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the frequency, received level, and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. In addition, substrates that are soft (*e.g*., sand) would absorb or attenuate the sound more readily than hard substrates (*e.g*., rock), which may reflect the acoustic wave. Soft porous substrates would also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

In the absence of mitigation, impacts to marine species could be expected to include physiological and behavioral responses to the acoustic signature (Viada *et al*., 2008). Potential effects from impulsive sound sources like pile driving can range in severity from effects such as behavioral disturbance to temporary or permanent hearing impairment (Yelverton *et al*., 1973).

Hearing Impairment and Other Physical Effects— Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shifts. PTS constitutes injury, but TTS does not (Southall *et al*., 2007). Based on the best scientific information available, the SPLs for the construction activities in this Project are below the thresholds that could cause TTS or the onset of PTS (Table 6).

Non-auditory Physiological Effects—Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.*, 2006; Southall *et al.*, 2007). Studies examining such effects are limited. In general, little is known about the potential for pile driving or removal to cause auditory impairment or other physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would presumably be limited to short distances from the sound source and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected

(Southall *et al.*, 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of pile driving, including some odontocetes and some pinnipeds, are especially unlikely to incur auditory impairment or non-auditory physical effects.

Disturbance Reactions

Responses to continuous sound, such as vibratory pile installation, have not been documented as well as responses to pulsed sounds. With both types of pile driving, it is likely that the onset of pile driving could result in temporary, short term changes in an animal's typical behavior and/or avoidance of the affected area. These behavioral changes may include (Richardson *et al.*, 1995): changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or flight responses (*e.g.*, pinnipeds flushing into water from haul-outs or rookeries). Pinnipeds may increase their haul-out time, possibly to avoid in-water disturbance (Thorson and Reyff 2006). If a marine mammal responds to a stimulus by changing its behavior (*e.g.*, through relatively minor changes in locomotion direction/speed or vocalization behavior), the response may or may not constitute taking at the individual level, and is unlikely to affect the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals, and if so potentially on the stock or species, could potentially be significant (*e.g.*, Lusseau and Bejder 2007; Weilgart 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, or reproduction. Significant behavioral modifications that could potentially lead to effects on growth, survival, or reproduction include:

- Drastic changes in diving/surfacing patterns (such as those thought to cause beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Longer-term habitat abandonment due to loss of desirable acoustic environment; and
- Longer-term cessation of feeding or social interaction.

The onset of behavioral disturbance from anthropogenic sound depends on both external factors (characteristics of sound sources and their paths) and the specific characteristics of the receiving animals (hearing, motivation, experience, demography) and is difficult to predict (Southall *et al.*, 2007).

Auditory Masking

Natural and artificial sounds can disrupt behavior by masking. The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Because sound generated from in-water pile driving and removal and DTH drilling is mostly concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds made by porpoises. The most intense underwater sounds in the proposed action are those produced by impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, sound from these sources would likely be within the audible range of marine mammals present in the Project area. Impact pile driving activity is relatively short-term, with rapid pulses occurring for approximately fifteen minutes per pile. The probability for impact pile driving resulting from this proposed action masking acoustic signals important to the behavior and survival of marine mammal species is low. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for approximately one and a half hours per pile. It is possible that vibratory pile driving resulting from this proposed action may mask acoustic signals important to the behavior and survival of marine mammal species, but the short-term duration and limited affected area would result in insignificant impacts from masking. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for DTH drilling and vibratory and impact pile driving, and which have already been taken into account in the exposure analysis.

Acoustic Effects, Airborne - Pinnipeds that occur near the Project site could be exposed to airborne sounds associated with pile driving and removal and DTH drilling that have the potential to cause behavioral harassment, depending on their distance from pile driving activities. Cetaceans are not expected to be exposed to airborne sounds that would result in harassment as defined under the MMPA.

Airborne noise will primarily be an issue for pinnipeds that are swimming or hauled out near the Project site within the range of noise levels elevated above the acoustic criteria. We recognize that pinnipeds in the water could be exposed to airborne sound that may result in behavioral harassment when looking with their heads above water. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater sound. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon the area and move further from the source. However, these animals would previously have been ‘taken’ as a result of exposure to underwater sound above the behavioral harassment thresholds, which are in all cases larger than those associated with airborne sound. Thus, the behavioral harassment of these animals is already accounted for in these estimates of potential take. Multiple instances of exposure to sound above NMFS' thresholds for behavioral harassment are not believed to result in increased behavioral disturbance, in either nature or intensity of disturbance reaction. Therefore, we do not believe that authorization of incidental take resulting from airborne sound for pinnipeds is warranted, and airborne sound is not discussed further here.

Anticipated Effects on Habitat

The proposed activities at the Project area would not result in permanent negative impacts to habitats used directly by marine mammals, but may have potential short-term impacts to food sources such as forage fish and may affect acoustic habitat (see masking discussion above). There are no known foraging hotspots or other ocean bottom structure of significant biological importance to marine mammals present in the marine waters of the Project area during the construction window. Therefore, the main impact issue associated with the proposed activity would be temporarily elevated sound levels and the associated direct effects on marine mammals, as discussed previously in this document. The primary potential acoustic impacts to marine mammal habitat are associated with elevated sound levels produced by vibratory and impact pile driving and removal and DTH drilling in the area. However, other potential impacts to the surrounding habitat from physical disturbance are also possible.

In-water Construction Effects on Potential Prey (Fish)

Construction activities would produce continuous (*i.e.*, vibratory pile driving and DTH drilling) and pulsed (*i.e.* impact driving) sounds. Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (*e.g.*, Scholik and Yan 2001, 2002; Popper and Hastings 2009). Sound pulses at received levels of 160 dB may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Pearson *et al.*, 1992; Skalski *et al.*, 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality.

The most likely impact to fish from pile driving and drilling activities at the Project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the short timeframe for the Project.

Pile Driving Effects on Potential Foraging Habitat

The area likely impacted by the Project is relatively small compared to the available habitat in Sitka Sound (*e.g.*, most of the impacted area is limited to inside Symonds Bay, and some scenarios include a ZOI that extends several km into Sitka Sound (see the FAA's application)). Avoidance by potential prey (*i.e.*, fish) of the immediate area due to the temporary loss of this foraging habitat is also possible. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity in Sitka Sound.

