UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802-1668

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion

Port of Alaska Cargo Terminals Replacement (CTR) Project, Anchorage, Alaska

NMFS Consultation Number: AKRO-2024-02213

Action Agencies: National Marine Fisheries Service (NMFS), Office of Protected Resources, Permits and Conservation Division; U.S. Army Corps of Engineers (USACE)

Affected Species and Determinations:

ESA-Listed Species	Status	Is the Action Likely to Adversely Affect Species?	Is the Action Likely to Adversely Affect Critical Habitat?	Is the Action Likely To Jeopardize the Species?	Is the Action Likely To Destroy or Adversely Modify Critical Habitat?
Steller Sea Lion, Western DPS (*Eumetopias jubatus)*	Endangered	Yes	No	No	No
Humpback Whale, Western North Pacific DPS (*Megaptera novaeangliae*)	Endangered	Yes	No	No	No
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	Yes	No	No	No
Cook Inlet Beluga Whale (*Delphinapterus leucas)*	Endangered	Yes	No	No	No

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

Jonathan M. Kurland
Regional Administrator

Date: May 5, 2025

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TERMS AND ABBREVIATIONS

µPa	Micro Pascal
2D	Two-Dimensional
3D	Three-Dimensional
Ac	Acre
ACIA	Arctic Climate Impact Assessment
ADNR	Alaska Department of Natural Resources
AEWC	Alaska Eskimo Whaling Commission
AGL	Above Ground Level
AKR	Alaska Region
ARBO	Arctic Regional Biological Opinion
ASAMM	Aerial Surveys of Arctic Marine Mammals
ASL	Above Sea Level
ASLC	Alaska SeaLife Center
BA	Biological Assessment
Bbbl	Billion Barrels
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BSAI	Bering Sea/Aleutian Island
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Conflict Avoidance Agreement
CHIRP	Compressed High Intensity Radar Pulse
CI	Confidence Interval
CIBW	Cook Inlet Beluga Whale
CPUE	Catch Per Unit Effort
CSEL	Cumulative Sound Exposure Level
Cui	Cubic Inches
CV	Coefficient of Variance
CWA	Clean Water Act
dB re 1µPa	Decibel referenced 1 microPascal
DEIS	Draft Environmental Impact Statement
District Court	U.S. District Court for the District of Alaska
DP	Dynamic Positioning
DPP	Development and Production Plan
DPS	Distinct Population Segment

TERMS AND ABBREVIATIONS

EEZ	Exclusive Economic Zone
EP	Exploration Plan
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EZ	Exclusion Zone
°F	Fahrenheit
FAA	Federal Aviation Administration
FR	Federal Register
ft	Feet
g	Gallons
G&G	Geological and Geophysical
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITA	Incidental Take Authorization
ITS	Incidental Take Statement
IWC	International Whaling Commission
kHz	Kilohertz
km	Kilometers
kn	Knots
L	Liter
m	Meter
mi	Mile
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MODU	Mobile Offshore Drilling Unit
ms	Milliseconds
MSY	Maximum Sustainable Yield
MWCS	Marine Well Containment System
μPa	Micro Pascal
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System

TERMS AND ABBREVIATIONS

NRC	National Research Council
NSB	North Slope Borough
NSF	National Science Foundation
NSR	Northern Sea Route
NTL	Notice to Lessees
OBC	Ocean Bottom Cable
OBN	Ocean Bottom Node
OC	Organochlorine
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
Opinion	Biological Opinion
OSRA	Oil Spill Risk Analysis
OSRB	Oil Spill Response Barge
OSRV	Oil Spill Response Vessel
Pa	Pascals
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PTS	Permanent Threshold Shift
RMS	Root Mean Square
ROV	Remotely Operated Vehicle
RPA	Reasonable and Prudent Alternative
s	Second
SAR	Search and Rescue
SEL	Sound Exposure Level
Shell	Shell Offshore Inc. and Shell Gulf of Mexico, Inc.
SONAR	Sound Navigation And Ranging
SPLASH	Structure of Populations, Level of Abundance and Status of Humpback Whales
SSL	Steller Sea Lion
Tcf	Trillion Cubic Feet
TTS	Temporary Threshold Shift
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
VGP	Vessel General Permit

TERMS AND ABBREVIATIONS

VLOS	Very Large Oil Spill
VMS	Vessel Monitoring System
VSP	Vertical Seismic Profiling
WCD	Worst Case Discharge

1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536(a)(2)), requires each Federal agency to ensure 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 critical habitat of such species. When a Federal agency's action "may affect" a protected species, that agency is required to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR 402.14(a)). Federal agencies may fulfill this general requirement informally if they conclude that an action may affect, but "is not likely to adversely affect" endangered species, threatened species, or designated critical habitat, and NMFS or the USFWS concurs with that conclusion (50 CFR 402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the Federal agency's action is likely to affect ESA-listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking, specifies those reasonable and prudent measures necessary or appropriate to minimize such impact, and sets forth terms and conditions to implement those measures.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 FR 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to NMFS's existing practice in implementing section 7(a)(2) of the Act (84 FR at 45015; 89 FR at 24268). We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

In this document, the action agencies are NMFS Office of Protected Resources, Permits and Conservation Division (hereafter referred to as Permits Division) and U.S. Army Corps of Engineers (hereafter referred to as USACE). The NMFS Permits Division plans to issue incidental take regulations (ITRs) and a Letter of Authorization (LOA) to the Don Young Port of Alaska (POA), pursuant to section 101(a)(5)(A) of the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*), for taking marine mammals incidental to the Port of Alaska Modernization Program (PAMP) Phase 2B: Cargo Terminals Replacement (CTR) Project, in Anchorage, Alaska, for years 1 through 5 of the proposed project. NMFS Permits Division anticipates that POA will apply for an Incidental Harassment Authorization (IHA), under MMPA section 101(a)(5)(D), for the 6th construction year. In addition, USACE plans to issue the POA a Clean Water Act section 404 permit for the proposed action (POA-2003-00502-M21). The consulting agency for this proposal is NMFS's Alaska Region. This document represents NMFS's biological opinion (opinion) and concurrence on the effects of this proposal on endangered and threatened species and designated critical habitat.

The opinion and ITS were prepared by NMFS Alaska Region in accordance with section 7(b) of the ESA (16 U.S.C. 1536(b)), and implementing regulations at 50 CFR part 402.

The opinion and ITS are in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1)) and underwent pre-dissemination review.

1.1 **Background**

This opinion and concurrence are based on information provided in the ITR and LOA application, the proposed ITRs (89 FR 85686, October, 28, 2024), and the POA's Biological Assessment. Other sources of information relied upon primarily include consultation communications (emails and virtual meetings), recent consultations completed in the same region, previous monitoring reports, and marine mammal surveys conducted in Cook Inlet. A complete record of this consultation is on file at NMFS's Juneau, Alaska office.

The POA, located on Knik Arm in upper Cook Inlet, is Alaska's largest seaport and provides critical infrastructure for the state. The POA moves more than four million tons of material across its docks annually, which is consumed by 90 percent of Alaska's population. Existing POA marine-side infrastructure and facilities include three cargo terminals, two petroleum terminals, one dry barge berth, two miles of rail-spur connected to Alaska Railroad, and two floating, small-vessel docks, plus 220 acres of land at its facility located in Anchorage. The POA is modernizing its marine terminals through the PAMP, which is divided into five separate and independent phases. This opinion considers the Cargo Terminal Replacement phase (Figure 1), which is a stand-alone project with independent utility apart from the future PAMP phases.

The proposed action involves the new construction of Terminal 1 (T1) and Terminal 2 (T2), which include planned wharves and access trestles. The two new terminals will be located 140 feet (ft) seaward of existing Terminals 1, 2, and 3. It is anticipated that this more seaward location of the new terminals will reduce sedimentation, improve room for handling of berthing ships, and allow construction of the new terminals while the existing terminals remain in use. The proposed action also includes demolition of the existing Petroleum, Oil, and Lubricants Terminal 1 (POL1) and general cargo terminals (Terminal 1, Terminal 2, and Terminal 3) as needed to advance construction of T1 and T2.

This project is Phase 2B of the PAMP, and landside construction will commence in 2025. In-water construction will commence in 2026. CTR in-water construction with potential impacts on marine mammals is scheduled to begin on April 1, 2026 and continue through November 30 of each of the 6 years, 2026 through 2031. These dates are estimates and may shift as contracting details, starting dates, ice-free conditions, production rates, and other factors vary.

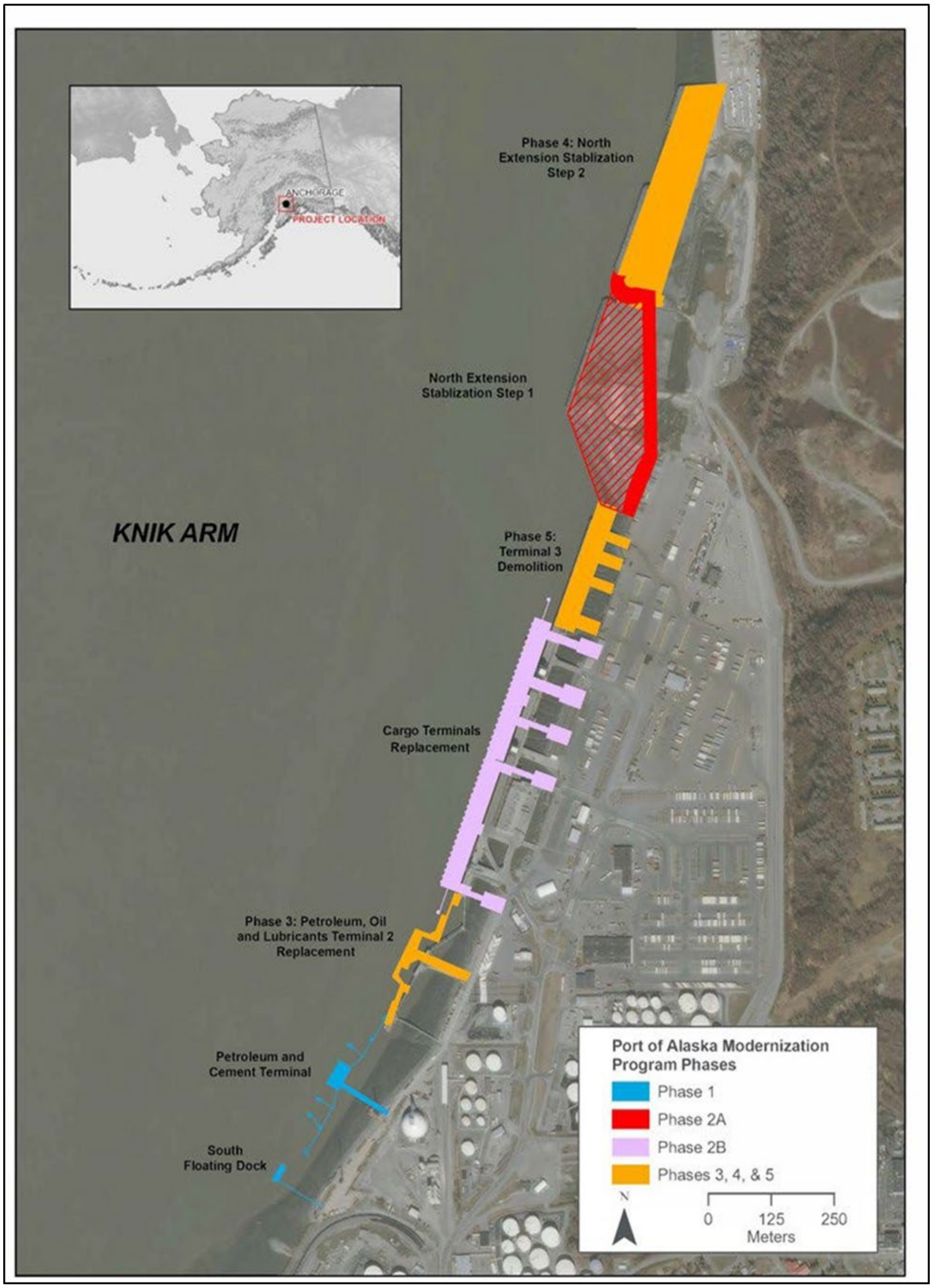

Figure 1. Location of the Port of Alaska Modernization Program phases. Image from Biological Assessment (Port of Alaska 2024).

This opinion considers the effects from in-water pile installation and removal and from the operation of vessels during construction on listed species and designated critical habitat, and the associated proposed issuance of ITRs and an LOA. The action agency has determined that the proposed action is likely to adversely affect the endangered western distinct population segment (DPS) Steller sea lion (*Eumetopias jubatus*), threatened Mexico DPS humpback whale (*Megatera novaeangliae*), endangered Western North Pacific DPS humpback whale (*Megaptera novaeangliae*), and endangered Cook Inlet beluga whale (*Delphinapterus leucas*).

The action agency has determined that the proposed action may affect but is not likely to adversely affect Cook Inlet beluga whale critical habitat. Critical habitat for humpback whales and Steller sea lions is outside the action area of this project.

1.2 Consultation History

On August 19, 2024, NMFS AKR received from U.S. Army Corps of Engineers (USACE) a biological assessment for the Cargo Terminals Replacement Project, along with a request to initiate formal consultation. On September 27, 2024, NMFS AKR informed USACE that the biological assessment was sufficient for initiating formal consultation. On October 22, 2024, NMFS AKR received from NMFS Permits Division a copy of the proposed rule along with a request to initiate formal consultation.

More background on the history of the PAMP is provided below:

July 14, 2021	POA had a kick-off Meeting to discuss Phase 2 of the Port of Alaska Modernization Project.
March 17, 2022	Monthly meetings began and continued throughout the consultation process to discuss the status of POA projects including Cargo Terminals.
July 27, 2022	POA held a PAMP Phase 2 Permitting Pre-Application Meeting.
August 10, 2022	NMFS Permits Division and AKR met internally to discuss the POA's proposal for beluga whale incidental take estimation for the CTR project.
August 12, 2022	NMFS (Permits Division and AKR), POA/Jacobs HDR Inc (HDR), and USACE met to discuss the POA's proposal for beluga whale incidental take estimates for the POA projects. NMFS (NMFS Permits Division and AKR) presented slides that included questions regarding the POA's proposed approach, background information regarding the sighting rate method used for recently issued IHAs to the POA, proposed approach considerations, and recommendations to inform take estimates. These discussions were directly relevant to the CTR project. NMFS requested that the POA/HDR send NMFS a written proposal of sound source levels and transmission loss coefficients to be used in the

	CTR.
January 3, 2023	NMFS Permits Division receives ITR application from POA.
January 26, 2023	NMFS Permits Division and the POA met to discuss the transmission losses to be used for the POA Cargo Dock Replacement Project. NMFS (NMFS Permits Division and AKR) met internally to discuss the transmission loss coefficients proposed to be used in the POA's CTR project.
January 27, 2023	NMFS Permits Division met internally to discuss the sound source levels and transmission loss coefficients proposed to be used in POA's CTR project.
January 30, 2023	NMFS Permits Division met internally to discuss the source levels to be used in POA's CTR project.
February 2, 2023	Monthly standing meeting with NMFS (Permits Division and AKR), POA/HDR, and USACE.
February 6, 2023	NMFS (Permits Division and AKR) met internally to discuss the sound source levels and transmission loss coefficients proposed to be used in the POA's CTR project. NMFS Permits Division's acousticians shared analysis regarding the POA's proposed source levels and transmission loss coefficients.
February 23, 2023	Meeting held with NMFS (NMFS Permits Division and AKR) and POA/HDR to discuss the sound source levels and transmission loss coefficients relevant to the CTR project.
March 16, 2023	POA provided a presentation on the project description for the POA Cargo Terminal Replacement Project.
March 24, 2023	POA/HDR sent the completed comment-response matrix for the CTR project.
April 10, 2023	NMFS Permits Division and AKR met internally to discuss source levels for the CTR project.
May 18, 2023	NMFS Permits Division sent POA a memo detailing NMFS AKR's proposed incidental take estimation methodology for beluga whales for the CTR project.
October 13, 2023	NMFS Permits Division received a revised ITR application.

May 23, 2024	NMFS Permits Division received a revised ITR application for the CTR.
June 11, 2024	NMFS staff (AKR and NMFS Permits Division) visited the Port of Alaska site.
August 19, 2024	The USACE requested consultation and provided a Biological Assessment to the Alaska Region. POA submitted a revised Incidental Take Regulation application to NMFS Permits Division.
September 26, 2024	NMFS AKR initiated consultation.
October 22, 2024	NMFS Permits Division requested consultation.
October 28, 2024	NMFS Permits Division published the proposed ITRs for the CTR.
November 21, 2024	POA proposed changes to the project description during public comment for the proposed Incidental Take Regulations.
March 3, 2025	POA provided NMFS Permits Division with updated data to finalize incidental take analysis based on changes during public comments. NMFS Permits Division in turn provided the updated data to NMFS AKR.

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. 50 CFR 402.02.

To address operational deficiencies, the POA is modernizing its marine terminals through the PAMP to enable safe, reliable, and cost-effective Port operations. The PAMP will support infrastructure resilience in the event of a catastrophic natural disaster over a 75-year design life.

The PAMP is critical to maintaining food and fuel security for the state. At the completion of the PAMP, the POA will have modern, safe, resilient, and efficient facilities through which more than 90 percent of Alaskans will continue to obtain food, supplies, tools, vehicles, and fuel. The PAMP is divided into five separate phases; these phases are designed to include projects that have independent utility yet streamline agency permitting. The projects associated with the PAMP include:

- Phase 1: Petroleum and Cement Terminal (PCT Phase 1 and 2) and South Floating Dock (SFD) replacement;
- Phase 2A: North Extension Stabilization Phase 1 (NES1);

- **Phase 2B: CTR**;
- Phase 3: Petroleum, Oil and Lubricants Terminal 2 Replacement;
- Phase 4: North Extension Stabilization part 2; and
- Phase 5: Demolition of Terminal 3.