The duration of the construction activities is relatively short. The construction window is for a maximum of 70 days and each day, construction activities would only occur for a few hours during the day. Impacts to habitat and prey are expected to be minimal based on the short duration of activities.

In summary, given the short daily duration of sound associated with individual pile driving and drilling events and the relatively small areas being affected, pile driving and drilling activities associated with the proposed action are not likely to have a permanent, adverse effect on any fish habitat, or populations of fish species. Thus, any impacts to marine mammal habitat are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

Estimated Take by Incidental Harassment

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of whether the number of takes is "small" and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would be by Level A and Level B harassment, in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to vibratory and impact pile driving and removal and DTH drilling, and potential PTS for animals that may transit through the Level A zones undetected. Based on the nature of the activity and the anticipated effectiveness of the mitigation measures (*i.e.*, soft start, ramp-up, etc. – discussed in detail below in *Proposed Mitigation* section), Level A harassment is not anticipated; however, a small number of takes by Level A harassment are proposed to be authorized for all species as a precaution if animals go undetected before a shutdown is in place.

As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Described in the most basic way, we estimate take by considering: 1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; 2) the area or volume of water that will be ensonified above these levels in a day; 3) the density or occurrence of marine mammals within these ensonified areas; and, 4) and the number of days of activities. Below, we describe these components in more detail and present the proposed take estimate.

The estimation of marine mammal takes typically uses the following calculation since site-specific density is unavailable:

Level B exposure estimate = N (number of animals) in the area * Number of days of noise generating activities.

Acoustic Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment for non-explosive sources – Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.*, frequency, predictability, duty cycle), the environment (*e.g.*, bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.*, 2007, Ellison *et al.*, 2011). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa (rms) for continuous (*e.g*. vibratory pile-driving, drilling) and above 160 dB re 1 μPa (rms) for non-explosive impulsive (*e.g.*, seismic airguns) or intermittent (*e.g.*, scientific sonar) sources.

The FAA's proposed activities include the use of continuous (vibratory pile driving and DTH drilling) and impulsive (impact pile driving) sources, and therefore the 120 and 160 dB re 1 μPa (rms) are applicable.

Level A harassment for non-explosive sources - NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2016) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). The FAA's proposed activity includes the use of impulsive (impact pile driving) and non-impulsive (vibratory pile driving and DTH drilling) sources.

These thresholds were developed by compiling and synthesizing the best available science and soliciting input multiple times from both the public and peer reviewers to inform the final product, and are provided in the table below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2016 Technical Guidance, which may be accessed at: *http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm*.

Table 6. Thresholds Identifying the Onset of Permanent Threshold Shift.

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	Impulsive	Non-impulsive
Low-frequency cetaceans	*Cell 1* Lpk,flat: 219 dB LE,LF,24h: 183 dB	*Cell 2* LE,LF,24h: 199 dB
Mid-frequency cetaceans	*Cell 3* Lpk,flat: 230 dB LE,MF,24h: 185 dB	*Cell 4* LE,MF,24h: 198 dB
High-frequency cetaceans	*Cell 5* Lpk,flat: 202 dB LE,HF,24h: 155 dB	*Cell 6* LE,HF,24h: 173 dB
Phocid Pinnipeds (underwaters)	*Cell 7* Lpk,flat: 218 dB LE,PW,24h: 185 dB	*Cell 8* LE,PW,24h: 201 dB
Otariid Pinnipeds (underwater)	*Cell 9* Lpk,flat: 232 dB LE,OW,24h: 203 dB	*Cell 10* LE,OW,24h: 219 dB

[1]NMFS 2016

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds.

Pile driving and removal and DTH drilling generates underwater noise that can potentially result in disturbance to marine mammals in the Project area. Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

$TL = B * \log_{10}(R_1/R_2)$, where

R_1 = the distance of the modeled SPL from the driven pile, and

R_2 = the distance from the driven pile of the initial measurement.

This formula neglects loss due to scattering and absorption, which is assumed to be zero here. The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the water bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6 dB reduction in sound level for each doubling of distance from the source (20*log[range]). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source (10*log[range]). A practical spreading value of 15 is often used under conditions, such as at the Biorka Island dock, where water increases with depth as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions. Practical spreading loss (4.5 dB reduction in sound level for each doubling of distance) is assumed here.

Underwater Sound – The intensity of pile driving and removal sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. A number of studies, primarily on the west coast, have measured sound produced during underwater pile driving projects. These data are largely for impact driving of steel pipe piles and concrete piles as well as vibratory driving of steel pipe piles.

JASCO Applied Sciences (JASCO) conducted acoustic modeling of pile installation and removal activities planned for the Project, which is included as Appendix A of the FAA’s application. To assess potential underwater noise exposure of marine mammals during construction activities, Quijano and Austin (2017) determined source levels for six different construction scenarios (see Table 3). The source levels are frequency-dependent and suitable for modeling underwater acoustic propagation using JASCO's Marine Operations Noise Model (MONM). The modeling predicted the extent of ensonification and the acoustic footprint from construction activities, taking into account the effects of pile driving equipment, bathymetry, sound speed profile, and seabed geoacoustic parameters. Auditory weighting was applied to the modeled sound fields to estimate received levels relative to hearing sensitivities of five marine mammal hearing groups following NMFS 2016 guidance.

The results are based on currently adopted sound level thresholds for auditory injury (Level A) expressed as peak pressure level (PK) and 24-hr sound exposure level (SEL), and behavioral disturbance (Level B) expressed as sound pressure level (SPL). Using these guidelines, Quijano and Austin (2017) calculated the maximum extent (distance and ensonified areas) of the Level A and Level B exposure zones for each marine mammal functional hearing group. This was calculated for both impact and vibratory pile driving of 18- and 30-in piles for each of the following six Project scenarios.

The model required as input, source sound levels in 1/3-octave bands between 10 Hz and 25 kHz. Source levels for sheet pile and H pile installation were obtained from literature, but the available measurements did not cover the full frequency spectrum of interest; data for vibratory installation of sheet and H piles were available to maximum frequencies of 4 kHz and 10 kHz, respectively. Modeling of the six construction scenarios at the Project site on Biorka Island followed three steps:

1. Piles driven into the sediment by impact, vibratory, or downhole drilling were characterized as sound-radiating sources. Source levels in 1/3-octave-bands were obtained by modeling or by adjusting source levels found in the literature. The exact method to obtain the

1/3-octave-band levels depends on the pile geometry and pile driving equipment, and it is described on a case-by-case basis (see Appendix A);

2. Underwater sound propagation was applied to predict how sound propagates from the pile into the water column as a function of range, depth, and azimuthal direction. Propagation depends on several conditions including the frequency content of the sound, the bathymetry, the sound speed in the water column, and sediment geoacoustics; and

3. The propagated sound field was used to compute received levels over a grid of simulated receivers, from which distances to criteria thresholds and maps of ensonified areas were generated.

Modeled results are presented as tables of distances at which SPLs or SELs fell below thresholds defined by criteria. For marine mammal injury, the Level A thresholds considered here follow the NMFS guidelines (NMFS 2016). A detailed description of the modeling process is provided in Appendix A of the FAA’s IHA application.

Table 7. Modeled Distances to Level A and Level B Exposure Thresholds from Vibratory and Impulsive Sources Modeled Distances to Exposure Thresholds for Non-Impulsive Sources.

			Distance to Level A Threshold (m)[1]											
			S1[2]		**S2**		**S3**		**S4**		**S5**		**S6**	
Functional Hearing Group	**Level A Vibratory Threshold** *(dB re1 $\mu Pa^2 \cdot s$)*	**Level A Impulse Threshold** *(dB re1 $\mu Pa^2 \cdot s$)*	Vibratory	Impulse	Vibratory	Impulse	Vibratory	Impulse	Vibratory	Impulse	Vibratory	Impulse	Vibratory	Impulse
LFC[3]	199	183	10	NA	350	30	10	630	260	80	-	670	40	1,360
MFC[4]	198	185	-	NA	10	-	-	10	10	-	-	130	<10	220
HFC[5]	173	155	-	NA	510	50	-	770	360	90	10	2,050	10	2,930
PPW[6]	201	185	-	NA	80	<10	-	200	60	10	-	290	10	770
OPW[7]	219	203	-	NA	-	-	-	10	-	-	-	<10	-	80
	Level B Vibratory Threshold *(dB re1 $\mu Pa^2 \cdot s$)*	**Level B Impulse Threshold** *(dB re1 $\mu Pa^2 \cdot s$)*	**Distance to Level B Threshold (m)**[1]											
All marine mammals	120	160	1,800	NA	10,002	710	4,270	550	10,002	1,250	790	430	4,720	790

[1]$R_{95\%}$ as modeled in Appendix A (Quijano and Austin 2017).

[2]Scenario 1 does not include impulsive sources.

[3]Low-frequency cetaceans, humpback whales.

[4]Mid-frequency cetaceans, killer whales.

[5]High-frequency cetaceans, harbor porpoise.

[6]Phocid pinnipeds in water, harbor seals.

[6]Otariid pinnipeds in water, Steller sea lions.

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations.

At-sea densities for marine mammal species have not been determined for marine mammals in Sitka Sound; therefore, all estimates here are determined by using observational data from biologists, peer-reviewed literature, and information obtained from personal communication with researchers and state and Federal biologists, and from local charter boat operators.

Harbor Seals

Harbor seals are expected to be in the Project area in low numbers (see *Description of Marine Mammals in the Area of the Specified Activity* Section). We estimate that up to five harbor seals per day may be present in the Project area on all days of construction. Therefore, we propose to authorize 350 takes by Level B harassment. Because the Level A ZOI for harbor seals is nearly 1 km, the FAA requests up to two harbor seal takes by Level A harassment if the animals enter the ZOI undetected and marine mammal observers (MMO)s are not able to request a shutdown prior to the seals being exposed to potential Level A harassment.

Steller sea lion

Steller sea lion abundance in the Project area is dependent on prey availability. Prey species are uncommon during the Project window; therefore, sea lion abundance is expected to be low. The FAA estimates that five sea lions may be in the Project area every day (70 days) of construction, therefore, we estimate that 350 sea lions may be taken by Level B harassment. We estimate that these takes would be split equally between the eDPS and wDPS (175 each). The Level A zone is less than 10 m; however, to be conservative, the FAA is requesting a small group of Steller sea lions to be taken by Level A harassment. This would equate to six total animals if split equally by DPS (3 each).

Humpback whale

Humpback whales are found in Sitka Bay seasonally. During mid-summer, tour boats generally see four to five whales per day, in the middle of Sitka Sound. Therefore, a count of 5 humpback whales per day (70 days) was used to estimate takes per day on every day of construction for a total of 350 takes by Level B harassment. All takes would be from the Central North Pacific stock under the MMPA. For ESA purposes, 93.9 percent would be from the Hawaii DPS (328 animals) and 6.1 percent would be from the Mexico stock (22 animals) based on Wade *et al*., 2016. The maximum distance at which a humpback whale may be exposed to noise levels that exceed Level A thresholds is 1.4 km during Scenario 6. Even though the ensonified area extends outside of the entrance to Symonds Bay, a MMO stationed near the mouth of the bay at Hanus Point would be able to see a humpback whale outside Symonds Bay before it enters the Level A zone and could shut down the noise producing activity to avoid Level A take. In the unlikely event a whale would go undetected and enter the Level A zone, the FAA has requested three takes by Level A harassment for humpback whales. We estimate that all three humpback whales would be from the Hawaii DPS.