This opinion will focus on the replacement of the cargo terminals (Phase 2B). Construction will include completion of the following components: 1) ground improvement stabilization of the shoreline, 2) shoreline expansion and protection, 3) general cargo terminals (new T1 and T2) construction, 4) demolition of existing terminals and 5) onshore utilities and storm drain outfall replacement. The new T1 wharf will be 870 ft x 120 ft with two 36-ft-wide trestles of varying length. The new T2 wharf will be 938 ft x 120 ft with three access trestles each approximately 300-foot-long. The southern and northern access trestles would be 36-foot-wide. The middle trestle would be 60-foot-wide to provide an additional emergency vehicle access lane. Both T1 and T2 wharves will be constructed using 72-inch-diameter steel piles. The T1 and T2 access trestles will be constructed using 48- and 72-inch-diameter steel piles. The 48-inch-diameter piles will be installed in the dry (see 2.1.1). Two 144-inch-diameter steel monopile mooring dolphins with associated mooring systems and access catwalks will be constructed, one on the south end of T1 and one on the north end of T2.

In addition to these permanent structures, temporary work including temporary pile installation and removal will be required to support construction. Temporary piles will likely be 36-inch-diameter steel; however, 24-inch steel piles may be used in place of some of the larger temporary piles. Various tugs, work boats and barges will be utilized and will be moored at or in the immediate vicinity of the project. During pile installation, it may become necessary to remove relic anode sleds. Old anode sleds are currently buried in the sediment behind the existing terminals. If an old sled is encountered in the footprint of a new pile to be installed, the anode sled will be excavated and removed. The excavated anode sled(s) will be hauled to an appropriate disposal location in an upland area. All other relic anode sleds will be abandoned in place.

2.1.1 **Proposed Activities**

Project component activities, locations, and approximate estimated quantities for 7 years (6 years of in-water construction) are summarized in Table 1, and each component is described in more detail below. For this project, “in the dry” indicates a location that is above the high tide line or is in the intertidal zone, with no standing water.

This project, Phase 2B of the PAMP, is itself composed of five components (see Table 1) and are described in more detail below. The components include: 1) shoreline stabilization, 2) shoreline expansion and protection, 3) general cargo terminals construction, 4) demolition of the existing terminals and 5) onshore utilities and storm drain outfall replacement.

Table 1. Components of the Port of Alaska Cargo Terminal Replacement Project.

Component Number	Type of Activity	Location	Size and Type	Total Amount or Number
1. Shoreline Stabilization				
	Placement of temporary construction work pads	In water; In the dry	Granular fill and rock	61,100 cubic yards below HTL (3.6 acres)
	Ground Improvements	In the dry	Cementitious materials and aggregate materials	Unknown
2. Shoreline Expansion and Protection				
	Excavation/dredging of silt	In water; In the dry	Silt, granular fill, and rock	50,000 cubic yards
	Protection of shoreline	In the dry	Granular fill and armor rock	60,000 cubic yards
3. General Cargo Terminals Construction				
	Installation of permanent piles	In water; in the dry	48-, 72-, and 144-inch steel pipe piles	363 piles
	Installation of temporary piles	In water; in the dry	36-inch steel pipe piles	674 piles
	Removal of temporary piles	In water; in the dry	36-inch steel pipe piles	236 piles
	Installation of concrete pile caps, deck, and utilities	Above water	Concrete, steel	281,535 square feet
4. Demolition of Existing Terminals (POL1 and Terminals 1, 2, and 3)				
	Demolition and removal of concrete pile caps, deck, and utilities	POL1 and T1 Above water	Concrete, steel	173,798 square feet
	Cutting of piles at mudline or leaving intact and in place	POL1 and T1 In water, in the dry	16- to 42-inch steel pipe	1,508 piles
	Demolition and removal of concrete pile caps, deck, and utilities	T2 and T3 Above water	Concrete, steel	159,677 square feet
	Cutting of piles at mudline or leaving intact and in place	T2 and T3 In water, in the dry	16- to 42-inch steel pipe	1,525 piles
5. Onshore Utilities and Storm Drain Outfall Replacement				
	Addition of electrical, water, and gas pipes and conduit	Above water, on land	Concrete, steel pipes	Unknown
	Addition of drain pipes and manholes	Above water, on land	Concrete, steel pipes	Unknown

Component Number	Type of Activity	Location	Size and Type	Total Amount or Number
	Addition of outflow pipe through armor rock	In water	Concrete, steel pipes	4 outfalls

2.1.1.1 **Component 1. Ground Improvement Stabilization of the Shoreline**

Soil composition of the tidal flats adjacent to T1 and T2 exhibit potential for liquefaction and likelihood of large ground deformations during seismic events, therefore soil improvements at trestle abutments, and potentially between the abutments, will mitigate the potential for seismic-induced slope failure that could result in structural failure. Construction will include installation of soil improvements in the five locations where the access trestles meet the beach. Centered at each of the five trestle abutments, the ground improvement technique will create approximately 200- by 96-ft blocks of treated soil extending from the surface to the top of the clay layer approximately 85 ft deep. Ground improvements will extend along the embankment in areas between the abutments. The drilling process to conduct ground improvement will likely require containment and collection of the cement/soil slurry and spoils during construction. Drying beds will be constructed on dry land to contain the excess slurry until it can be disposed of off-site or incorporated into other portions of the project. The drying beds will be removed once construction is completed. During construction, a temporary soil work pad will be constructed at each of the five trestles to provide a level temporary work surface. The ground improvement panels/columns will extend approximately 80 ft seaward and shoreward of the crest of the slope and approximately 30 ft to either side of the trestle structure (Figure 2). After completion of the ground improvement work, the temporary construction work pads will be removed and the foreshore graded and armored. All work under Component 1, including ground improvement and placement of temporary work pads, will take place “in the dry,” either above the high tide line or in the intertidal zone but when dewatered.

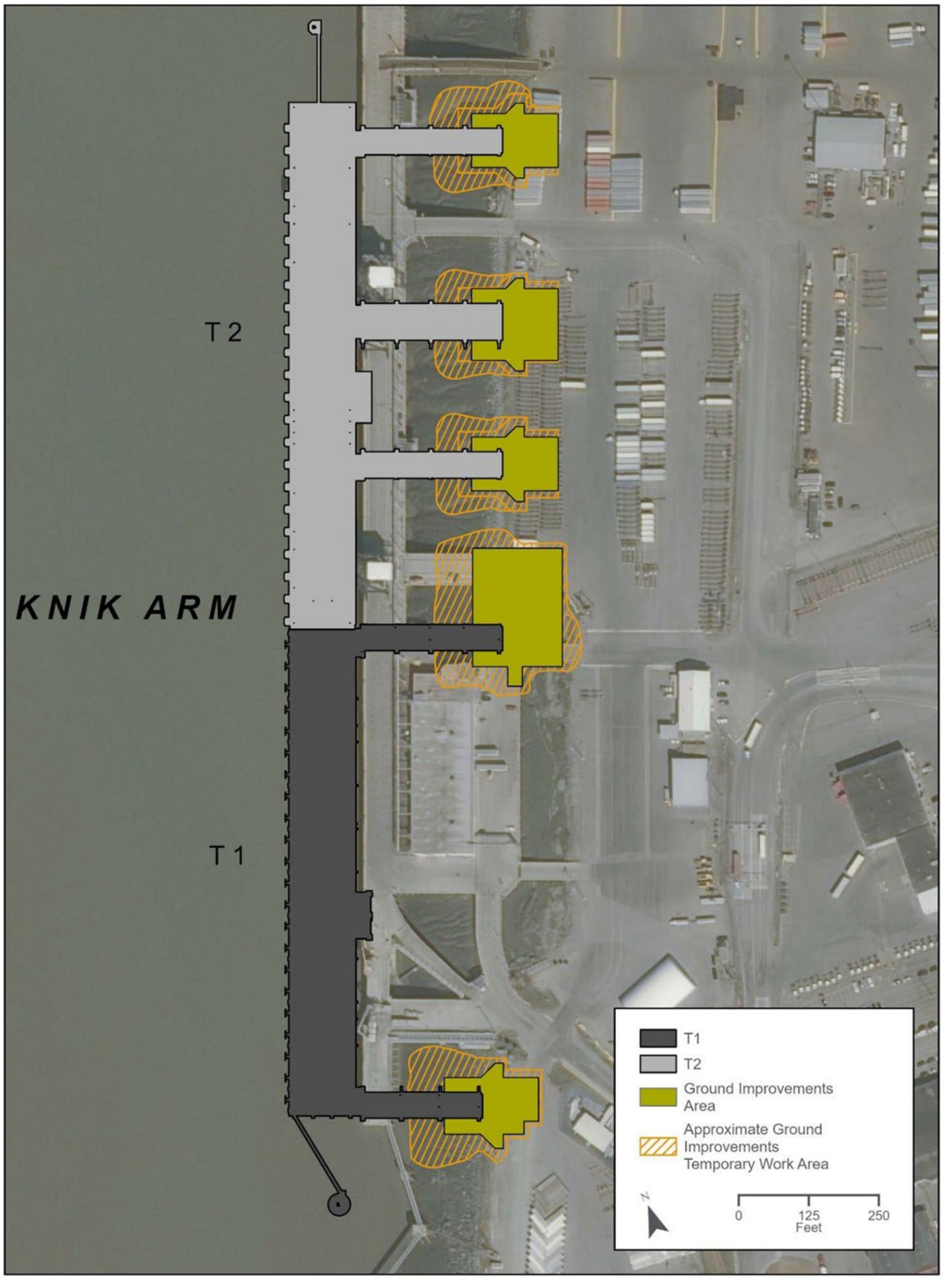

Figure 2. Component 1: Ground Improvement Locations and Approximate Areas. Image from Biological Assessment (Port of Alaska 2024).

2.1.1.2 Component 2. Shoreline Expansion and Protection

The shoreline behind the existing Terminals 1, 2, and 3 is irregular, with two areas where the shoreline is located about 30 meters to the east of the typical shoreline (Figure 3). Areas that are above the high-water line or below the tide line in a dewatered state will be excavated from the landward side to remove deposited silts before the areas are then filled with more dense, stable materials such as clean granular fill and rock. If the material is unable to be excavated in the dry, it will be dredged. The filled area will provide a consistent shoreline and additional container storage area. See Table 1 for estimated quantities.

After ground improvement work and shoreline expansion have been completed, the slope along the shore will be secured with armor stone placed over the clean granular and rock fill. Placement of armor rock requires good visibility of the shore, as each rock is placed carefully to interlock with surrounding armor rock. It is therefore anticipated that placement of most armor rock, filter rock, and granular fill will occur in the dry at low tide levels; however, some placement of armor rock, filter rock, and granular fill may occur in shallow water. After placement of armor rock, the top of the fill will be paved to match the existing backland pavements.

Figure 3. Component 2: Shoreline Expansion and Protection Areas (Port of Alaska 2024).

2.1.1.3 **Component 3. General Cargo Terminals Construction**

Two new cargo terminals will be constructed, T1 and T2, which include new wharves and access trestles (Figure 4). Pile installation and removal is anticipated to take place for the 6-year period starting in 2026. Other terminal construction activities above water and on land may occur year-round. Construction dates may change because of unexpected project delays, ongoing construction activities in other areas of the POA, timing of ice-out and spring breakup, and other factors. A bubble curtain will be used during impact and vibratory installation of permanent 72- and 144-inch piles.

The two new terminals will be located 140 ft seaward of the existing Terminals 1, 2, and 3. New T1 and T2 will be pile-supported structures, and their construction will occur over a period of six in-water construction seasons. Construction of each terminal will require installation and removal of temporary steel pipe piles, including template piles, and installation of permanent steel pipe piles. Pile installation will occur in water depths that range from a few feet or dry (dewatered) conditions nearest the shore to approximately 20 meters (70 ft) at the outer face of the wharves, depending on tidal stage; the mean diurnal tide range at the POA is approximately 8.0 meters (26 ft) (NMFS 2015a).

Construction activities will occur at multiple locations across the project site simultaneously. It is anticipated that in-water pile installation and removal will occur at one or two locations; however, it is possible that installation and removal will occur at up to three locations at the same time. It is also possible that two hammers may be used simultaneously to increase production rates, especially during months when beluga whale attendance is anticipated to be low. At most, two vibratory hammers will be simultaneously active in-water at any given time. Duration of active hammer use is anticipated to be brief each day and it is therefore anticipated that overlap in use of hammers will be uncommon. Pile installation and removal will occur intermittently over the work period, for durations of minutes to hours at a time. Use of two or three hammers (though no more than two vibratory at a time) will serve to reduce the overall duration of in-water pile installation and removal during each construction season. One construction crane will likely be based on a floating work barge, and one will likely be based on land or on an access trestle.

Pile Installation and Removal

Vibratory and impact hammers will be used for installation of 48-, 72-, and 144-inch permanent piles. Vibratory hammers will be used for installation and removal of 24- and/or 36-inch temporary piles; an impact hammer may be used if necessary to complete installation. Some temporary and permanent steel pipe piles will be installed or removed in the dry, depending on construction sequencing and tide heights. To avoid potential effects on marine mammals from in-water pile installation and removal, conducting these activities in the dry will be maximized as feasible. However, until the Construction Contractor and Designer of Record (DOR) for both terminals are under contract, the exact number of piles that may be installed and removed in the dry is unknown. It is anticipated that the permanent and temporary piles in the three bents nearest the shore for all five trestles will be installed in the dry at low tide levels. An additional bent will be installed in the dry for the northernmost trestle of T1 and for the three trestles of T2. Estimated numbers of piles of each size that will be installed and/or removed in the dry are presented in Table 2.

Table 2. Component 3: Pile Installation and Removal.

Pile Diameter and Type	**Number of Piles**		
	In-water	**In the Dry**	**Total Piling Events**
Permanent Pile Installation			
48" Trestle	0	16	16
72" Wharf	284	0	284
72" Trestle	48	13	61
144" Monopile Mooring Dolphin	2	0	2
Total Number of Permanent Installations	334	29	363
Temporary Pile Installation and Removal			
36" Installation	513	161	674
36" Removal	75	161	236
Total Number of Temporary Installations and Removals	588	322	910
Project Total	**922**	**351**	**1,273**

Although some piles will be installed or removed in the dry, it is anticipated that most piles will be installed or removed in water. Table 3 presents the estimated monthly and annual distribution of in-water pile installation and removals. While these estimates begin in April each year, POA has stated they will start work as early in the season as possible to minimize impacts to belugas.

Table 3. Estimated Annual and Monthly Distribution of In-water Pile Installation and Removal for Component 3.

Number of Piles									
Year 1	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	12	12	12	12	12	6	4	75
24- or 36-Inch	1	1	1	1	1	1	1	1	8

Number of Piles									
Year 1	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
Temporary Pile Removal									
72-Inch Permanent Pile Installation	5	11	11	11	9	9	9	4	69
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 2	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	6	10	10	10	10	10	5	4	65
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	0	7
72-Inch Permanent Pile Installation	5	9	9	9	9	8	8	4	61
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 3	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	13	26	26	26	26	26	13	4	160
24- or 36-Inch Temporary Pile Removal	1	3	3	3	2	2	1	1	16
72-Inch Permanent Pile Installation	4	4	4	3	3	3	3	3	27
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 4	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	11	11	12	11	11	5	4	70
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	0	7
72-Inch Permanent Pile Installation	5	9	9	9	9	8	8	4	61
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 5	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile	5	12	12	12	12	11	11	5	80

Number of Piles									
Year 1	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
Installation									
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	1	8
72-Inch Permanent Pile Installation	3	9	9	9	8	8	8	3	57
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 6	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	10	10	10	10	10	4	4	63
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	4	10	10	29
72-Inch Permanent Pile Installation	3	9	9	9	8	8	8	3	57
144-Inch Permanent Pile Installation	0	2			0	0	0	0	2

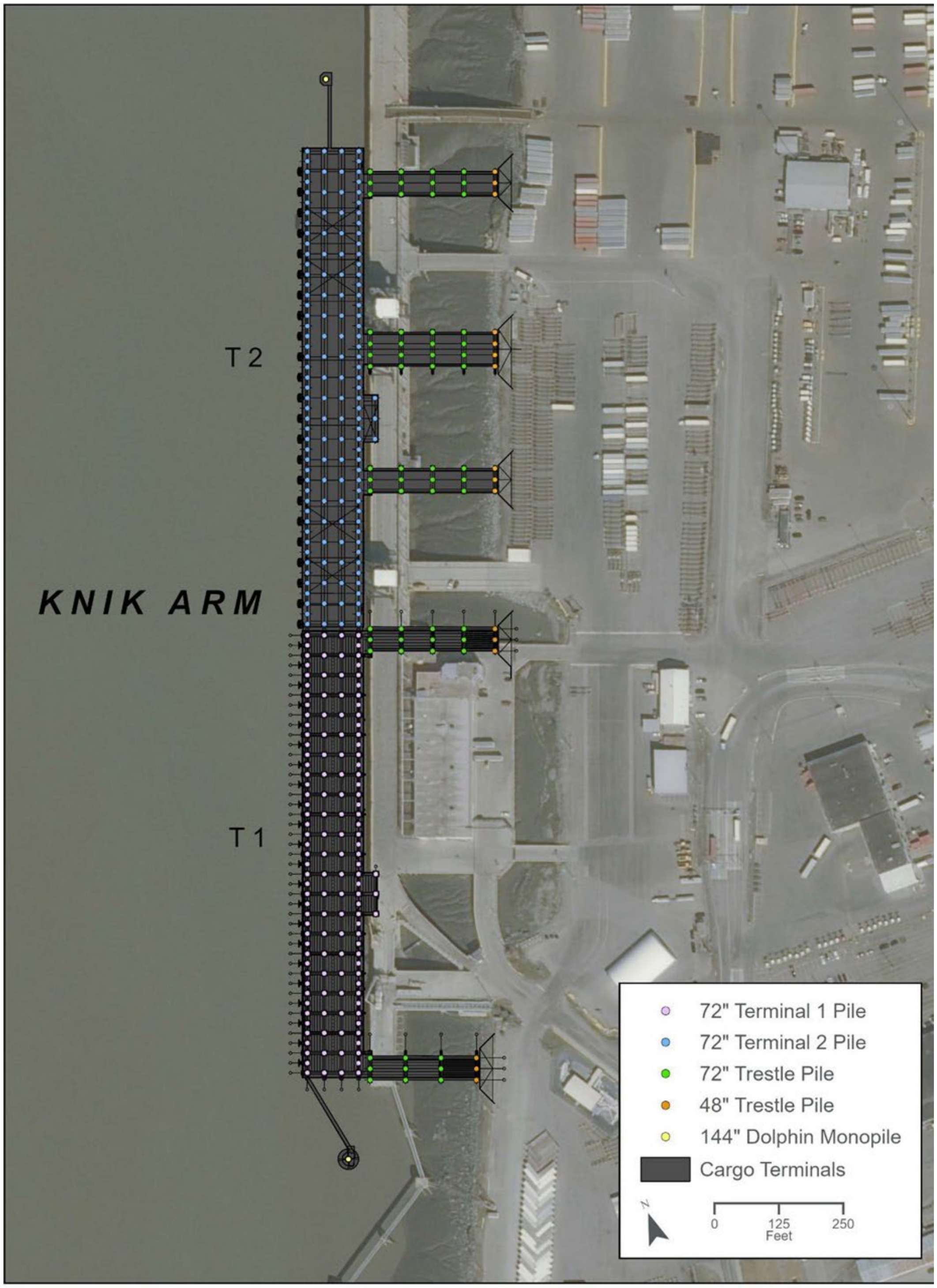

Figure 4. Component 3: Overview of the New Terminal 1 (T1) and Terminal 2 (T2) (Port of Alaska 2024).