Killer whale

Generally, transient killer whales follow the movements of Steller sea lions and harbor seals on which they prey. Given the low numbers of Steller sea lions in Sitka Sound during summer, it is consistent that transient killer whales would also be rare or infrequent in the Project area (*e.g.*, killer whales were only observed on five or six days by the whale watching industry). Small groups of 5 to 6 transient killer whales per day could be observed throughout the summer months; therefore, we estimate that a group of 6 animals could enter the Project area on 6 occasions during the construction window, for a total of 36 takes by Level B harassment. No Level A takes of killer whales is proposed to be authorized for this species. The maximum linear distance to the Level A threshold for killer whales is less than 250 m from the source and a MMO would be able to observe animals at this distance and shutdown activities in time to avoid Level A take.

Harbor porpoise

Harbor porpoise are expected to occur in the Project area in low numbers during the construction window. Sightings during this time period are infrequent; this species is not observed every day. The mean group size of harbor porpoise in Southeast Alaska was estimated to be between 2 to 3 individuals (Dahlheim *et al*., 2009); therefore, we conservatively estimate that a group of three harbor porpoise may be present every other day of construction for a total of 105 takes by Level B harassment. The distances to Level A thresholds for harbor porpoise (HFC) are largest during impulse driving under Scenarios 5 and 6 (see Table 3), and extend beyond the entrance to Symonds Bay. The duration of Scenarios 5 and 6 is expected to be 21 days (see Table 3); therefore, we expect that a small group of three harbor porpoise may enter the Level A zone on half of the days of Scenarios 5 and 6 (10.5 days) for a total of 32 takes by Level A harassment.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate.

All estimates are conservative and include the following assumptions:

- All pilings installed at each site would have an underwater noise disturbance equal to the piling that causes the greatest noise disturbance *(i.e*., the piling farthest from shore) installed with the method that has the ZOI. The largest underwater disturbance (Level B) ZOI would be produced by DTH drilling; therefore take estimates were calculated using the vibratory pile-driving ZOIs. The ZOIs for each threshold are not spherical and are truncated by land masses on either side of the Project area, which would dissipate sound pressure waves.
- Exposures were based on an estimated total of 70 work days. Each activity ranges in amount of days needed to be completed (Table 3).

- All marine mammal individuals potentially available are assumed to be present within the relevant area, and thus incidentally taken;
- An individual can only be taken once during a 24-hour period; and,
- Exposures to sound levels at or above the relevant thresholds equate to take, as defined by the MMPA.

Estimates of potential instances of take may be overestimates of the number of individuals taken. In the context of stationary activities such as pile driving and in areas where resident animals may be present, this number represents the number of total take that may accrue to a smaller number of individuals, with some number of animals being exposed more than once per individual. While pile driving and removal can occur any day throughout the in-water work window, and the analysis is conducted on a per day basis, only a fraction of that time (typically a matter of hours on any given day) is actually spent pile driving/removal. The potential effectiveness of mitigation measures in reducing the number of takes is typically not quantified in the take estimation process. For these reasons, these take estimates may be conservative.

Table 8. Calculations for Incidental Take Estimation.

Species	Takes proposed to be authorized by Level A harassment	Takes proposed to be authorized by Level B harassment
Steller sea lion Eastern and Western stock	6	350
Harbor seal	2	350
Humpback whale	3	350
Killer whale Eastern North pacific Gulf of Alaska, Aleutian Island, and Bering Sea Transient stock and West Coast Transient stock	0	36
Harbor porpoise	32	105

Proposed Mitigation

In order to issue an IHA under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully balance two primary factors:

1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat – which considers the nature of the potential adverse impact being mitigated (likelihood, scope, range), as well as the likelihood that the measure will be effective if implemented; and the likelihood of effective implementation, and;

2) The practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

The ZOIs were used to develop mitigation measures for pile driving and removal activities at the Project area. The ZOIs effectively represent the mitigation zone that would be established around each pile to prevent Level A harassment to marine mammals, while providing estimates of the areas within which Level B harassment might occur. In addition to the specific measures described later in this section, the FAA would conduct briefings between construction supervisors and crews, marine mammal monitoring team, and staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

Monitoring and Shutdown for Construction Activities

The following measures would apply to the FAA's mitigation through shutdown and disturbance zones:

Shutdown Zone – For all pile driving activities, the FAA will establish a shutdown zone intended to contain the area in which SPLs equal or exceed the auditory injury criteria for cetaceans and pinnipeds. The purpose of a shutdown zone is to define an area within which shutdown of activity would occur upon sighting of a marine mammal (or in anticipation of an animal entering the defined area), thus preventing injury of marine mammals (as described previously under *Potential Effects of the Specified Activity on Marine Mammals*, serious injury or death are unlikely outcomes even in the absence of mitigation measures). Modeled radial distances for shutdown zones are shown in Table 9. However, a minimum shutdown zone of 10 m will be established during all pile driving activities, regardless of the estimated zone; and

Disturbance Zone – Disturbance zones are the areas in which SPLs equal or exceed 160 and 120 dB rms (for impulse and continuous sound, respectively). Disturbance zones provide utility for monitoring conducted for mitigation purposes (*i.e.*, shutdown zone monitoring) by establishing monitoring protocols for areas adjacent to the shutdown zones. Monitoring of disturbance zones enables observers to be aware of and communicate the presence of marine mammals in the Project area but outside the shutdown zone and thus prepare for potential shutdowns of activity. However, the primary purpose of disturbance zone monitoring is for documenting instances of Level B harassment; disturbance zone monitoring is discussed in greater detail later (see *Proposed Monitoring and Reporting*). Nominal radial distances for disturbance zones are shown in Table 9.

Given the size of the disturbance zone for vibratory pile driving and DTH drilling, it is impossible to guarantee that all animals would be observed or to make comprehensive observations of fine-scale behavioral reactions to sound, and only a portion of the zone (*e.g.*, what may be reasonably observed by visual observers stationed between Symonds Bay and Sitka Sound) would be observed. In order to document observed instances of harassment, monitors record all marine mammal observations, regardless of location. The observer's location, as well as the location of the pile being driven, is known from a GPS. The location of the animal is estimated as a distance from the observer, which is then compared to the location from the pile. It may then be estimated whether the animal was exposed to sound levels constituting incidental harassment on the basis of predicted distances to relevant thresholds in post-processing of observational and acoustic data, and a precise accounting of observed incidences of harassment created. This information may then be used to extrapolate observed takes to reach an approximate understanding of actual total takes.