Table 4. Estimated Timing and Duration (in Hours per Month) of Pile Installation and Removal Activities[1]

Activity	Duration [hours of activity by month and year]															
	Apr		May		Jun		Jul		Aug		Sep		Oct		Nov	
	Imp[2]	Vib[3]	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib
Year 1 - 2026																
24- or 36-in Temporary Pile Installation	-	2.5	-	6.0	-	6.0	-	6.0	-	6.0	-	6.0	-	3.0	-	2
24- or 36-in Temporary Pile Removal	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	1
72-in Permanent Pile Installation	7.2	0.8	15.8	1.8	15.8	1.8	15.8	1.8	15.8	1.8	15.8	1.8	7.2	0.8	1.4	-
Year 1 total hours	*7.2*	*4.1*	*15.8*	*8.6*	*15.8*	*8.6*	*15.8*	*8.6*	*15.8*	*8.6*	*15.8*	*8.6*	*7.2*	*4.6*	*1.4*	*2.9*
Year 2 - 2027																
24- or 36-in Temporary Pile Installation	-	3.0	-	5.0	-	5.0	-	5.0	-	5.0	-	5.0	-	2.5	-	2
24- or 36-in Temporary Pile Removal	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	-
72-in Permanent Pile Installation	5.7	0.7	14.3	1.7	14.3	1.7	14.3	1.7	14.3	1.7	14.3	1.7	7.2	0.8	1.4	-
Year 2 total hours	*5.7*	*4.4*	*14.3*	*7.4*	*14.3*	*7.4*	*14.3*	*7.4*	*14.3*	*7.4*	*14.3*	*7.4*	*7.2*	*4.1*	*1.4*	*2.2*
Year 3 - 2028																
24- or 36-in Temporary Pile Installation	-	6.5	-	13.0	-	13.0	-	13.0	-	13.0	-	13.0	-	6.5	-	2
24- or 36-in Temporary Pile Removal	-	0.8	-	2.3	-	2.3	-	2.3	-	1.5	-	1.5	-	0.8	-	1

Activity	Duration [hours of activity by month and year]															
	Apr		May		Jun		Jul		Aug		Sep		Oct		Nov	
	Imp[2]	Vib[3]	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib
72-in Permanent Pile Installation	1.4	0.2	5.7	0.7	5.7	0.7	5.7	0.7	5.7	0.7	5.7	0.7	2.9	0.3	1.4	-
Year 3 total hours	*1.4*	*7.4*	*5.7*	*15.9*	*5.7*	*15.9*	*5.7*	*15.9*	*5.7*	*15.2*	*5.7*	*15.2*	*2.9*	*7.6*	*1.4*	*2.9*
Year 4 - 2029																
24- or 36-in Temporary Pile Installation	-	2.5	-	5.5	-	5.5	-	6.0	-	5.5	-	5.5	-	2.5	-	2
24- or 36-in Temporary Pile Removal	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	0.8	-	-
72-in Permanent Pile Installation	7.2	0.8	15.8	1.8	15.8	1.8	15.8	1.8	14.3	1.7	14.3	1.7	7.2	0.8	1.4	-
Year 4 total hours	*7.2*	*4.1*	*15.8*	*8.1*	*15.8*	*8.1*	*15.8*	*8.6*	*14.3*	*7.9*	*14.3*	*7.9*	*7.2*	*4.1*	*1.4*	*2.2*
Year 5 - 2030																
24- or 36-in Temporary Pile Installation	-	4.0	-	8.0	-	8.0	-	8.0	-	8.0	-	8.0	-	4.0	-	2
24- or 36-in Temporary Pile Removal	-	0.8	-	0.8	-	1.5	-	1.5	-	0.8	-	0.8	-	0.8	-	1
72-in Permanent Pile Installation	4.3	0.5	11.5	1.3	11.5	1.3	11.5	1.3	11.5	1.3	11.5	1.3	4.3	0.5	1.4	-
Year 5 total hours	*4.3*	*5.3*	*11.5*	*10.1*	*11.5*	*10.8*	*11.5*	*10.8*	*11.5*	*10.1*	*11.5*	*10.1*	*4.3*	*5.3*	*1.4*	*2.9*
Year 6 - 2031																
72-in Permanent Pile Installation	3.6	0.4	12.2	1.4	12.2	1.4	12.2	1.4	10.8	1.3	10.8	1.3	10.8	1.3	3.6	0.4
144-in Permanent Pile Installation	-	-	4	0.5	-	-	-	-	-	-	-	-	-	-	-	-

Activity	Duration [hours of activity by month and year]															
	Apr		May		Jun		Jul		Aug		Sep		Oct		Nov	
	Imp[2]	Vib[3]	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib	Imp	Vib

1 – Duration estimates assume a single hammer active at any time and therefore likely overestimates of actual time needed due to simultaneous pile installation and removal;
2 – Impact pile installation; 3 – Vibratory pile installation or extraction

Pile Cutting

A majority of in-water temporary piles (approximately 90 percent) will be cut off at the mudline and remain in place or will remain in place intact (without cutting). Temporary piles will be removed that conflict with construction or operations or that can be removed in the dry. Leaving piles in place below the mudline supports stability of the soil. The number of piles that will be cut or remain in place will be maximized as feasible.

2.1.1.4 **Component 4. Demolition of Existing Terminals**

Once the new T1, T2, and petroleum products transfer system[1] are complete and operational, any remaining existing Terminal 1, Terminal 2, and POL1 platforms, wharves, and trestles will be dismantled (Figure 5). All temporary work structures will be removed. Existing permanent piles and most temporary piles will be cut and removed or left in place. Many piles are corroded and may break during removal, with the lower part remaining in place. The existing structure is closer to shore than new construction, and many piles can be cut or removed in the dry when their locations are dewatered.

Terminal 3 may be partially demolished during Phase 2B construction of T1 and T2, especially where the existing infrastructure may interfere with new construction. Elements of T3 that persist after Phase 2B is complete will remain in place until Phase 5, when the POA plans to remove them under a separate permitting process.

The selection of construction equipment by the Contractor, including cranes and barges, will determine the plans and sequencing for demolition. Portions of the existing terminals may be used for construction phasing and as support platforms for ongoing new construction, as feasible.

Demolition will take place above the water, and demolished decking, pipes, and other superstructure materials will be contained before they fall into the water, following best management practices. Demolished materials will be removed by barge or truck.

[1] The petroleum products transfer system is part of the utilities under component 3 of Table 1.

Figure 5. Component 4: Demolition of Existing Terminals (Port of Alaska 2024).

2.1.1.5 **Component 5. Onshore Utilities and Storm Drain Outfall Replacement**

The replacement of onshore utilities will involve construction on land and replacement of utilities above the high tide line, on land. No in-water work is anticipated as part of this component.

The storm drain outfall replacement will involve construction on land and replacement of four outfall pipes above the high tide line, on land. No in-water work is anticipated as part of this component.

2.1.2 **Mitigation Measures**

POA informed NMFS via email on April 2, 2025 that the proposed action will incorporate the following mitigation measures:[2]

For all reporting that results from implementation of these mitigation measures, NMFS will be contacted using the contact information specified in (Table 6). In all cases, notification will reference the NMFS consultation tracking number AKRO-2024-02213.

2.1.2.1 **General Mitigation Measures**

1. The project proponent will inform NMFS of impending in-water activities a minimum of one week prior to the onset of those activities (email information to akr.prd.records@noaa.gov).

2. If construction activities will occur outside of the 6-year time window specified in this opinion, the project proponent will notify NMFS of the situation at least 60 days prior to the end of the specified time window to allow for reinitiation of consultation.

3. In-water work will be conducted at the lowest points of the tidal cycle to the extent possible.

4. Consistent with AS 46.06.080, trash will be disposed of in accordance with state law. The project proponent will ensure that all closed loops (e.g., packing straps, rings, bands, etc.) will be cut prior to disposal. In addition, the project proponent will secure all ropes, nets, and other marine mammal entanglement hazards so they cannot enter marine waters.

2.1.2.2 **Protected Species Observer (PSO) Requirements**

5. At least one PSO on duty will have either prior experience as a PSO in Alaska, or will have taken a NMFS-approved PSO or marine mammal observer training course.

6. PSOs must be knowledgeable in, and marine mammal training will include, the following:

    a. field identification of marine mammals and marine mammal behavior;

    b. ecological information on marine mammals and specifics on the ecology and

[2] The POA is the applicant and designated non-federal representative for the CTR Project. The mitigation measures primarily use the term "proponent" to refer to POA.

management concerns of those marine mammals;

c. ESA and Marine Mammal Protection Act (MMPA) regulations;

d. proper equipment use;

e. methodologies in marine mammal observation and data recording and property reporting protocols; and

f. an overview of PSO roles and responsibilities.

7. PSOs will be individuals independent from the project proponent and must have no other assigned tasks during monitoring periods.

8. The action agency or its designated non-federal representative will provide resumes or qualifications of PSO candidates to consultation biologist and akr.prd.records@noaa.gov for approval at least one week prior to in-water work. NMFS will provide a brief explanation of lack of approval in instances where an individual is not approved.

9. PSOs will:

    a. collectively be able to effectively observe the entirety of the shutdown zone;

    b. be able to identify marine mammals and accurately record the date, time, and species, of all observed marine mammals in accordance with project protocols;

    c. be able to identify listed marine mammals that may occur in the action area, at a distance equal to the outer edge of the applicable shutdown zone and determine marine mammal's location and distance from sound source;

    d. have the ability to effectively communicate orally, by radio or in person with project personnel to provide real-time information on listed marine mammals;

    e. possess a copy of mitigation measures; and

    f. possess data forms.

10. PSOs will observe for no more than four hours at a time without a break and no more than 12 hours per day.

2.1.2.3 **PSO Procedures**

11. PSOs will have the ability, authority, and obligation to order appropriate mitigation response, including shutdown, to avoid takes of listed marine mammals.

12. One or more PSOs will perform PSO duties onsite throughout the authorized activity.

13. Where a team of three or more PSOs are required, a lead observer or monitoring coordinator will be designated.

14. For each in-water activity, PSOs will monitor all marine waters within the indicated monitoring zone radius for that activity (Table 5).

Table 5. Shutdown Zones for Each Activity

<table>
<tr><th rowspan="2">Activity</th><th rowspan="2">Pile Type / Size</th><th rowspan="2">Attenuated or Unattenuated[1]</th><th colspan="3">Shutdown Zone (m)</th></tr>
<tr><th>Humpback whales</th><th>CIBWs</th><th>Steller sea lions</th></tr>
<tr><td rowspan="8">Vibratory Installation</td><td>24-in</td><td rowspan="4">Unattenuated</td><td rowspan="12">100</td><td>2,250</td><td rowspan="12">100</td></tr>
<tr><td>36-in</td><td>4,520</td></tr>
<tr><td>72-in</td><td>9,100</td></tr>
<tr><td>144-in</td><td>1,960</td></tr>
<tr><td>24-in</td><td rowspan="4">Attenuated</td><td>2,630</td></tr>
<tr><td>36-in</td><td>3,580</td></tr>
<tr><td>72-in</td><td>6,120</td></tr>
<tr><td>144-in</td><td>1,140</td></tr>
<tr><td rowspan="4">Vibratory Removal</td><td>24-in</td><td rowspan="2">Unattenuated</td><td>5,970</td></tr>
<tr><td>36-in</td><td>1,700</td></tr>
<tr><td>24-in</td><td rowspan="2">Attenuated</td><td>2,100</td></tr>
<tr><td>36-in</td><td>1,320</td></tr>
<tr><td rowspan="6">Impact Installation – 1 pile per day</td><td>24-in</td><td rowspan="3">Unattenuated</td><td rowspan="3">500</td><td rowspan="2">1,600</td><td rowspan="3">100</td></tr>
<tr><td>36-in</td></tr>
<tr><td>144-in</td><td>18,478</td></tr>
<tr><td>24-in</td><td rowspan="3">Attenuated</td><td rowspan="3">100</td><td rowspan="2">550</td><td rowspan="3">100</td></tr>
<tr><td>36-in</td></tr>
<tr><td>144-in</td><td>13,594</td></tr>
<tr><td rowspan="2">Impact Installation – 1 pile per day</td><td rowspan="4">72-in</td><td>Unattenuated</td><td rowspan="4">500</td><td>7,360</td><td rowspan="4">100</td></tr>
<tr><td rowspan="3">Attenuated</td><td rowspan="3">2,520</td></tr>
<tr><td>Impact Installation – 2 piles per day</td></tr>
<tr><td>Impact Installation – 3 piles per day</td></tr>
</table>

Activity	Pile Type / Size	Attenuated or Unattenuated[1]	Shutdown Zone (m)		
			Humpback whales	CIBWs	Steller sea lions
Concurrent – 2 Vibratory sources	36-in AND 36-in	Attenuated / Attenuated	100	5,670	100
		Attenuated / Unattenuated		9,370	
		Unattenuated / Unattenuated		9,070	
	36-in AND 72-in	Attenuated / Attenuated		8,320	
		Unattenuated / Attenuated		9,370	
Concurrent Vibratory / Impact	36-in AND 72-in	Attenuated / Attenuated (1 pile per day)	500	3,580	100
		Attenuated / Attenuated (2 piles per day)			
		Attenuated / Attenuated (3 piles per day)			
		Unattenuated / Attenuated (1 pile per day)		4,520	
		Unattenuated / Attenuated (2 piles per day)			
		Unattenuated / Attenuated (3 piles per day)			

Notes: cm = centimeter(s), m = meter(s); POA may elect to use either 36-in or 24-in temporary piles; as 36-in piles are more likely and estimated to have larger ensonified areas, we have used these piles in our analyses of concurrent activities.
[1] Attenuated includes the use of a bubble curtain.

15. PSOs will be positioned such that they will collectively be able to monitor the entirety of each activity's shutdown zone.

16. Prior to commencing any activity listed in Table 5, PSOs will scan waters within the appropriate shutdown zone and confirm no listed marine mammals are within the shutdown zone for at least 30 minutes immediately prior to initiation of the in-water activity. If one or more listed marine mammals are observed within the shutdown zone, the in-water activity will not begin until the listed marine mammals exit the shutdown zone of their own accord, or the shutdown zone has remained clear of listed marine mammals for 30 minutes immediately prior to the commencement of the activities listed in Table 5.

17. The on-duty PSOs will continuously monitor the shutdown zone and adjacent waters

during any of the activities listed in Table 5 for the presence of listed marine mammals.