Table 9. Distances to Level A Shutdown and Level B Exposure Zones.

	Distance to Level A Shutdown zone (m)[1]

	Scenario 1[2]		Scenario 2[3]		Scenario 3		Scenario 4[3]		Scenario 5		Scenario 6	
	22 days		16 days		9 days		2 days		5 days		16 days	
Species	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse
Harbor Porpoise	-	-	600	50	-	800	400	100	10	1,600[4]	80	1,600[4]
Humpback whales	10	-	400	30	10	700	300	80	-	700	40	1,400
Harbor Seals	-	-	80	<10	-	200	60	10	-	300	10	800
Killer whales	-	-	10	-	-	10	10	-	-	150	<10	250
Steller sea lions	-	-	-	-	-	10	-	-	-	10	-	80
	Distance to Level B Exposure Zones (m)[1]											
All marine mammals	1,800	-	10,100[5]	800	5,000	600	10,100[5]	1,300	800	430	5,000	800

NOTE: Vibratory and impulse hammering will not happen simultaneously; there will be sufficient time tor MMOs to be notified and to adjust monitoring as needed. An MMO will be stationed at the mouth of the bay about 800 m from the noise source. Pink shading indicates monitoring and potential shutdown for presence outside of the bay is required. Green shading indicates monitoring for shutdown or counting as a Level B take if an animal enters the bay.

[1]From Table 6-3 rounded up as appropriate.

[2]Scenario 1 does not include impulse hammering

[3]Includes DTH drilling (non-impulsive).

[4]Actual Level A zone is larger (see Table 6-3), but 1.6 km (1 mile) is considered to be a reasonable distance to monitor.

[5]Takes will be extrapolated due to these large monitoring zones.

Monitoring Protocols – Monitoring would be conducted before, during, and after pile driving and vibratory removal activities. In addition, observers shall record all instances of marine mammal occurrence, regardless of distance from activity, and shall document any behavioral reactions in concert with distance from piles being driven. Observations made outside the shutdown zone will not result in shutdown; that pile segment would be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point all pile driving activities would be halted. Monitoring will take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving and removal activities. Pile driving activities include the time to install or remove a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than 30 minutes. Please see Section 11 of the FAA's application (*www.nmfs.noaa.gov/pr/permits/incidental/construction.htm*), for the FAA's proposed monitoring protocols.

The following additional measures apply to visual monitoring:

(1) Monitoring will be conducted by qualified observers, who will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. A minimum of two observers will be required for all pile driving/removal activities. Marine Mammal Observer (MMO) requirements for construction actions are as follows:

(a) Independent observers (*i.e.*, not construction personnel) are required;

(b) At least one observer must have prior experience working as an observer;

(c) Other observers (that do not have prior experience) may substitute education (undergraduate degree in biological science or related field) or training for experience;

(d) Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer; and

(e) NMFS will require submission and approval of observer resumes.

(2) Qualified MMOs are trained biologists, and need the following additional minimum qualifications:

(a) Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target;

(b) Ability to conduct field observations and collect data according to assigned protocols

(c) Experience or training in the field identification of marine mammals, including the identification of behaviors;

(d) Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;

(e) Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury from construction sound of marine mammals observed within a defined shutdown zone; and marine mammal behavior; and

(f) Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

(3) Prior to the start of pile driving activity, the shutdown zone will be monitored for 15 minutes to ensure that it is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals; animals will be allowed to remain in the shutdown zone (*i.e.*, must leave of their own volition) and their behavior will be monitored and documented. The shutdown zone may only be declared clear, and pile driving started, when the entire shutdown zone is visible (*i.e.*, when not obscured by dark, rain, fog, *etc*.).

In addition, if such conditions should arise during impact pile driving that is already underway, the activity would be halted.

(4) If a marine mammal approaches or enters the shutdown zone during the course of pile driving operations, activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of small cetaceans and pinnipeds, and 30 minutes for humpback whales. Monitoring will be conducted throughout the time required to drive a pile.

(5) Using delay and shut-down procedures, if a species for which authorization has not been granted or if a species for which authorization has been granted but the authorized takes are met, approaches or is observed within the Level B harassment zone, activities will shut down immediately and not restart until the animals have been confirmed to have left the area.

Soft Start

The use of a soft start procedure is believed to provide additional protection to marine mammals by warning or providing a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. This procedure is repeated two additional times. It is difficult to specify the reduction in energy for any given hammer because of variation across drivers and, for impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in “bouncing” of the hammer as it strikes the pile, resulting in multiple “strikes.” For impact driving, we require an initial set of three strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then 2 subsequent 3 strike sets. Soft start will be required at the beginning of each day’s impact pile driving work and at any time following a cessation of impact pile driving of 30 minutes or longer.

Timing Restrictions

The FAA will only conduct construction activities during daytime hours. Construction will also be restricted to the months of May through September to avoid overlap with times when marine mammals have higher densities in the Project area.

We have carefully evaluated the FAA's proposed mitigation measures and considered their effectiveness in past implementation to preliminarily determine whether they are likely to effect the least practicable impact on the affected marine mammal species and stocks and their habitat.

Any mitigation measure(s) we prescribe should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(1) Avoidance or minimization of injury or death of marine mammals wherever possible (goals 2, 3, and 4 may contribute to this goal);

(2) A reduction in the number (total number or number at biologically important time or location) of individual marine mammals exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only);

(3) A reduction in the number (total number or number at biologically important time or location) of times any individual marine mammal would be exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only);

(4) A reduction in the intensity of exposure to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing the severity of behavioral harassment only);

(5) Avoidance or minimization of adverse effects to marine mammal habitat, paying particular attention to the prey base, blockage or limitation of passage to or from biologically important areas, permanent destruction of habitat, or temporary disturbance of habitat during a biologically important time; and

(6) For monitoring directly related to mitigation, an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on our evaluation of the FAA's proposed measures, as well as any other potential measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical to both compliance and ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

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

Visual Marine Mammal Observations

The FAA will collect sighting data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of activity. All MMOs will be trained in marine mammal identification and behaviors and are required to have no other construction-related tasks while conducting monitoring. A minimum of two MMOs will be required for all pile driving/removal activities. The FAA will monitor the shutdown zone and disturbance zone before, during, and after pile driving, with observers located at the best practicable vantage points. Based on our requirements, the FAA would implement the following procedures for pile driving and removal:

- MMOs would be located at the best vantage point(s) in order to properly see the entire shutdown zone and as much of the disturbance zone as possible;
- During all observation periods, observers will use binoculars and the naked eye to search continuously for marine mammals;
- If the shutdown zones are obscured by fog or poor lighting conditions, pile driving at that location will not be initiated until that zone is visible. Should such conditions arise while impact driving is underway, the activity would be halted; and
- The shutdown and disturbance zones around the pile will be monitored for the presence of marine mammals before, during, and after any pile driving or removal activity.

Data Collection

We require that observers use approved data forms. Among other pieces of information, the FAA will record detailed information about any implementation of shutdowns, including the distance of animals to the pile and description of specific actions that ensued and resulting behavior of the animal, if any. In addition, the FAA will attempt to distinguish between the number of individual animals taken and the number of incidences of take. We require that, at a minimum, the following information be collected on the sighting forms:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (*e.g.*, percent cover, visibility);
- Water conditions (*e.g.*, sea state, tide state);

- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel, and if possible, the correlation to SPLs;
- Distance from pile driving or removal activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (*e.g.*, shutdown or delay);
- Locations of all marine mammal observations; and
- Other human activity in the area.

Reporting

A draft report would be submitted to NMFS within 90 days of the completion of marine mammal monitoring, or 60 days prior to the requested date of issuance of any future IHA for projects at the same location, whichever comes first. The report will include marine mammal observations pre-activity, during-activity, and post-activity during pile driving and removal days, and will also provide descriptions of any behavioral responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within 30 days following resolution of comments on the draft report.

Negligible Impact Analysis and Determinations

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.*, intensity, duration), the context of any responses (*e.g.*, critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Pile driving and removal activities associated with the dock replacement Project, as outlined previously, have the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level A and Level B harassment (PTS and behavioral disturbance), from underwater sounds generated from pile driving and removal. Potential takes could occur if individuals of these species are present in the ensonified zone when pile driving and removal occurs. Most of the Level A takes are precautionary as marine mammals are not expected to enter and stay in the Level A ensonified area for the duration needed to incur PTS. However, if all authorized takes be Level A harassment were to occur, they would be of small numbers compared to the stock sizes and would not adversely affect the stock through effects on annual rates of recruitment or survival. Additionally, the FAA's mitigation measures, including a shutdown of construction activities if animals enter the Level A zone, further reduces the chance for PTS in marine mammals. Therefore, the effects to marine mammals are expected to be negligible.

No TTS, serious injury, or mortality is anticipated given the nature of the activities and measures designed to minimize the possibility of injury to marine mammals. The potential for these outcomes is minimized through the construction method and the implementation of the planned mitigation measures. Specifically, vibratory and impact hammers and drilling will be the primary methods of installation. Impact pile driving produces short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks. If impact driving is necessary, implementation of soft start and shutdown zones significantly reduces any possibility of injury. Given sufficient "notice" through use of soft start (for impact driving), marine mammals are expected to move away from a sound source that is annoying prior to it becoming potentially injurious, however, as noted previously a small number of potential takes by PTS are proposed for authorization and have been analyzed. The FAA will use a minimum of two MMOs stationed strategically to increase detectability of marine mammals, enabling a high rate of success in implementation of shutdowns to avoid injury.

The FAA's proposed activities are localized and of relatively short duration (a maximum of 70 days for pile driving and removal). The entire Project area is limited to Symonds Bay and into Sitka Sound for some scenarios. These localized and short-term noise exposures may cause short-term behavioral modifications in harbor seals, Steller sea lions, harbor porpoises, killer whales, and humpback whales. Moreover, the proposed mitigation and monitoring measures are expected to reduce the likelihood of injury. Additionally, no important feeding and/or reproductive areas for marine mammals are known to be within the ensonified area during the construction window.

Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.*, Thorson and Reyff 2006; Lerma 2014). Significant behavioral modifications that could potentially lead to effects on growth, survival, or reproduction are not expected to occur given the short duration and small scale of the project activities. Most likely, individuals will simply move away from the sound source and be temporarily displaced from the areas of pile driving and drilling, although even this reaction has been observed primarily only in association with impact pile driving. Thus, even repeated Level B harassment of some small subset of the overall stock is unlikely to result in any significant realized decrease in fitness for the affected individuals, and thus would not result in any adverse impact to the stock as a whole. Non-auditory physiological effects and masking are not expected to occur from the FAA's Project activities.

The Project also is not expected to have significant adverse effects on affected marine mammals' habitat. The Project activities would not modify existing marine mammal habitat for a significant amount of time. The activities may cause some fish to leave the area of disturbance, thus temporarily impacting marine mammals' foraging opportunities in a limited portion of the foraging range. However, because of the short duration of the activities and the relatively small area of the habitat that may be affected, and the decreased potential of prey species to be in the Project area during the construction work window, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No mortality or serious injury is anticipated or authorized;
- Level B harassment may consist of, at worst, temporary modifications in behavior (*e.g.* temporary avoidance of habitat or changes in behavior);
- The lack of important feeding, pupping, or other areas in the action area during the construction window;
- Mitigation is expected to minimize the likelihood and severity of the level of harassment; and
- The small percentage of the stock that may be affected by Project activities (< 15 percent for all stocks).

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the FAA's construction activities will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Section 101(a)(5)(D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

Table 10 details the number of instances that animals could be exposed to received noise levels that could cause Level A and Level B harassment for the proposed work at the Project site relative to the total stock abundance. The numbers of animals authorized to be taken for all species would be considered small relative to the relevant stocks or populations even if each estimated instance of take occurred to a new individual – an extremely unlikely scenario. The total percent of the population (if each instance was a separate individual) for which take is requested is less than 15 percent for all stocks (Table 10). For pinnipeds, especially harbor seals occurring in the vicinity of the Project area, there will almost certainly be some overlap in individuals present day-to-day, and the number of individuals taken is expected to be notably lower.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Table 10. Estimated Numbers and Percentage of Stock That May Be Exposed to Level A and Level B Harassment.