18. Activities listed in Table 5 will only take place:
    a. between civil dawn and civil twilight;
    b. during conditions with a Beaufort Sea State of 4 or less; and
    c. when the entire shutdown zone and adjacent waters are visible (e.g., monitoring effectiveness is not reduced due to rain, fog, snow, haze, or other environmental/atmospheric conditions).
19. If visibility degrades such that PSOs can no longer ensure that the shutdown zone remains devoid of listed marine mammals during any of the activities listed in Table 5, the crew will stop activities until the entire shutdown zone is visible and the PSOs have indicated that the zone remained devoid of listed marine mammals for 30 minutes.
20. The PSOs will order ongoing activities listed in Table 5 to immediately cease if one or more listed marine mammals has entered, or appears likely to enter, the shutdown zone.
21. If any of the activities listed in Table 5 are shut down for less than 30 minutes due to the presence of listed marine mammals in the shutdown zone, the activities may commence when the PSOs provides assurance that listed marine mammals were observed exiting the shutdown zone. Otherwise, the activities may only commence after the PSO provides assurance that listed marine mammals have not been seen in the shutdown zone for 30 minutes.
22. If a listed marine mammal is observed within a shutdown zone or is otherwise harassed, harmed, injured, or disturbed, the PSO will immediately report that occurrence to NMFS using the contact information specified in Table 6.
23. Prior to commencing any activity listed in Table 5, or at changes in watch, PSOs will establish a point of contact with the construction crew. The PSO will brief the point of contact as to the shutdown procedures if the PSO observes that listed marine mammals are likely to enter or enter the shutdown zone. If the point of contact goes “off shift” and delegates their duties, the point of contact must inform the PSO and brief the new point of contact.
24. During in-water dredging or use of a barge-mounted excavator in water, if a beluga whale comes within 50 m of the dredge when it is actively dredging, the POA will cease operations until the beluga whale has moved beyond 50 m from the dredge. Dredging will not commence or recommence if a beluga whale is inside the 50-meter shutdown zone. Dredging will cease for non-beluga-whale species if they approach within 10 m of the active in-water dredge.

2.1.2.4 **Impact Pile Installation**

25. If no listed marine mammals are observed within the applicable shutdown zone (Table 5) for 30 minutes immediately prior to pile installation, soft-start procedures will be implemented immediately prior to activities. Soft-start procedures require contractors to provide an initial set of strikes at no more than half the operational power, followed by a 30-second waiting period, then two subsequent reduced-power-strike sets. A soft-start must be implemented:

    a. at the start of each day's impact pile installation;

    b. any time pile installation has been shut down or delayed due to the presence of a listed marine mammal;

    c. whenever pile installation has temporarily stopped (≤30 min) and PSO observation has also stopped; or

    d. whenever pile installation has temporarily stopped for more than 30 min and PSO observation has also stopped.

26. Following the soft-start procedure, operational impact pile installation may commence and continue provided listed marine mammals remain absent from the shutdown zone.

27. Following a lapse of impact pile installation activities of more than 30 minutes, the PSO will authorize resumption of impact pile installation only after the PSO provides assurance that listed species have not been present in the shutdown zone for at least 30 minutes immediately prior to resumption of operations.

2.1.2.5 **Vibratory Pile Removal and Installation**

28. If no listed marine mammals are observed within the applicable shutdown zone (Table 5) for 30 minutes immediately prior to pile removal or installation, vibratory pile removal or installation may commence. This pre-pile removal or installation observation period will take place at the start of each day's vibratory pile removal or installation, each time pile removal or installation has been shut down or delayed due to the presence of a listed species, and following a cessation of pile driving for a period of 30 minutes or longer.

29. Following a lapse of vibratory pile removal or installation activities of more than 30 minutes, the PSO will authorize resumption of vibratory pile removal or installation only after the PSO provides assurance that listed marine mammals have not been present in the shutdown zone for at least 30 minutes immediately prior to resumption of operations.

2.1.2.6 **Additional Cook Inlet Beluga Whale (CIBW)-specific Pile Driving and/or Removal Mitigation Measures**

30. Prior to the onset of pile driving, should CIBW(s) be observed approaching the estimated shutdown zone (Table 5), pile driving must not commence until the whale(s) moves at least 100 m past the estimated shutdown zone and on a path away from the zone, or the whale(s) has not been re-sighted within 30 minutes.

31. If pile installation or removal has commenced and CIBW(s) is observed within or likely to enter the shutdown zone, pile installation or removal must shut down and not re-commence until the whale(s) has traveled at least 100 m beyond the shutdown zone and is on a path away from such zone or until no CIBW(s) has been observed in the shutdown zone for 30 minutes.

32. If during installation and removal of piles, PSOs can no longer effectively monitor the entirety of the CIBW shutdown zone due to environmental conditions (*e.g*., fog, rain, wind), pile driving may continue only until the current segment of the pile is driven; no additional sections of pile or additional piles may be driven until conditions improve such that the shutdown zone can be effectively monitored. If the shutdown zone cannot be monitored for more than 15 minutes, work must shut down until conditions have sufficiently improved, and the PSOs have indicated that the zone remained devoid of listed marine mammals for 30 minutes prior to pile driving.

2.1.2.7 **Use of Bubble Curtains During Impact and Vibratory Pile Activities**

33. A bubble curtain system will be used during impact and vibratory pile installation of permanent 72- and 144-inch piles when water depth is greater than 3 meters. No bubble curtain is required for vibratory pile driving or removal of temporary (24-in or 36-in) piles.

2.1.2.8 **Intertidal Fill/Bank Stabilization and Maintenance**

34. Fill material will consist of rock fill that is free of fine sediments to the extent practical, or will come from on-site dredged material

35. Fill material will be obtained from local sources or will be free of non-native marine and terrestrial vegetation species.

2.1.2.9 **Project-Dedicated Vessels**

36. Vessel operators will:

    a. maintain a watch for marine mammals at all times while underway;

    b. stay at least 91 meters (100 yards) away from listed marine mammals,

c. travel at less than 5 knots when within 274 meters (300 yards) of a whale;

d. avoid changes in direction and speed within 274 meters (300 yards) of a whale, unless doing so is necessary for maritime safety;

e. not position vessel(s) in the path of a whale, and will not cut in front of a whale in a way or at a distance that causes the whale to change direction of travel or behavior (including breathing/surfacing pattern);

f. reduce vessel speed to 10 knots or less when weather conditions reduce visibility to 1.6 kilometers (1 mile) or less; and

g. adhere to the Alaska Humpback Whale Approach Regulations when vessels are transiting to and from the project site: (see 50 CFR §§ 216.18, 223.214, and 224.103(b); these regulations apply to all humpback whales). Specifically, pilot and crew will not:

   i. approach, by any means, including by interception (i.e., placing a vessel in the path of an oncoming humpback whale), within 100 yards of any humpback whale:

   ii. cause a vessel or other object to approach within 100 yards of any humpback whale; or

   iii. disrupt the normal behavior or prior activity of a humpback whale by any other act or omission.

37. If a whale's course and speed are such that it will likely cross in front of a vessel that is underway, or approach within 91 meters (100 yards) of the vessel, and if maritime conditions safely allow, the engine will be put in neutral and the whale will be allowed to pass beyond the vessel, except that vessels will remain 460 meters (500 yards) from North Pacific right whales.

38. Vessels will not allow lines to remain in the water unless both ends are under tension and affixed to vessels or gear.

39. Project-specific barges will travel at 12 knots or less.

2.1.2.10 Data Collection

PSOs have the following responsibilities for data collection:

40. PSOs will record observations on data forms or into electronic data sheets.

41. The project proponent will ensure that PSO data will be submitted electronically in a

format that can be queried such as a spreadsheet or database (i.e., digital images of data sheets are not sufficient).

42. PSOs will record the following:

    a. project name, date, shift start time, shift stop time, and PSO identifier;

    b. date and time of each reportable event (e.g., a listed marine mammal observation, operation shutdown, reason for operation shutdown, change in weather conditions);

    c. weather parameters (e.g., percent cloud cover, percent glare, visibility) and sea state where the Beaufort Wind Force Scale will be used to determine sea state (https://www.weather.gov/mfl/beaufort);

    d. species, numbers, and, if possible, sex and age class of observed listed marine mammal;

    e. the predominant anthropogenic sound-producing activities occurring during each listed marine mammal observation;

    f. observations of listed marine mammal behaviors and reactions to anthropogenic sounds and presence;

    g. geographic coordinates of initial, closest, and last location of listed species, including distance from observer to the listed species, and minimum distance from the predominant sound-producing activity to listed species; and

    h. whether the presence of a listed species necessitated the implementation of mitigation measures to avoid acoustic impact (i.e., shutdown), and the duration of time that normal operations were affected by the presence of listed species.

2.1.2.11 **Reporting**

Unauthorized Take

43. If a listed marine mammal is determined by the PSO to have been disturbed, harassed, harmed, injured, or killed (e.g., a listed marine mammal is observed entering a shutdown zone before operations can be shut down, or is injured or killed as a direct or indirect result of the action), the PSO will report the incident to NMFS within one business day, with information submitted to akr.prd.records@noaa.gov. These PSO records will include:

    a. digital, queryable documents containing PSO observations and records, and digital, queryable reports;

b. the date, time, and location of each event (provide geographic coordinates);

c. description of the event;

d. number of individuals of each listed marine mammal species affected;

e. the time the animal(s) was first observed or entered the shutdown zone, and, if known, the time the animal was last seen or exited the zone, and the fate of the animal;

f. mitigation measures implemented prior to and after the animal was taken;

g. if a vessel struck a listed marine mammal, the contact information for the PSO on duty on the vessel or the contact information for the individual piloting the vessel; and

h. photographs or video footage of the animal(s), if available.

Stranded, Injured, Sick or Dead Listed Species (not associated with the project)

44. If the PSO observes an injured, sick, or dead marine mammals (i.e., stranded), they will notify the Alaska Marine Mammal Stranding Hotline at 877-925-7773. The PSOs will submit photos and available data to aid NMFS in determining how to respond to the stranded animal. If possible, data submitted to NMFS in response to stranded marine mammals will include date/time, location of stranded marine mammal, species and number of stranded individuals, description of the stranded marine mammal's condition, event type (e.g., entanglement, dead, floating), and behavior of live-stranded marine mammals.

Illegal Activities

45. If the PSO observes listed marine mammals or other marine mammals being disturbed, harassed, harmed, injured, or killed (e.g., feeding or unauthorized harassment), these activities will be reported to NMFS Alaska Region Office of Law Enforcement (Table 6; 1-800-853-1964).

46. Data submitted to NMFS will include date/time, location, description of the event, and any photos or videos taken.

Extralimital Sightings

47. All observations of ESA-listed marine mammal species not considered in this consultation will be reported to NMFS within 24 hours. Photographs and/or video should be taken if possible to aid in Photo ID of individual animals. Reports will include all applicable information that would be included in a final report.

3 FINAL REPORT

48. A final report will be submitted to NMFS within 90 calendar days of the completion of the project summarizing the data recorded by emailing it to akr.prd.records@noaa.gov. The report will summarize all in-water activities associated with the proposed action, and results of PSO monitoring conducted during the in-water activities.

49. The final report for projects will include:

    a. summaries of monitoring efforts, including dates and times of construction, dates and times of monitoring, dates and times and duration of shutdowns due to listed marine mammal presence;

    b. dates and times of listed marine mammal observations, geographic coordinates of listed marine mammals at their closest approach to the project site, including date, water depth, species, age/size/gender (if determinable), and group sizes;

    c. number of listed marine mammals observed (by species) during periods with and without project activities (and other variables that could affect detectability);

    d. observed listed marine mammal behaviors and movement types versus project activity at the time of observation;

    e. numbers of marine mammal observations/individuals seen versus project activity at time of observation;

    f. any photos or videos taken of marine mammals; and

    g. digital, queryable documents containing PSO observations and records, and digital, queryable reports.

Table 6. Summary of Agency Contact Information

Reason for Contact	**Contact Information**
Consultation Questions & Unauthorized Take	akr.prd.section7@noaa.gov
Reports & Data Submittal	akr.prd.records@noaa.gov
Stranded, Injured, or Dead Marine Mammals	Stranding Hotline (24/7 coverage) 1-877-925-7773

Reason for Contact	**Contact Information**
Oil Spill & Hazardous Materials Response	U.S. Coast Guard National Response Center: 1-800-424-8802 and AKRNMFSSpillResponse@noaa.gov
Illegal Activities *(not related to project activities; e.g., feeding, unauthorized harassment, or disturbance to marine mammals)*	NMFS Office of Law Enforcement (AK Hotline): 1-800-853-1964
In the event that this contact information becomes obsolete	NMFS Anchorage Main Office: 907-271-5006 or NMFS Juneau Main Office: 901-206-4342

3.1 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur. For CTR, the basis for defining the action area takes into consideration in-air and underwater construction-related noise associated with in-water pile installation and removal.

3.1.1 Underwater Portion of Action Area

During CTR, in-water pile installation and removal will result in the greatest geographic extent of potential underwater impacts. The propagation of underwater noise by different methods is discussed in Section 6 of this opinion and the ITR/LOA application for this project (POA 2024). To define the underwater portion of the action area, the maximum distance at which project-related underwater noise would be detectable was used. In construction Year 1 through Year 5, impact pile installation of 72-inch piles with a bubble curtain would produce the loudest project-related underwater noise and would be audible above ambient (background) sound levels up to approximately 2,512 meters (Figure 6). In construction Year 6, impact pile installation of 144-inch monopiles for the two mooring dolphins with a bubble curtain would produce the loudest project-related underwater noise and would be audible above ambient (background) sound levels up to approximately 13,594 meters (Figure 7). Landforms located less than 6.0 km away from CTR would block the propagation of noise to some extent and reduce the total area of Knik Arm included in the underwater portion of the action area in all years.

Figure 6. CTR In-Water Action Area for Year 1 through Year 5 (Port of Alaska 2024).

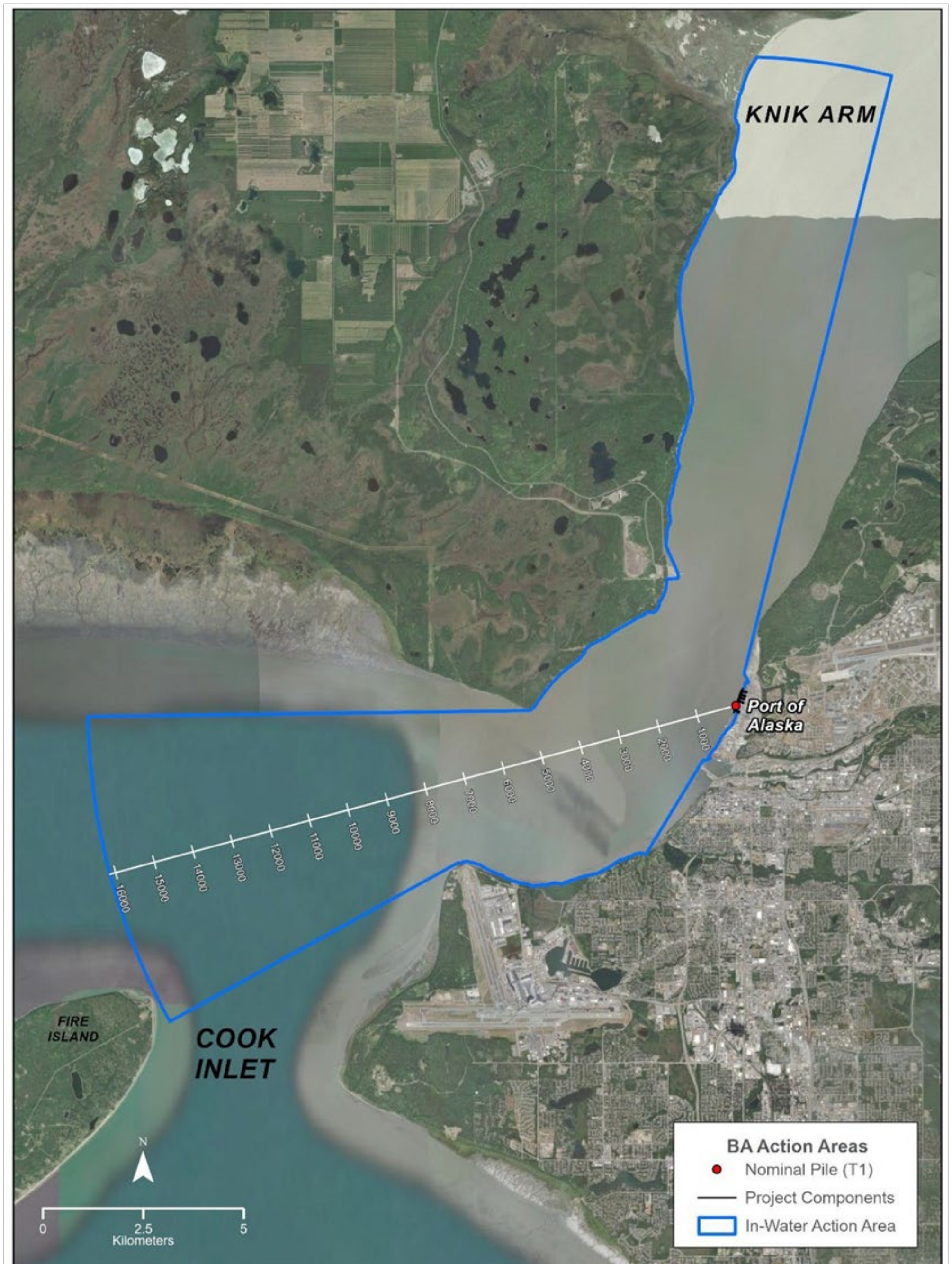

Figure 7. CTR In-Water Action Area for Year 6 (Port of Alaska 2024).

3.1.2 **In-Air Portion of Action Area**

The in-air portion of the action area is defined by the acoustic effects related to impact installation of the two 144-inch steel piles. For construction Years 1 through 5, it was assumed that impact installation of 72-inch monopiles would produce the highest in-air sound levels. Because no data could be found on in-air noise estimates from impact installation of 72-inch piles, a proxy sound source based on 96-inch steel piles from the San Francisco-Oakland Bay Bridge East Space Project (Illingworth & Rodkin and Denise Duffy and Associates 2001) was used. In-air noise levels ranging from 90 to 105 A-weighted decibels (dBA) were measured at a distance of 100 meters (328 ft) during impact installation of 96-inch piles, and it was therefore assumed that 105 dBA would be the highest anticipated in-air sound source level for the CTR for construction Years 1 through 5.