Species	Proposed Authorized Level A	Proposed Authorized Level B	Stock(s) Abundance Estimate[1]	Percentage of Total Stock (percent)

	Takes	Takes		
Harbor Seal (*Phoca vitulina*) *Sitka/Chatham stock*	2	350	14,855	2.37
Steller sea lion (*Eumatopias jubatus*) *Western U.S. Stock* *Eastern U.S. Stock*	6	350	50,983 41,638	0.698 0.855
Killer whale (*Orcinus orca*) *Eastern North Pacific, Gulf of AK, Aleutian Island, and Bering Sea Transient Stock* *West Coast Transient Stock*	0	36	587 243	6.13 14.8
Humpback whale (*Megaptera noviaengliae*) *Central North Pacific Stock*	3	350	10,103	3.49
Harbor Porpoise (*Phocoena phocoena*) *Southeast Alaska Stock*	32	105	11,146	1.23

[1] All stock abundance estimates presented here are from the 2016 Alaska Stock Assessment Report

Unmitigable Adverse Impact Analysis and Determination

In order to issue an IHA, NMFS must find that the specified activity will not have an "unmitigable adverse impact" on the subsistence uses of the affected marine mammal species or stocks by Alaskan Natives. NMFS has defined "unmitigable adverse impact" in 50 CFR 216.103 as: an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) Placing physical barriers between the marine mammals and the subsistence hunters; and (2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

Harbor seals and Steller sea lions are subsistence harvested in Alaska. During 2012, the estimated subsistence take of harbor seals in southeast Alaska was 595 seals with 49 of these taken near Sitka (Wolfe *et al.*, 2013). This is the lowest number of seals taken since 1992 (Wolfe *et al.*, 2013) and is attributed to the decline in subsistence hunting pressure over the years as well as a decrease in efficiency per hunter (Wolf *et al.*, 2013).

The peak hunting season in southeast Alaska occurs during the month of November and again over the March to April time frame (Wolfe *et al.*, 2013). This corresponds to times when seals are aggregated in shoal areas as they prey on forage species such as herring, making them easier to find and hunt.

The proposed Project is in an area where subsistence hunting for harbor seals or sea lions could occur (Wolfe *et al.*, 2013), but the location is not preferred for hunting. There is little to no hunting documented in the vicinity and there are no harvest quotas for non-listed marine mammals. For these reasons and the fact that Project activities would occur outside of the primary subsistence hunting seasons, there would be no impact on subsistence activities or on the availability of marine mammals for subsistence use.

To satisfy requirements under Section 106 of the National Historic Preservation Act, R&M Consultants, Inc. reached out to the Sitka Tribe of Alaska, Central Council of the Tlingit and Haida, and Sealaska regarding cultural resources in 2016. No issues or concerns with the Project were raised during this effort

Based on the description of the specified activity, the measures described to minimize adverse effects on the availability of marine mammals for subsistence purposes, and the proposed mitigation and monitoring measures, NMFS has preliminarily determined that there will not be an unmitigable adverse impact on subsistence uses from the FAA's proposed activities.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq*.) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally, in this case with the Alaska regional Protected Resources Division Office, whenever we propose to authorize take for endangered or threatened species.

NMFS is proposing to authorize take of two DPSs (*i.e*., wDPS of Steller sea lions and Mexico DPS of humpback whales), which are listed under the ESA. The Permit and Conservation Division has requested initiation of Section 7 consultation with the Alaska Region for the issuance of this IHA. NMFS will conclude the ESA consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to the FAA for conducting their Biorka Island Dock Replacement Project, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. This section contains a draft of the IHA itself. The wording contained in this section is proposed for inclusion in the IHA (if issued).

1. This IHA is valid for 1 year from May 1, 2018 through April 30, 2019.

2. This IHA is valid only for pile driving and removal activities associated with the Biorka Island Dock Replacement Project in Symonds Bay, Alaska from May 1 to September 30, 2018.

3. General Conditions

(a) A copy of this IHA must be in the possession of the FAA, its designees, and work crew personnel operating under the authority of this IHA.

(b) The species authorized for taking are summarized in Table 11.

(c) The taking, by Level A and Level B harassment, is limited to the species listed in condition 3(b). See Table 1 for numbers of take authorized.

Table 11. Authorized Take Numbers.

Species	Authorized Take	
	Level A	Level B
Harbor seal	2	350
California sea lion	6	350
Harbor porpoise	32	105
Killer whale	0	36
Humpback whale	3	350

(d) The taking by injury (Level A harassment), serious injury, or death of the species listed in condition 3(b) of the Authorization or any taking of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this IHA, unless authorization of take by Level A harassment is listed in condition 3(b) of this Authorization.

(e) The FAA shall conduct briefings between construction supervisors and crews, marine mammal monitoring team, and staff prior to the start of all pile driving and removal activities, and when new personnel join the work.

4. Mitigation Measures

The holder of this Authorization is required to implement the following mitigation measures.

(a) For all pile driving and removal, the FAA shall implement a minimum shutdown zone of 10 m radius around the pile. Additionally, the FAA shall implement shutdown zones for each construction scenario as presented in Table 12. If a marine mammal comes within or approaches the applicable shutdown zone, such operations shall cease.

Table 12. Distances to Level A Shutdown and Level B Exposure Zones.

	Distance to Level A Shutdown zone (m)											
	Scenario 1		**Scenario 2**		**Scenario 3**		**Scenario 4**		**Scenario 5**		**Scenario 6**	
	22 days		16 days		9 days		2 days		5 days		16 days	
Species	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse	Continuous	Impulse
Harbor Porpoise	-	-	600	50	-	800	400	100	10	1,600[4]	80	1,600[4]
Humpback whales	10	-	400	30	10	700	300	80	-	700	40	1,400
Harbor Seals	-	-	80	<10	-	200	60	10	-	300	10	800
Killer whales	-	-	10	-	-	10	10	-	-	150	<10	250
Steller sea lions	-	-	-	-	-	10	-	-	-	10	-	80
	Distance to Level B Exposure Zones (m)											
All marine mammals	1,800	-	10,100[5]	800	5,000	600	10,100[5]	1,300	800	430	5,000	800

(b) For in-water heavy machinery work other than pile driving (*e.g.*, standard barges, tug boats, barge-mounted excavators, or clamshell equipment used to place or remove material), if a marine mammal comes within 10 meters, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions.

(c) The FAA shall establish monitoring locations as described below. Please also refer to the FAA’s application (see *www.nmfs.noaa.gov/pr/permits/incidental/construction.htm).*

i. For all pile driving and removal activities, a minimum of two observers shall be deployed, with one positioned to achieve optimal monitoring of the shutdown zones and the second positioned to achieve optimal monitoring of surrounding waters of Biorka dock and portions of Symonds Bay and Sitka Sound. If practicable, the second observer should be deployed to an elevated position with clear sight lines to the Project area.

ii. These observers shall record all observations of marine mammals, regardless of distance from the pile being driven, as well as behavior and potential behavioral reactions of the animals.

iii. All observers shall be equipped for communication of marine mammal observations amongst themselves and to other relevant personnel (*e.g.*, those necessary to effect activity delay or shutdown).

(d) Monitoring shall take place from 15 minutes prior to initiation of pile driving and removal activity through 30 minutes post-completion of pile driving and removal activity. In the event of a delay or shutdown of activity resulting from marine mammals in the shutdown zone, animals shall be allowed to remain in the shutdown zone (*i.e.*, must leave of their own volition) and their behavior shall be monitored and documented. Monitoring shall occur throughout the time required to drive a pile. The shutdown zone must be determined to be clear during periods of good visibility (*i.e.*, the entire shutdown zone and surrounding waters must be visible to the naked eye).

(e) If a marine mammal approaches or enters the shutdown zone, all pile driving and removal activities at that location shall be halted. If pile driving is halted or delayed due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or fifteen minutes have passed without re-detection of small cetaceans and pinnipeds and 30 minutes for humpback whales.

(f) Using delay and shut-down procedures, if a species for which authorization has not been granted or if a species for which authorization has been granted but the authorized takes are met, approaches or is observed within the Level B harassment zone (Table 2), activities will shut down immediately and not restart until the animals have been confirmed to have left the area.

(g) Monitoring shall be conducted by qualified observers. Trained observers shall be placed from the best vantage point(s) practicable to monitor for marine mammals and implement shutdown or delay procedures when applicable through communication with the equipment operator. Observer training must be provided prior to project start and in accordance with the monitoring measures in the application, and shall include instruction on species identification (sufficient to distinguish the species listed in 3(b)), description and categorization of observed behaviors and interpretation of behaviors that may be construed as being reactions to the specified activity, proper completion of data forms, and other basic components of biological monitoring, including tracking of observed animals or groups of animals such that repeat sound exposures may be attributed to individuals (to the extent possible).

(h) The FAA shall use soft start techniques recommended by NMFS for impact pile driving. Soft start requires contractors to provide an initial set of strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy strike sets. Soft start shall be implemented at the start of each day’s impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.

(i) Pile driving shall only be conducted during daylight hours.

5. Monitoring

The holder of this Authorization is required to conduct marine mammal monitoring during pile driving and removal activities. Marine mammal monitoring and reporting shall be conducted in accordance with the monitoring measures in the application.

(a) The FAA shall collect sighting data and behavioral responses to pile driving and removal and drilling activities for marine mammal species observed in the region of activity during the period of activity. All observers shall be trained in marine mammal identification and behaviors, and shall have no other construction-related tasks while conducting monitoring.

(b) For all marine mammal monitoring, the information shall be recorded as described in the monitoring measures section of the application.

6. Reporting

The holder of this Authorization is required to:

(a) Submit a draft report on all monitoring conducted under the IHA within 90 days of the completion of marine mammal monitoring, or 60 days prior to the issuance of any subsequent IHA for projects at the Project area, whichever comes first. A final report shall be prepared and submitted within thirty days following resolution of comments on the draft report from NMFS. This report must contain the informational elements described in the application, at minimum (see *www.nmfs.noaa.gov/pr/permits/incidental/construction.htm*), and shall also include:

i. Detailed information about any implementation of shutdowns, including the distance of animals to the pile and description of specific actions that ensued and resulting behavior of the animal, if any.

ii. Description of attempts to distinguish between the number of individual animals taken and the number of incidents of take, such as ability to track groups or individuals.

iii. An estimated total take estimate extrapolated from the number of marine mammals observed during the course of construction activities, if necessary.

(b) Reporting injured or dead marine mammals:

i. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as a serious injury or mortality, the FAA shall immediately cease the specified activities and report the incident to the Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinator. The report must include the following information:

A. Time and date of the incident;

B. Description of the incident;

C. Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);

D. Description of all marine mammal observations in the 24 hours preceding the incident;

E. Species identification or description of the animal(s) involved;

F. Fate of the animal(s); and

G. Photographs or video footage of the animal(s).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with the FAA to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The FAA may not resume their activities until notified by NMFS.

ii. In the event that the FAA discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.*, in less than a moderate state of decomposition), the FAA shall immediately report the incident to the Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinator.

The report must include the same information identified in 6(b)(i) of this IHA. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the FAA to determine whether additional mitigation measures or modifications to the activities are appropriate.

iii. In the event that the FAA discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), the FAA shall report the incident to the Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. The FAA shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS.

7. This Authorization may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein, or if NMFS determines the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Request for Public Comments

We request comment on our analyses, the draft authorization, and any other aspect of this Notice of Proposed IHAs for the FAA's dock replacement construction activities. Please include with your comments any supporting data or literature citations to help inform our final decision on the FAA's request for MMPA authorization.

Dated: August 24, 2017.

Donna S. Wieting,

Director,

Office of Protected Resources,

National Marine Fisheries Service.

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