For construction Year 6, it was assumed that impact installation of 144-inch monopiles would produce the highest in-air sound levels. Because no data could be found on in-air noise estimates from impact installation of 144-inch piles, a proxy sound source based on the same study noted above was used, which addressed 96-inch steel piles from the San Francisco-Oakland Bay Bridge East Space Project (Illingworth & Rodkin and Denise Duffy and Associates 2001). In-air noise levels ranging from 90 to 105 dBA were measured at a distance of 100 meters (328 ft) during impact installation of 96-inch piles. Based on the 50% increase in diameter between 96- and 144-inch piles, in-air sound source levels for 144-inch piles are estimated to be 2 dB above what was measured for 96-inch piles. Therefore, it is assumed that 107 dBA would be the highest anticipated in-air sound source level for the CTR.

The spherical spreading model with sound transmission loss (TL) of 6.0 dB per doubling distance for a hard surface (D = Do × 10 ((Construction Noise – Ambient Sound Level in dBA)/α; (Washington State Department of Transportation [WSDOT] 2020) was used to estimate sound threshold distances from the mean source levels. In the model:

$$D = D_o \times 10((\text{Construction Noise} - \text{Ambient Sound Level})/\alpha)$$

- D = the distance from the noise source
- D_o = the reference measurement distance (100 meters [328 ft] in this case)
- α = 20 for hard ground or water, which assumes a 6 dBA reduction per doubling distance
- α = 25 for soft ground, which assumes a 7.5 dBA reduction per doubling distance

Based on estimated in-air ambient noise levels of 65 dBA (WSDOT 2020), the spherical spreading loss model indicates that noise from impact pile installation would attenuate to ambient noise levels approximately 10,000 meters (32,808 ft) from the work area in construction Year 1 through Year 5, and 12,589 meters (41,302 ft) from the work area in construction Year 6. Use of 22.5 for transmission loss, to better represent the mixed hard and soft surfaces and scattering that takes place in urban and suburban areas, yields distances of approximately 5,995 meters (19,669 ft) from the work area in construction Year 1 through Year 5, and 7,356 meters (24,134 ft) from the work area in construction Year 6.

This defines the in-air portion of the action area. There is no critical habitat nor any haulouts for

ESA-listed Western DPS Steller sea lions (areas where Steller sea lions could use terrestrial habitat that would expose them to in-air sound) within the in-air portion of the action area. Marine mammals in the water are not expected to be impacted by in-air sound because they can dive to avoid the noise. Therefore, the analysis below focuses solely on impacts on the aquatic portion of the action area.

4 APPROACH TO THE ASSESSMENT

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

To jeopardize the continued existence of a listed species means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934; June 3, 1986).

Under NMFS's regulations, the destruction or adverse modification of critical habitat means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species (50 CFR 402.02).

When designated, critical habitat uses the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (81 FR 7414; February 11, 2016) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, our use of the term PBF also applies to Primary Constituent Elements and essential features.

We use the following approach to determine whether the proposed action described in Section 2 of this opinion is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify those aspects (or stressors) of the proposed action that are likely to have effects on listed species or critical habitat. As part of this step, we identify the action area – the spatial and temporal extent of these effects.

- Identify the range wide status of the species and critical habitat likely to be adversely affected by the proposed action. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. We determine the range-wide status of critical habitat by examining the condition of its PBFs - which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 4 of this opinion.

- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.

- Analyze the effects of the proposed action. Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also evaluates the proposed action's effects on critical habitat PBFs, if relevant. The effects of the action are described in Section 6 of this opinion with the exposure analysis described in Section 6.2 of this opinion.

- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.3 of this opinion.

- Describe any cumulative effects. Cumulative effects, as defined in NMFS's implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 7 of this opinion.

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of critical habitat for the conservation of the species, if relevant. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.

- Reach jeopardy and adverse modification conclusions. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.
- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action.

5 RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

This opinion considers the effects of the proposed action on the species and designated critical habitats specified in Table 7.

Table 7. Listing status and critical habitat designation for species considered in this opinion.

Species	Status	Listing	Critical Habitat
Humpback Whale, Mexico DPS *(Megaptera novaeangliae)*	Threatened	NMFS 2016, 81 FR 62260	NMFS 2021, 86 FR 21082
Humpback Whale, Western North Pacific DPS *(Megaptera novaeangliae)*	Endangered	NMFS 2016, 81 FR 62260	NMFS 2021, 86 FR 21082
Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered	NMFS 2008, 73 FR 62919	NMFS 2011, 76 FR 20180
Steller Sea Lion, Western DPS *(Eumetopias jubatus)*	Endangered	NMFS 1997, 62 FR 24345	NMFS 1993, 58 FR 45269

5.1 Species and Critical Habitat Not Likely to be Adversely Affected by the Action

NMFS uses two criteria to identify those endangered or threatened species or critical habitat that are likely to be adversely affected by the proposed action. The first criterion is exposure or some reasonable expectation of a co-occurrence between one or more potential stressors associated with the proposed action and a listed species or designated critical habitat. The second criterion is an assessment of the potential response given exposure. We applied these criteria to the species and critical habitats listed above and determined that critical habitat for Steller sea lions and both DPSs of humpback whale will not be exposed to any of the stressors associated with the proposed project because each is located over 200 km away from the action area. Cook Inlet beluga whale critical habitat will be exposed to stressors from the proposed project but is not likely to be adversely affected.

5.1.1 **Cook Inlet Beluga Whale Critical Habitat**

On April 11, 2011, NMFS published a final rule to designate critical habitat for the Cook Inlet beluga whale (Figure 8, 76 FR 20180). Critical habitat is defined by two areas that together encompass 7,800 km^2 (3,013 mi^2) of marine and estuarine habitat in Cook Inlet. For national security reasons, critical habitat excludes all property and waters of Joint Base Elmendorf-Richardson (JBER) and waters adjacent to the POA.

Critical habitat Area 1 encompasses 1,909 km^2 (738 mi^2) of Cook Inlet northeast of a line from the mouth of Threemile Creek to Point Possession. This area is bounded by the Municipality of Anchorage, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough. The area contains shallow tidal flats and river mouths or estuarine areas, and it is an important foraging and calving habitat. Mudflats and shallow areas adjacent to medium and high flow accumulation streams may also provide for other biological needs, such as molting or escape from predators (Shelden et al. 2003). Area 1 has the highest concentrations of beluga whales from spring through fall, as well as the greatest potential for adverse impact from anthropogenic threats (76 FR 20180).

Critical habitat Area 2 is located south of Area 1, and includes both near and offshore areas of the mid and upper Inlet, and nearshore areas along the west side and Kachemak Bay on the east side of the lower Inlet. Area 2 consists of 5,891 km^2 (2,275 mi^2) of less concentrated spring and summer beluga whale use, but known fall and winter use areas. It is largely based on dispersed fall and winter feeding and transit areas in waters where whales typically occur in smaller densities or deeper waters (76 FR 20180).

The Cook Inlet Beluga Whale Critical Habitat Final Rule included designation of five PCEs, referred to as PBFs in this opinion. The below five PBFs were deemed essential to the conservation of the Cook Inlet beluga whale (50 CFR 226.220(c)):

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within five miles of high and medium flow anadromous fish streams.

2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.

3. Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.

4. Unrestricted passage within or between the critical habitat areas.

5. Waters with in-water noise below levels resulting in the abandonment of critical habitat

areas by Cook Inlet beluga whales.

Portions of critical habitat Area 1 exist within the action area. Knik Arm is used intensively by beluga whales from spring through fall for foraging and as nursery habitat. Foraging primarily occurs at river mouths (e.g., Susitna Delta, Eagle River flats), which are unlikely to be influenced by pile driving activities. The Susitna Delta is more than 20 km from the POA and the land structure at Cairn Point is likely to impede any pile driving noise from propagating into the Eagle River flats in northern Knik Arm.

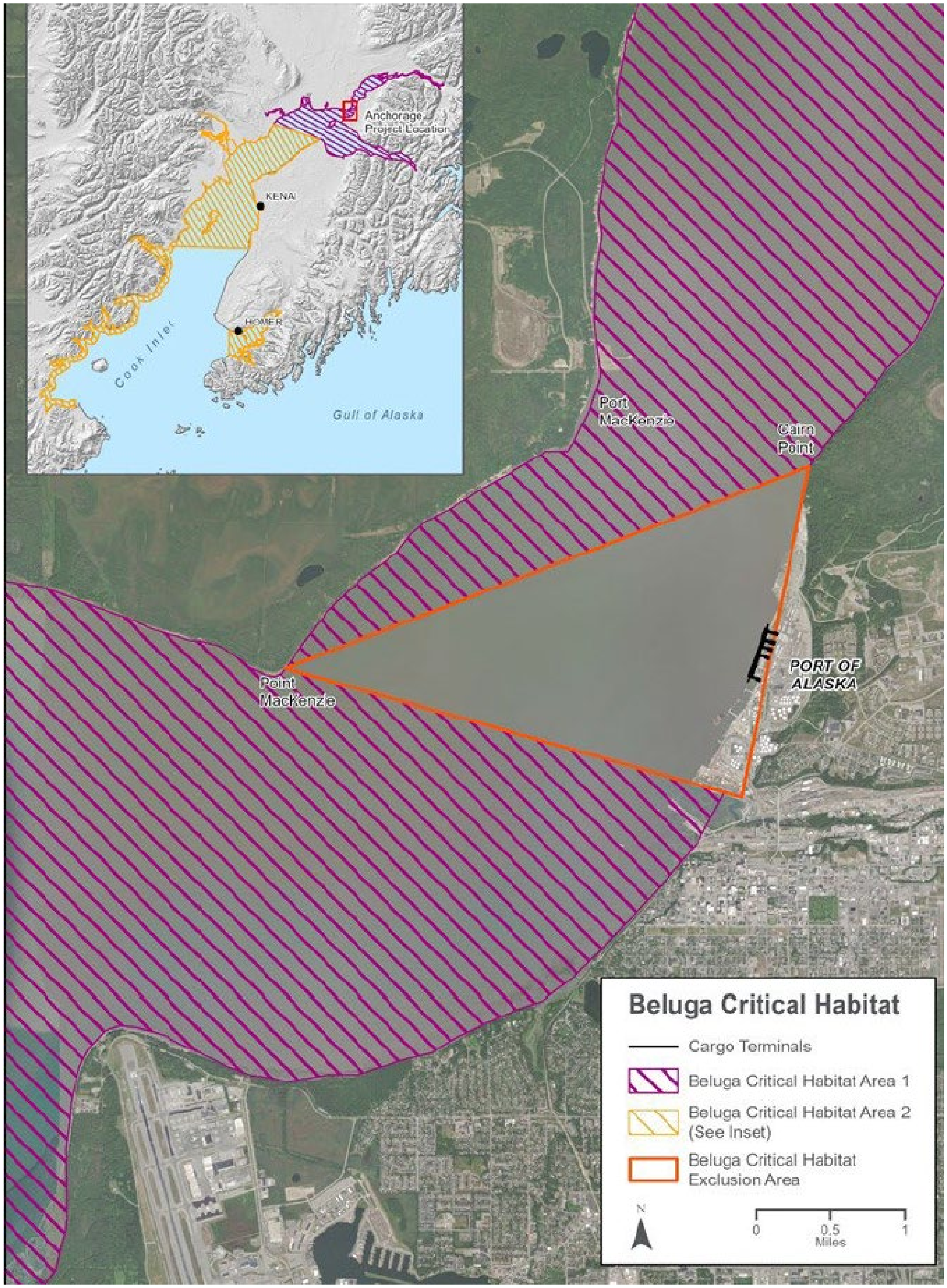

Figure 8. Designated Cook Inlet beluga critical habitat near the POA Cargo Terminals project site.

NMFS has identified noise from project activities, disturbance to the seafloor, turbidity, and the possible accidental release of pollutants as the stressors that may affect Cook Inlet beluga whale critical habitat. The potential effects of these stressors on the PBFs are discussed below.

PBF 1: Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within five miles of high and medium flow anadromous fish streams.

The shallow water channels and mudflats at the mouths of anadromous streams are important to belugas because they concentrate prey into narrow channels and offer protection from killer whales. There are several anadromous streams and associated intertidal and subtidal waters that occur within the action area. However, project activities are not expected to affect the bathymetry or hydrology of the anadromous streams or their channels, and their function in concentrating prey or providing protection from killer whales will not be altered. We expect the proposed project to have no effect on PBF 1.

PBF 2: Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.

The action area is located within designated essential fish habitat (EFH) for chum, coho, Chinook, sockeye, and pink salmon. Other groundfish species, such as Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole, may occur within the area during early life stages. Increased turbidity, elevation in noise levels during pile driving, and small spills have the potential to impact PBF 2.

Project activities may temporarily increase turbidity in the action area. Pile driving may cause temporary and localized turbidity through sediment disturbance. Turbidity from this activity would not be expected to extend beyond an approximately 25-foot radius of the pile (Everitt et al. 1980). Due to the implementation shutdown zones, the high silt loads in the action area, and the unlikely drift of suspended sediments beyond the shutdown zone, such turbidity is unlikely to measurably affect ESA-listed species during passage through or while foraging in the action area.

Sediment loads in Cook Inlet are naturally high. The majority of freshwater discharged into Cook Inlet originates from three glacially-fed rivers, which introduce large quantities of sediment into the system. Disposal of fill material will be intermittent, with a period of hours or days between disposal events, and the POA plans to complete in-water work as early in the construction season as possible when beluga presence in the area is typically lower. Only a limited amount of fine sediment is expected to travel into Cook Inlet beluga critical habitat and tidal exchanges will rapidly disperse any localized increase in suspended sediments. The POA is also required to comply with state water quality standards during construction. Therefore, any increases in turbidity are expected to be temporary, localized, and have no measurable impacts to prey species, and thus insignificant.

Construction activities will produce non-impulsive and impulsive sounds. Fish react to intermittent low-frequency sounds and sounds that are especially strong. It is likely that fish will avoid sound sources within ranges that may be harmful (McCauley et al. 2003). The most likely impact to fish from pile driving activities would be temporary behavioral avoidance of the project area. The duration of fish avoidance is unknown, but a rapid return to normal recruitment, distribution, and behavior is expected. The impact of noise on beluga prey is expected to be localized, temporary, and very minor, and adverse effects to PBF 2 will be immeasurably small, and thus insignificant.

Small, unauthorized spills have the potential to affect prey species, including adult anadromous fishes and out-migrating smolts. Several different petroleum products may be associated with a spill from project vessels, such as hydraulic oil, engine lubricant, gasoline, or diesel fuel. In the occurrence of a small spill, refined petroleum products such as gasoline, diesel fuel, and solvents rapidly dissipate into thin films (Neff 1990a). The toxic volatile components of these products dissipate from the environment quickly via evaporation, therefore exposure to harmful fractions of oil products would be highly localized and transient. Small spills are expected to rapidly disperse due to tide-induced turbulence and mixing, and changes in primary prey population levels, distribution, or availability to belugas are not expected. Based on the localized nature of small spills, the relatively rapid weathering and dispersion, and the safeguards in place to avoid and minimize spills, adverse effects to PBF 2 prey species are expected to be immeasurably small, and thus insignificant.

PBF 3: Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.

No aspect of the proposed project is expected to purposefully or knowingly introduce toxins or harmful agents into the waters of Cook Inlet. Authorized discharges of pollutants are regulated through NPDES permits, which undergo separate ESA section 7 consultations (NMFS 2010b). As discussed in PBF 2, an accidental small spill could occur. Unauthorized small spills are expected to rapidly disperse due to tide-induced currents, turbulence, and mixing. Based on the localized nature of small spills, the relatively rapid weathering and dispersion, and the safeguards in place to avoid and minimize spills, adverse effects to PBF 3 are expected to be immeasurably small, and thus insignificant.

PBF 4: Unrestricted passage within or between the critical habitat areas.

Cook Inlet beluga whales are unlikely to be physically restricted from passing through critical habitat; however, noise from pile driving and vessel presence could cause belugas to avoid certain areas while activities are occurring. Avoidance of project-related ensonified areas has the potential to restrict beluga passage between lower and upper Knik Arm. Belugas were observed swimming past the POA during previous construction and dredging activities (Kendall et al. 2014; Kendall and Cornick 2015; POA 2019a; USACE 2019) and we expect belugas to continue unimpeded during the proposed action. Mitigation measures are also expected to allow for unrestricted passage through the action area; pile driving will shut down when belugas are observed approaching the Level B harassment zone and will not resume until the whales have cleared the zone. Based on previous beluga behavior and the implementation of mitigation measures, any effects on passage will likely be too small to detect or measure, and thus insignificant.

PBF 5: Waters with in-water noise below levels resulting in abandonment of critical habitat areas by Cook Inlet Belugas.

Marine mammals have been observed to abandon habitat during periods of construction noise (Wartzok et al. 2003; Forney et al. 2017), however Cook Inlet beluga presence in the area has persisted during numerous periods of pile driving, dredging, and other construction activities at the POA. In order to minimize the amount of work occurring during months with high beluga presence, the POA plans to start and complete in-water work as early in the construction season as possible. Additionally, the implementation of mitigation measures such as pile driving shutting down when belugas are observed approaching the Level B harassment zone and not resuming until the whales have cleared the zone will reduce the impact of in-water noise and the likelihood of temporary avoidance by belugas of the POA area. Thus, we expect the effects on PBF5 will be immeasurably small and insignificant.

Critical Habitat Effects Summary

In summary, activities associated with the proposed CTR project are not likely to have an adverse effect on Cook Inlet beluga whale critical habitat. Beluga whales may choose not to forage in close proximity to the CTR site during project activities; however, the POA is not an important foraging location and is excluded from critical habitat. Project stressors will have no effect on PBF 1, an insignificant effect on PBFs 2, 3, 4, and 5. NMFS therefore concurs that the proposed CTR project is not likely to adversely affect Cook Inlet beluga whale critical habitat.

Effects of the project on Cook Inlet beluga whale critical habitat will not be discussed further.

5.2 Climate Change

One threat common to all the species we discuss in this opinion is global climate change. Because of this commonality, we present an overview here rather than in each of the species-specific narratives. A vast amount of literature is available on climate change and for more detailed information we refer the reader to these websites, which provide the latest data and links to the current state of knowledge on the topic.

https://www.ipcc.ch/reports/

https://climate.nasa.gov/evidence/

http://nsidc.org/arcticseaicenews/

https://arctic.noaa.gov/Report-Card

Increased air temperatures, increased ocean temperatures, and ocean acidification are the three facets of climate change presented here as they have the most direct impact on marine mammals and their prey.

5.2.1 **Air temperature**

Recording of global temperatures began in 1850, and the last nine years (2014–2023) have ranked as the ten warmest years on record. The yearly temperature for North America has increased at an average rate of 0.23°F since 1910; however, the average rate of increase has doubled since 1982 (0.61°F).[3]

The Arctic (latitudes between 60ºN and 90ºN) has been warming at more than two times the rate of lower latitudes since 2000. This is due to "Arctic amplification", a characteristic of the global climate system influenced by changes in sea ice extent, albedo, atmospheric and oceanic heat transports, cloud cover, black carbon, and many other factors (Serreze and Barry 2011; Richter-Menge et al. 2017; Richter-Menge 2019). The average annual temperature is now 3-4°F warmer than during the early and mid-century (Figure 9). The average annual temperature for Alaska in 2022 was 28.6°F, 2.6°F above the long-term average, ranking the 16th warmest year in the 98-year record for the state.[4] Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014).

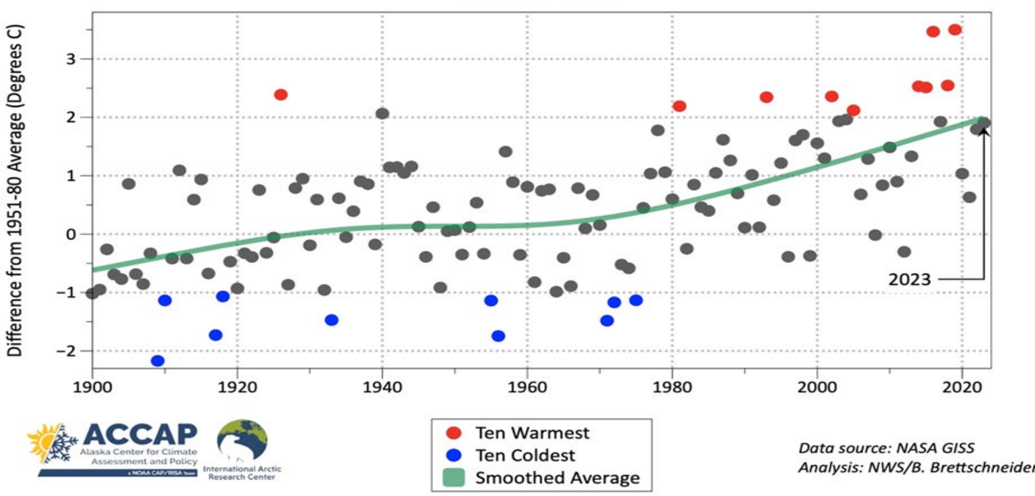

Figure 9. Alaska annual temperature 1900 to 2023.[5]

[3] https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202213 accessed October 2024.
[4] https://www.ncei.noaa.gov/access/monitoring/monthly-report/national/202213 accessed October 2024.
[5] Alaska Center for Climate Assessment and Policy, Weather and Climate Graphics, Gulf of Alaska.

5.2.2 **Marine water temperature**

Higher air temperatures have led to higher ocean temperatures. More than 90 percent of the excess heat created by global climate change is stored in the world's oceans, causing increases in ocean temperature (IPCC 2019; Cheng et al. 2020; IPCC 2021; IPCC 2023). The four highest annual global ocean heat content (OHC) measurements, which is the amount of heat stored in the upper 2,000 m (6,561 ft) of the ocean, have all occurred in the last four years (2019–2022), and regions of the North Pacific, North Atlantic, and Southern oceans, as well as the Mediterranean Sea, recorded their highest OHC since the 1950s.[6]

The seas surrounding Alaska have been unusually warm in recent years, with unprecedented warmth in some cases (Thoman and Walsh 2019). This effect is observed throughout the Alaska region, including the Bering, Chukchi, and Beaufort seas (). Warmer ocean water affects sea ice formation and melt. In the first decade of the 21st century, Arctic sea ice thickness and annual minimum sea ice extent began declining at an accelerated rate and continues to decline at a rate of approximately 2.7 percent per decade (Stroeve et al. 2007; Stroeve and Notz 2018).

Seasonal ice cover in Cook Inlet has not been characterized in as much detail as the Arctic, but the same general trend of later ice formation and earlier melt is expected. Of the three species considered in this opinion, beluga whales are likely the most affected by changing ice conditions in Cook Inlet, as their entire life is spent in this single body of water.

[6] https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202213 accessed October 2024.

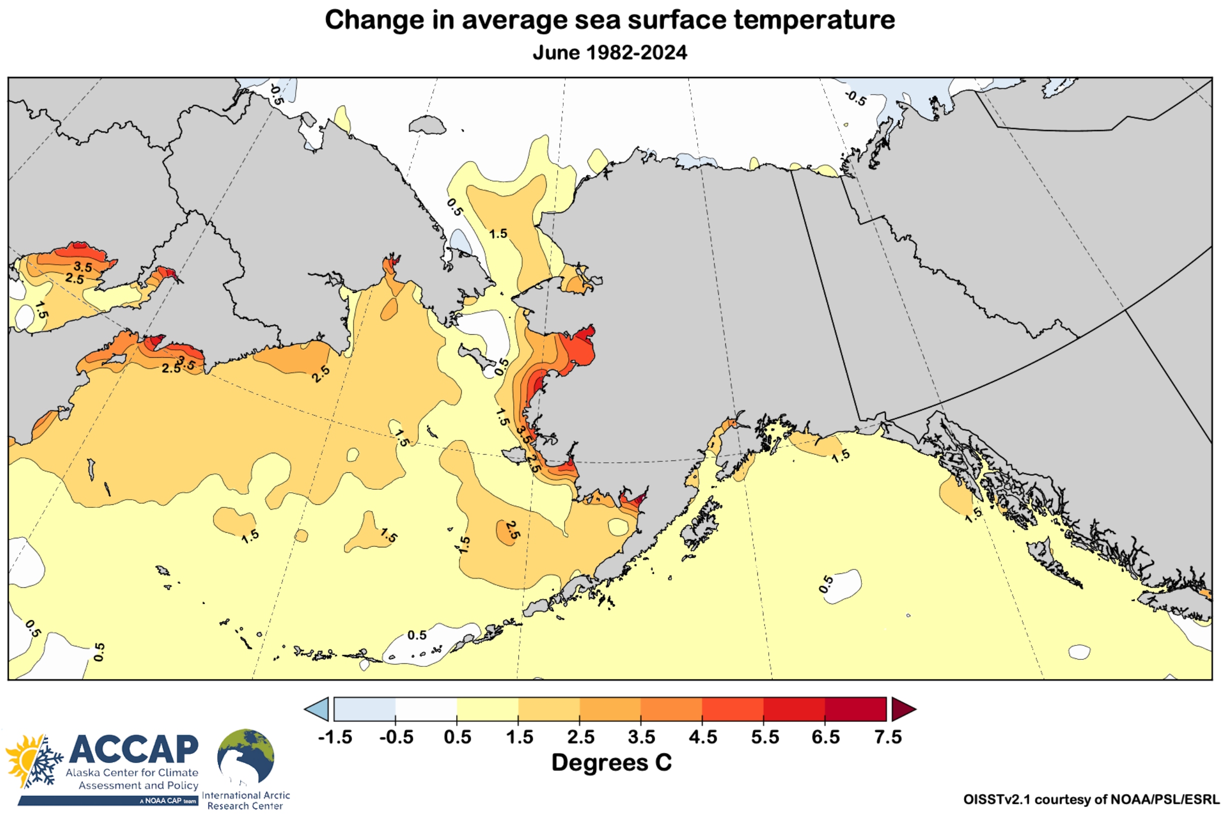

Figure 10. Change in average sea surface temperature in Alaskan waters, recorded in June of 1982-2024.

With the reduction in the cold-water pool in the northern Bering Sea, large scale northward movements of commercial fish stocks are underway, as previously cold-dominated ecosystems warm and fish move northward to higher latitudes (Grebmeier et al. 2006; Eisner et al. 2020). Not only fish, but plankton, crabs, and sessile invertebrates like clams are affected by these changes in water temperature (Grebmeier et al. 2006; Fedewa et al. 2020).

The marine heat wave, a coherent area of extreme warm temperature at the sea surface that persists, is another ocean water anomaly (Frölicher et al. 2018). Marine heatwaves are a key ecosystem driver and nearly 70 percent of global oceans experienced strong or severe heatwaves in 2016, compared to 30 percent in 2012 (Suryan et al. 2021). The largest recorded marine heat wave occurred in the northeast Pacific Ocean, appearing off the coast of Alaska in the winter of 2013-2014 and extending south to Baja California by the end of 2015 (Frölicher et al. 2018). The Pacific marine heatwave began to dissipate in mid-2016, but warming re-intensified in late-2018 and persisted into fall 2019 (Suryan et al. 2021). Consequences of this event included an unprecedented harmful algal bloom that extended from the Aleutian Islands to southern California, mass strandings of marine mammals, shifts in the distribution of invertebrates and fish, and shifts in abundance of several fish species (Cavole et al. 2016). Cetaceans, forage fish such as capelin and herring, Steller sea lions, adult cod, and chinook and sockeye salmon in the

Gulf of Alaska were all impacted by the Pacific marine heatwave (Bond et al. 2015; Peterson et al. 2016; Sweeney et al. 2018).

The 2018 Pacific cod stock assessment estimated that the female spawning biomass of Pacific cod (an important prey species for Steller sea lions) was at its lowest point in the 41-year time series, following three years of poor recruitment and increased natural mortality as a result of the Pacific marine heatwave.[7] The spawning stock biomass dropped below 20 percent of the unfished spawning biomass in 2020; 20 percent is a minimum spawning stock size threshold instituted to help ensure adequate prey availability for the endangered Western DPS of Steller sea lions. The federal Pacific cod fishery in the Gulf of Alaska was closed by regulation to directed Pacific cod fishing in 2020 as a result (Barbeaux et al. 2020). As of late 2022, Pacific cod had not recovered from the decline during the 2014-2016 marine heatwave.[8] Pacific cod abundance remains at reduced levels; however, the spawning stock biomass is above the 20 percent minimum spawning stock size threshold.[9]

5.2.3 Ocean Acidification

For 650,000 years or more, the average global atmospheric carbon dioxide (CO2) concentration varied between 180 and 300 parts per million (ppm). Since the beginning of the industrial revolution in the late 1700s, atmospheric CO2 concentrations have been increasing rapidly, primarily due to anthropogenic inputs (Fabry et al. 2008; Lüthi et al. 2008). The world's oceans have absorbed approximately one-third of the anthropogenic CO2 released, which has buffered the increase in atmospheric CO2 concentrations (Feely et al. 2004; Feely et al. 2009). Despite the ocean's role as a large carbon sink, the CO2 level continues to rise and is currently at 419 ppm.[10]

As the oceans absorb CO2, the buffering capacity and pH of seawater is reduced. This process is referred to as ocean acidification. Ocean acidification reduces the saturation states of certain biologically important calcium carbonate minerals like aragonite and calcite that many organisms use to form and maintain shells (Bates et al. 2009; Reisdorph and Mathis 2014). When seawater is supersaturated with these minerals, calcification (growth) of shells is favored. Likewise, when the seawater becomes undersaturated, dissolution is favored (Feely et al. 2009).

High latitude oceans have naturally lower saturation states of calcium carbonate minerals than more temperate or tropical waters, making Alaska's oceans more susceptible to the effects of ocean acidification (Fabry et al. 2009; Jiang et al. 2015). Model projections indicate that aragonite undersaturation would start to occur by about 2020 in the Arctic Ocean and by 2050, all of the Arctic will be undersaturated with this mineral (Feely et al. 2009; Qi et al. 2017). Large inputs of low-alkalinity freshwater from glacial runoff and melting sea ice contribute to the problem by reducing the buffering capacity of seawater to changes in pH (Reisdorph and Mathis

[7] https://www.fisheries.noaa.gov/alaska/population-assessments/2018-north-pacific-groundfish-stock-assessments accessed July 2023.
[8] https://gml.noaa.gov/ccgg/trends/ accessed July 2023.
[9] https://www.npfmc.org/wp-content/PDFdocuments/SAFE/2024/GOApcod.pdf accessed May 2025.
[10] https://gml.noaa.gov/ccgg/trends/ accessed July 2023.

2014). As a result, seasonal undersaturation of aragonite was already detected in the Bering Sea at sampling stations near the outflows of the Yukon and Kuskokwim rivers, and the Chukchi Sea (Fabry et al. 2009). Models and observations indicate that rapid sea ice loss will increase the uptake of CO2 and exacerbate the problem of aragonite undersaturation in the Arctic (Yamamoto et al. 2012; DeGrandpre et al. 2020).

Undersaturated waters are potentially highly corrosive to any calcifying organism, such as corals, bivalves, crustaceans, echinoderms and many forms of zooplankton, and, consequently, may affect Arctic food webs (Fabry et al. 2008; Bates et al. 2009). Pteropods, which are often considered indicator species for ecosystem health, are prey for many species of carnivorous zooplankton, fishes including salmon, mackerel, herring, and cod, and baleen whales (Orr et al. 2005). With their thin shells and dependence on aragonite, pteropods may not be able to grow and maintain shells under increasingly acidic conditions (Lischka and Riebesell 2012). It is uncertain if these species, which play a large role in supporting many levels of the Alaskan marine food web, will be able to adapt to changing ocean conditions (Fabry et al. 2008; Lischka and Riebesell 2012).

In sum, climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Hinzman et al. 2005; Burek et al. 2008; Doney et al. 2012; Huntington et al. 2020). The physical effects on the environment described above have impacted, are impacting, and will continue to impact marine species in a variety of ways (IPCC 2014), including shifting abundances, changes in distribution, changes in timing of migration, and changes in periodic life cycles of species. For example, cetaceans with restricted distributions linked to water temperature may be particularly susceptible to range restriction (Learmonth et al. 2006; Isaac 2009). Macleod (2009) estimated that, based on expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, 47 percent will be negatively affected, and 21 percent will be put at risk of extinction. Of greatest concern are cetaceans with ranges limited to non-tropical waters and preferences for shelf habitats (Macleod 2009).

5.3 Status of Listed Species Likely to be Adversely Affected by the Action

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. Species status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

For each species, we present a summary of information on the population structure and distribution of the species to provide a foundation for the exposure analyses that appear later in this opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the jeopardy determinations we make later in this opinion. That is, we rely on a species' status and trend to determine whether an action's effects are likely to increase the species' probability of becoming extinct.

5.3.1 **Cook Inlet Beluga Whale**

5.3.1.1 **Status and Population Structure**

Beluga whales inhabiting Cook Inlet are one of five distinct stocks found in Alaska (Muto et al. 2022). The best historical abundance estimate of the Cook Inlet beluga population is 1,293 whales, based on a survey in 1979 (Calkins 1989). NMFS began conducting comprehensive, systematic aerial surveys of the population in 1993. These surveys documented a decline in abundance from 653 whales in 1994 to 347 whales in 1998. In response to this nearly 50 percent decline, NMFS designated the Cook Inlet beluga population as depleted under the MMPA in 2000 (65 FR 34590; May 31, 2000). Abundance data collected between 1999 and 2008 indicated that the population did not increase. On October 22, 2008, NMFS published a final rule to list the Cook Inlet beluga whale as endangered under the ESA (73 FR 62919).

The best current abundance estimate for the Cook Inlet beluga whale population is 331 whales (95 percent probability interval of 290 to 386), and is based on aerial surveys conducted in June 2022 (Goetz et al. 2023). A declining trend of 2.3 percent per year occurred from 2008 to 2018, and a comparison of the population estimate over time is presented in Figure 11 (Shelden and Wade 2019). With the addition of the 2021 and 2022 survey data, the trend in the updated time-series suggests the population is stable and may be slightly increasing (Goetz et al. 2023).

Annual mortality, estimated from stranding deaths relative to the population size, averaged 2.2 percent between 2005 to 2017 (McGuire et al. 2021). This is a minimum estimate due to the challenges associated with detecting stranded animals in Cook Inlet, and the number of dead belugas reported is likely only a subset of the total number of whales that expired. Cook Inlet has over 2,400 km of shoreline (Zimmermann and Prescott 2014), most of which is remote. Additionally, carcasses during the winter are likely missed due to decreased visibility and access; 96 percent of carcasses were reported during the ice-free season (April-October). It is estimated that the mean number of reported beluga carcasses represents less than one third of the total number of dead belugas each year (McGuire et al. 2021).

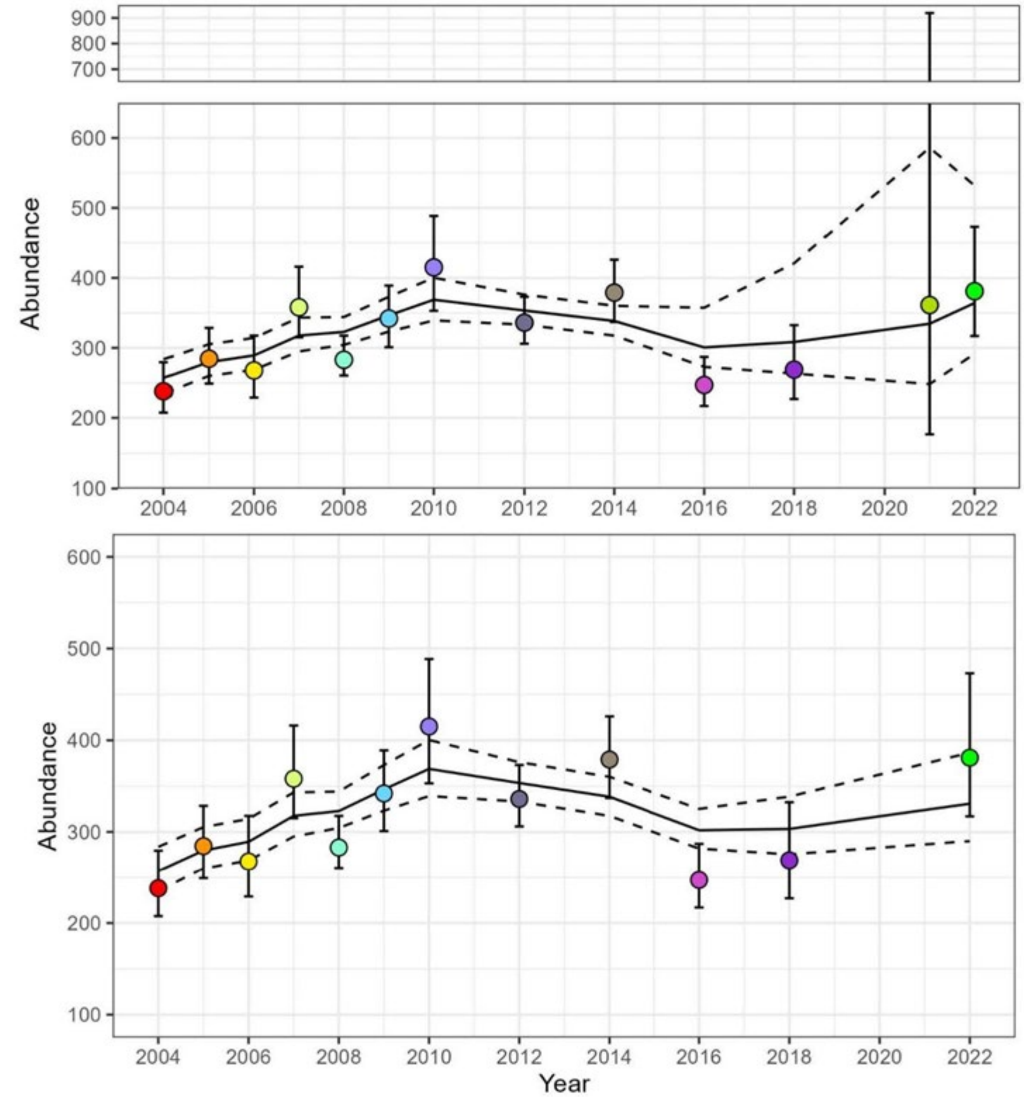

Figure 11. Cook Inlet beluga abundance estimates (circles), moving average (solid line), and 95 percent probability intervals (dotted lines and error bars; Goetz et al. 2023). Top panel includes 2021 survey data.

In the stranding dataset, mortality for Cook Inlet belugas was greatest for adults of reproductive age, followed by calves, with fewer subadults, and no adults older than 49 years (McGuire et al. 2021). Higher mortality of the very old and the very young compared to other age groups is typical in healthy mammal populations, and the mortality rates documented for Cook Inlet belugas are unusual (McGuire et al. 2021). Cook Inlet beluga whales are dying of as-yet unknown causes at relatively younger but still reproductive ages, with few surviving to reach their potential lifespan of 70+ years as reported in other beluga populations.

A detailed description of Cook Inlet beluga whale biology, habitat, and extinction risk factors can be found in the final listing rule for the species (73 FR 62919, October 22, 2008), the Conservation Plan (NMFS 2008a), and the Recovery Plan (NMFS 2016b).

Additional information regarding Cook Inlet beluga whales can be found on the NMFS AKR web site at: https://www.fisheries.noaa.gov/species/beluga-whale.

5.3.1.2 **Distribution**

Cook Inlet beluga whales remain in Cook Inlet year-round and have seasonal movement patterns. During the summer and fall, belugas typically occur in shallow coastal waters and are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Shelden et al. 2015b; Castellote et al. 2016a). Ice formation in the upper Inlet during the winter may restrict access to nearshore habitat (Ezer et al. 2013), and belugas are more dispersed in deeper waters in the mid-inlet to Kalgin Island, as well as in the shallow waters along the west shore to Kamishak Bay.

Distribution data, including aerial surveys and acoustic monitoring, indicate that the beluga's range in Cook Inlet has contracted markedly (Figure 12; Shelden et al. 2015b; Shelden and Wade 2019). The distributional shift and range contraction coincided with the decline in abundance (Moore et al. 2000; NMFS 2008a; Goetz et al. 2012). Surveys in the 1970s showed belugas dispersing into the lower inlet by mid-summer, and, prior to the 1990s, whales used areas throughout the upper, mid, and lower inlet during the spring, summer, and fall (Huntington 2000; Rugh et al. 2000; NMFS 2008a; Rugh et al. 2010). Currently, almost the entire population is found only in northern Cook Inlet from late spring into the fall.

The Susitna Delta is a very important area for Cook Inlet beluga whales, particularly in the summer and fall months. Groups of 200 to 300 individuals, including adults, juveniles, and neonates, have been observed in the Susitna River Delta area in recent years (McGuire et al. 2014). Acoustic recorders at the Little Susitna River detected a peak from late May to early June, and a large peak from July through August (Castellote et al. 2015). At the Beluga River, acoustic recorders detected three peaks of occurrence: mid-February to early April, June to mid-July (the strongest peak), and mid-November and December (Castellote et al. 2016a). The peaks in May and June appear to coincide with eulachon runs (Vincent-Lang and Queral 1984), and the peaks from June and July coincide with salmon runs (particularly silver and chinook salmon; Brenner et al. 2019).

The area around the East Forelands between Nikiski, Kenai, and Kalgin Island appears to provide important habitat in winter, early spring, and fall. Belugas have been observed in and around the Kenai and Kasilof Rivers throughout the summer (Ovitz 2019), and recent spring and fall monitoring efforts indicate beluga presence in the area during these time periods as well.[11] Acoustic detections indicate that belugas may also be present in the Kenai River throughout the winter (Castellote et al. 2016a).

[11] https://akbmp.org/ Accessed July 2023.

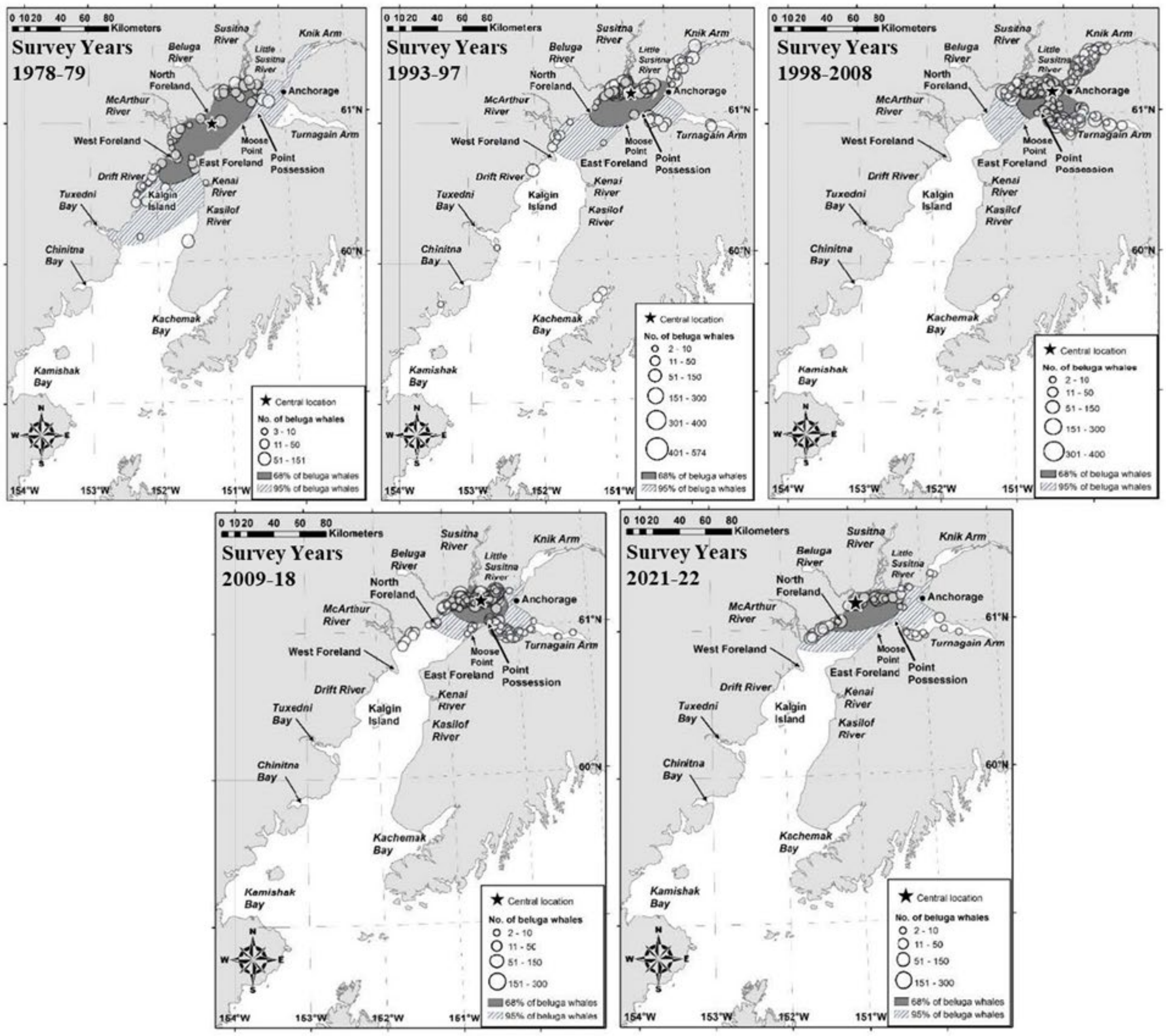

Figure 12. Areas occupied by Cook Inlet beluga whales during systematic aerial surveys (Goetz et al. 2023).

Presence in the Action Area

Beluga whales can be found in Knik Arm year-round, but are more frequently observed in the summer and fall. Large concentrations of belugas are present in Knik Arm from August through October (61 North Environmental 2021; 61 North Environmental 2022a; Easley-Appleyard and Leonard 2022) and their movements in the area are typically characterized by traveling to upper Knik Arm with the high tide and following the low tide back down to Eagle Bay and the POA (McGuire and Stephens 2017). Higher densities north of the POA are expected as belugas tend to concentrate in Eagle Bay to forage, whereas lower Knik Arm is more commonly associated with traveling behavior (McGuire and Stephens 2017). Traveling was the predominant behavior observed during recent monitoring efforts at the POA; however, belugas were also frequently observed milling in lower Knik Arm, sometimes for hours (61 North Environmental 2021; 61 North Environmental 2022a; Easley-Appleyard and Leonard 2022). When milling was recorded as one of the behaviors, the sighting duration was more than four hours for approximately nine percent of the beluga sightings (61 North Environmental 2021; 61 North Environmental 2022a; Easley-Appleyard and Leonard 2022).

In the final monitoring report for the North Extension Stabilization project at the POA, travelling was, again, the most commonly documented behavior, followed by milling. Additionally, it was documented that belugas remained milling in potentially biologically important areas (i.e., Ship Creek for feeding) despite ongoing construction activities (61 North Environmental 2025a).

Marine mammal monitoring programs have occurred at or in close proximity to the POA since 2005. Table 8 summarizes beluga whale observations and monitoring effort in the POA area.

Table 8. Beluga observations and monitoring effort in the POA area.

Year	Monitoring Project	Project Dates	Monitoring Effort		Total # of Groups	Total # of Belugas
			# of Days	# of Hours		
2005	MTRP[1]	August 2–Nov. 28	51	374	21	157
2006	MTRP[1]	April 26–Nov. 3	95	564	25	82
2007	MTRP[1]	Oct. 9–Nov. 20	28	139	14	61
2008	MTRP[1]	June 24–Nov. 14	86	612	74	283
	MTRP[2]	July 24–Dec. 2	108	607	59	431
2009	MTRP[1]	May 4–Nov. 18	86	783	54	166
	MTRP[2]	March 28–Dec. 14	214	3,322	NA	1,221

Year	Monitoring Project	Project Dates	Monitoring Effort		Total # of Groups	Total # of Belugas
			# of Days	# of Hours		
2010	MTRP[1]	June 29–Nov. 19	87	600	42	115
	MTRP[2]	July 21–Nov. 20	106	862	103	731
2011	MTRP[1]	June 28–Nov. 15	104	1,202	62	290
	MTRP[2]	July 17–Sept. 27	16	NA	5	48
2016	Port MacKenzie	April 18–April 30	12	98	12	113
	Test Pile Program	May 3–June 21	19	85.3	9	10
2017	Ship Creek Boat Launch	August 23–September 11	16	41.7	34	153
2018	POA Dredging	April 2–October 31	141	NA	NA	121
2019	PCT Dredging	May 8–September 17	133	NA	66	797
	POA Fender Pile	May 16–October 30	28	NA	1	3
2020	PCT	April 27–November	128	1,238.7	245	987

Year	Monitoring Project	Project Dates	Monitoring Effort		Total # of Groups	Total # of Belugas
			# of Days	# of Hours		
	Construction	24				
2021	POA Dredging	April 7–October 31	140	NA	NA	1,527
	PCT Construction	April 26–September 29	74	734.9	132	517
	NMFS	July 9–October 17	29	231.6	113	578
2022	PCT/SFD Dredging	May 3–August 24	70	727	90	529
	SFD Construction	May 20–June 11	13	108.2	9	41
	POA Geotechnical Survey	November 18–December 7	7	41.63	1	2
	Hilcorp Jack Up Rig Moving	June 2-3, September 15-16	2, 2	86, 29.8	1, 3	20, 25
	Seward Highway Improvement (MP 75-90)	January - December (no work July/Aug)	149	2820	5	29

Year	Monitoring Project	Project Dates	Monitoring Effort		Total # of Groups	Total # of Belugas
			# of Days	# of Hours		
2023	Hilcorp Jack Up Rig Moving (2023)	June 8-9, July 13-14	2, 2	46.1, 27.4	28, 10	175, 101-106
	Seward Highway Improvement (MP 75-90)	February-November	82	1159	0*	0*
2024	POA North Extension Stabilization	June 1- October	96	993.3	433	1924

[1]Marine Terminal Redevelopment Project (MTRP) Scientific Monitoring
[2] MTRP Construction Monitoring
*Belugas were spotted in October and November but the number of groups and individuals were not submitted in the monitoring report.

NOAA's Alaska Beluga Monitoring Program (AKBMP)[12], a citizen science project established in 2019, includes a monitoring location at the Ship Creek small boat launch located in Knik Arm just south of the POA. Monitoring sessions are typically two hours long and are scheduled around the tide cycle; belugas pass the POA as they move in and out of Knik Arm with the tides. AKBMP initiated spring monitoring sessions in 2021. A summary of AKBMP beluga monitoring sessions is provided in Table 9.

[12] www.akbmp.org, accessed on October 1, 2024

Table 9. Beluga observations and monitoring effort during AKBMP sessions at Ship Creek.

Year	Season	Dates	#of days monitored	# of hours monitored	Total number of sightings
2019	Fall	August 15-November 5	69	148.4	75
2020	Fall	August 15-November 14	53	117.7	95
2021	Spring	March 18-May 30	50	125.1	0
2021	Fall	August 15-November 6	48	115.9	83
2022	Spring	March 15-May 31	37	83.8	1
2022	Fall	August 2-November 27	68	157	202
2023	Spring	March 29-May 31	36	93.9	5
2023	Fall	August 1-November 20	82	246.6	389
2024	Spring	March 20-May 31	50	125.5	12
2024	Fall	August 1-November 30	75	191.13	279

5.3.1.3 **Feeding and Prey Selection**

Cook Inlet beluga whales have diverse diets (Quakenbush et al. 2015; Nelson et al. 2018), including multiple fish and benthos species, and often forage at river mouths. Primary prey species consist of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole. Belugas seasonally shift their distribution within Cook Inlet in relation to the timing of fish runs and seasonal changes in ice and currents (NMFS 2016b).

The seasonal availability of energy-rich prey is very important to the energetics of belugas (Abookire and Piatt 2005; Litzow et al. 2006). Cook Inlet belugas have much lower fat reserves in the spring than after feeding on abundant eulachon and salmon in the spring and summer (NMFS 2007; Saupe et al. 2014). Eating fatty prey and building up fat reserves in the spring and summer may allow beluga whales to sustain themselves during periods of reduced prey availability in winter or when metabolic needs are higher (NMFS 2007).

5.3.1.4 **Reproduction**

Probable mating behavior was observed in April and May of 2014 in Trading Bay (Lomac-MacNair et al. 2016). Conception is predicted to peak from March through May, based on analysis of stranded neonates, fetuses, and calves of the year; however, conception can occur over a wide period of up to seven months (Shelden et al. 2020). Neonates have been observed between early July and mid-October (McGuire and Stephens 2017), and the only documented beluga birth occurred on July 20, 2015 in the Susitna River Delta (McGuire and Stephens 2017). Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1989), but calving could occur through the entire ice-free period from April through November (Shelden et al. 2020). Young beluga whales are nursed for two years and may continue to associate with their mothers for a considerable time thereafter (Colbeck et al. 2013).

5.3.1.5 **Vocalization, Hearing, and Other Sensory Capabilities**

Beluga whales produce sounds for communication and echolocation. Belugas, and other odontocetes, make sounds across some of the widest frequency bands that have been measured in any animal group. For their social interactions, belugas emit communication calls with an average frequency range of about 0.2 to 7.0 kHz (Garland et al. 2015). Belugas produce a variety of audible whistles, squeals, clucks, mews, chirps, trills, and bell-like tones (Castellote et al. 2014). At the higher-frequency end of their hearing range, belugas use echolocation signals with peak frequencies at 40-120 kHz, which help to navigate and hunt in dark or turbid waters where vision is limited (Au 2000). Beluga whales are one of five non-human mammal species for which there is convincing evidence of frequency modulated vocal learning (Payne and Payne 1985; Tyack 1999; Stoeger et al. 2012).

Even among odontocetes, beluga whales are known to be one of the most adept users of sound. The unfused vertebrae and highly movable head of the beluga whale may have allowed for adaptation of their sophisticated directional hearing. Multiple studies have examined hearing sensitivity of belugas in captivity (Awbrey et al. 1988; Johnson et al. 1989; Klishin et al. 2000; Ridgway et al. 2001; Finneran et al. 2002a; Finneran et al. 2002c; Finneran et al. 2005; Mooney et al. 2008). In the first report of hearing ranges of belugas in the wild, Castellote et al. (2014) documented a wide range of sensitive hearing from 20-110 kHz, with minimum detection levels around 50 dB. These results were similar to the ranges reported in the captive studies, however, the levels and frequency range of the wild belugas indicate the whales have sensitive hearing compared to previous studies of belugas and other odontocetes (Houser and Finneran 2006; Houser et al. 2018). Most of these studies measured beluga hearing in very quiet conditions. Tidal currents in Cook Inlet regularly produce ambient sound levels well above 100 dB (Lammers et al. 2013), and beluga signal intensity can change with location and background noise levels (Au et al. 1985b).

5.3.1.6 **Threats**

The Recovery Plan for the Cook Inlet Beluga Whale (NMFS 2016b) addresses ten principal threats to the population. Table 10 provides a summary of these threats and their potential impact on Cook Inlet beluga recovery.

Table 10. Ten principal threats summary from the Recovery Plan for the Cook Inlet Beluga Whale (NMFS 2016b).

Threat Type	ESA § 4(a)(1) factor	Major effect	Extent	Frequency	Trend	Probability	Magnitude	Relative concern
Catastrophic events (e.g., natural disasters; spills; mass strandings)	A, D, E	Mortality, compromised health, reduced fitness, reduced carrying capacity	Localized	Intermittent and Seasonal	Stable	Medium to High	Variable Potentially High	High
Cumulative effects	C, D, E	Chronic stress; reduced resilience	Range wide	Continuous	Increasing	High	Unknown Potentially High	High

Threat Type	ESA § 4(a)(1) factor	Major effect	Extent	Frequency	Trend	Probability	Magnitude	Relative concern
Noise	A, D, E	Compromised communication & echolocation, physiological damage, habitat degradation	Localized & Range wide	Continuous, Intermittent, and Seasonal	Increasing	High	Unknown Potentially High	High
Disease agents (e.g., pathogens; parasites; harmful algal blooms)	C	Compromised health, reduced reproduction	Range wide	Intermittent	Unknown	Medium to High	Variable	Medium
Habitat loss or degradation	A	Reduced carrying capacity, reduced reproduction	Localized & Range wide	Continuous and Seasonal	Increasing	High	Medium	Medium
Reduction in prey	A, D, E	Reduced fitness (reproduction and/or survival); reduced carrying capacity	Localized & Range wide	Continuous, Intermittent, and Seasonal	Unknown	Unknown	Unknown	Medium
Unauthorized take	A, E	Behavior modification, displacement, injury or mortality	Range wide, localized hotspots	Seasonal	Unknown	Medium	Variable	Medium
Pollution	A	Compromised health	Localized & Range wide	Continuous, Intermittent, and Seasonal	Increasing	High	Low	Low

Threat Type	ESA § 4(a)(1) factor	Major effect	Extent	Frequency	Trend	Probability	Magnitude	Relative concern
Predation	C	Injury or mortality	Range wide	Intermittent	Stable	Medium	Low	Low
Subsistence hunting	B, D	Injury or mortality	Localized	Intermittent	Stable or Decreasing	Low	Low	Low

5.3.2 Mexico and Western North Pacific DPS Humpback Whales

5.3.2.1 Population Structure and Status

Humpback whales are found in all oceans of the world with a broad geographical range from tropical to temperate waters in the Northern Hemisphere and from tropical to near-ice-edge waters in the Southern Hemisphere. Additional information on humpback whale biology and natural history is available at: https://www.fisheries.noaa.gov/species/humpback-whale.

In 1970, the humpback whale was listed under the Endangered Species Conservation Act (ESCA) as endangered worldwide (35 FR 8491, June 2, 1970) ("baleen" listing); 35 FR 18319, Dec. 2, 1970) (original listing)), primarily due to overharvest by commercial whaling. Congress replaced the ESCA with the ESA in 1973 and humpback whales continued to be listed as endangered. Humpback whales are also considered "depleted" under the MMPA. Following the cessation of commercial whaling, humpback whale numbers increased.

NMFS conducted a global status review of humpback whales (Bettridge et al. 2015) and published a final rule recognizing 14 DPSs on September 8, 2016 (81 FR 62260). Four of these DPSs were designated as endangered and one as threatened, with the remaining nine not warranting ESA listing status.

Based on an analysis of migration between winter mating/calving areas and summer feeding areas using photo-identification, Wade (2021) concluded that humpbacks feeding in Alaskan waters belong primarily to the Hawaii DPS (recovered), with small numbers from the Mexico DPS (threatened) and Western North Pacific (WNP) DPSs (endangered). Whales from these three DPSs overlap on feeding grounds off Alaska, and are visually indistinguishable unless individuals have been photo-identified on breeding grounds and again on feeding grounds. All waters off the coast of Alaska may contain ESA-listed humpbacks.

There are approximately 2,913 animals in the Mexico DPS and 1,084 animals in the WNP DPS (Wade 2021). The population trend is unknown for both DPSs. The Hawaii DPS is estimated at 11,540 animals, and the annual growth rate is between 5.5 and 6.0 percent (Wade 2021). Humpbacks in Cook Inlet, which is considered part of their Gulf of Alaska summer feeding area, are comprised of approximately 89 percent Hawaii DPS individuals, 11 percent Mexico DPS individuals, and less than one percent WNP DPS individuals.

5.3.2.2 **Distribution**

Humpback whales generally undertake seasonal migrations from their tropical calving and breeding grounds in winter to their high-latitude feeding grounds in summer, although some individuals may remain in Alaska waters year-round. Most humpbacks that summer in Alaska winter in temperate or tropical waters near Mexico, Hawaii, or in the western Pacific near Japan. In the spring, those animals migrate back to Alaska, where food is abundant. They tend to concentrate in several areas, including Southeast Alaska, Prince William Sound, Kodiak, the Bering Sea, and along the Aleutian Islands (Wild et al. 2023). Large numbers of humpbacks have also been reported in waters over the continental shelf, extending up to 185 km offshore in the western Gulf of Alaska (Wade 2021). Some individuals remain in Alaska waters year-round.

Presence in Cook Inlet

Humpback whales have been observed throughout Cook Inlet, but are primarily found in the lower inlet. The NMFS aerial surveys for Cook Inlet belugas recorded 88 sightings of 192 humpbacks between 1993 and 2016 (Figure 13); all were located in lower Cook Inlet (Rugh et al. 2000; Rugh et al. 2005; Shelden et al. 2013; Shelden et al. 2015a; Shelden et al. 2017).

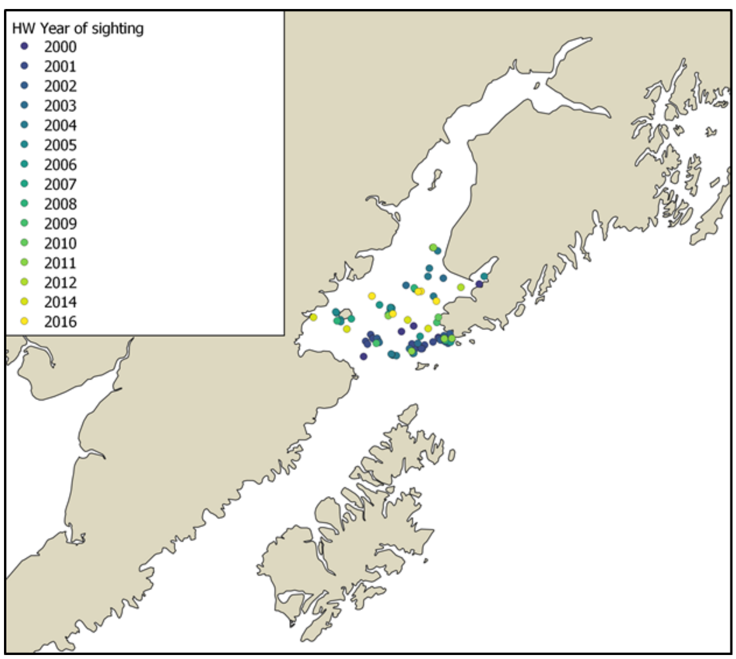

Figure 13. Humpback whale sightings recorded during NMFS Cook Inlet beluga whale aerial surveys from 2000-2016.

Two humpbacks were observed north of the Forelands during marine mammal monitoring in May and June of 2015 (Jacobs Engineering Group 2017). Marine mammal monitoring near the mouth of Ship Creek also recorded two humpback whale sightings, likely of the same individual, in September 2017 (ABR 2017). Three humpback whales were recorded near Ladd Landing, north of the Forelands, in 2018 during marine mammal monitoring (Sitkiewicz et al. 2018). One humpback was observed in July 2022 during transitional dredging at the POA (61 North Environmental 2022b). Deceased humpbacks were reported in upper Cook Inlet in 2015, 2017, and 2019. Sightings of humpback whales in the action area are rare, and few, if any, are expected.

5.3.2.3 Feeding and Prey Selection

Humpback whales exhibit flexible feeding strategies, sometimes foraging alone and sometimes cooperatively (Clapham 1993). Humpback whales are 'gulp' or 'lunge' feeders, capturing large mouthfuls of prey during feeding rather than continuously filtering food, as may be observed in some other large baleen whales (Goldbogen et al. 2008; Simon et al. 2012). When lunge feeding, whales advance on prey with their mouths wide open, then close their mouths around the prey and trap them by forcing engulfed water out past the baleen plates. Compared to some other baleen whales, humpbacks are relatively generalized in their prey selection. In the Northern Hemisphere, known prey includes euphausiids (krill), copepods, juvenile salmonids, herring, Arctic cod, walleye pollock, pteropods, and cephalopods (Johnson and Wolman 1984; Perry et al. 1999; Straley et al. 2018).

In the North Pacific, humpback whales forage in the coastal and inland waters along California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Tomilin 1967; Johnson and Wolman 1984). The waters surrounding Kodiak Island have been identified as a biologically important area for seasonal feeding and are considered active May through September (Wild et al. 2023).

5.3.2.4 Reproduction

Humpbacks in the Northern Hemisphere give birth and presumably mate on low-latitude wintering grounds from January to March. Females attain sexual maturity at five years old in some populations and exhibit a mean calving interval of approximately two years (Clapham 1992; Barlow and Clapham 1997). Gestation is about 12 months, and calves are probably weaned by the end of their first year (Perry et al. 1999).

5.3.2.5 Vocalization, Hearing, and Other Sensory Capabilities

Mysticetes are likely most sensitive to sound from an estimated tens of hertz to approximately ten kilohertz (Southall et al. 2007). Evidence suggests that humpbacks can hear sounds as low as 7 Hz up to 24 kHz, and possibly as high as 30 kHz (Ketten 1997; Au et al. 2006). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with a generalized hearing range between 7 Hz and 35 kHz (NMFS 2018e). Baleen whales have inner ears that appear to be specialized for low-frequency hearing. In a study of the morphology of the mysticete auditory apparatus, Ketten (1997) hypothesized that large mysticetes have acute infrasonic hearing.

Humpback whales produce a wide variety of sounds ranging from 20 Hz to 10 kHz, especially animals in mating groups (Tyack 1981; Silber 1986). During the breeding season males sing long, complex songs, with frequencies in the 20-5,000 Hz range and intensities as high as 181 dB (Payne 1970; Winn et al. 1970; Thompson et al. 1986). Source levels average 155 dB and range from 144 to 174 dB (Thompson et al. 1979). The songs appear to have an effective range of approximately 10 to 20 km. Social sounds associated with aggressive behavior by male humpback whales in breeding areas are very different than songs and extend from 50 Hz to 10 kHz (or higher), with most energy in components below 3 kHz (Tyack and Whitehead 1983; Silber 1986). These sounds appear to have an effective range of up to 9 km (Tyack and Whitehead 1983). Humpback whales produce sounds less frequently in their summer feeding areas. Feeding groups produce distinctive sounds ranging from 20 Hz to 2 kHz, with median durations of 0.2-0.8 seconds and source levels of 175-192 dB (Thompson et al. 1986). These sounds are attractive and appear to rally animals to the feeding activity (D'Vincent et al. 1985; Sharpe and Dill 1997).

5.3.2.6 **Threats**

Natural Threats

There is limited information on natural sources of injury or mortality to humpback whales. Based upon prevalence of tooth marks, attacks by killer whales appear to be highest among humpback whales migrating between Mexico and California, although populations throughout the Pacific Ocean appear to be targeted to some degree (Steiger et al. 2008). Juveniles appear to be the primary age group targeted.

Thirteen marine mammal species in Alaska were examined for domoic acid; humpback whales indicated a 38 percent prevalence (Lefebvre et al. 2016). Saxitoxin was detected in 10 of the 13 species, with the highest prevalence in humpback whales at 50 percent. The occurrence of the nematode Crassicauda boopis appears to increase the potential for kidney failure in humpback whales and may be preventing some populations from recovering (Lambertsen 1992).

Anthropogenic Threats

Historically, commercial whaling represented the greatest threat to every population of humpback whale. In 1963, the International Whaling Commission (IWC) banned commercial hunting of humpback whales in the Pacific Ocean, and, as a result, this threat has largely been curtailed. No commercial whaling occurs within the range of Mexico DPS humpbacks. Japan resumed commercial whaling in its territorial sea and exclusive economic zone, which is within the WNP DPS humpback range, in 2019. Previously, “commercial bycatch whaling” was documented within the WNP DPS humpback range in Japan and South Korea (Bettridge et al. 2015). Alaska Native subsistence hunters are not granted aboriginal subsistence whaling permits under the IWC to take humpback whales.

Vessel strike is one of the main threats and sources of anthropogenic impacts to humpback whales in Alaska. Neilson et al. (2012a) summarized 108 ship strike events in Alaska from 1978 to 2011; 86 percent involved humpback whales. Eighteen humpbacks were struck by vessels between 2016 and 2020 (Freed et al. 2022). Most ship strikes of humpback whales are reported in Southeast Alaska (Helker et al. 2019), where high vessel traffic overlaps with whale presence.

Fishing gear entanglement is another major threat. Entanglement may result in only minor injury or may significantly affect individual health, reproduction, or survival. Every year humpback whales are reported entangled in fishing gear in Alaska, particularly pot gear and gill net gear. Between 2016 and 2020, entanglement of humpback whales (n = 47) was the most frequent human-caused source of mortality and injury of large whales in Alaska (Freed et al. 2022).

5.3.3 **Steller Sea Lion**

5.3.3.1 **Population Structure and Status**

On November 26, 1990, NMFS published a final rule to list Steller sea lions as threatened (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs (62 FR 24345; May 5, 1997); the Eastern DPS was listed as threatened and the Western DPS was listed as endangered. On November 4, 2013, NMFS published a final rule to delist the Eastern DPS (78 FR 66140). Information on Steller sea lion biology and habitat (including critical habitat) is available in the revised Steller Sea Lion Recovery Plan (NMFS 2008b) and 5-year Status Review (NMFS 2020).

The Western DPS of Steller sea lions decreased from an estimated 220,000 to 265,000 animals in the late 1970s to fewer than 50,000 in 2000 (Muto et al. 2021). Factors that may have contributed to this decline include incidental take in fisheries, competition with fisheries for prey, legal and illegal shooting, predation, exposure to contaminants, disease, and ocean regime shift-driven climate change (NMFS 2008b). The most recent comprehensive surveys of Western DPS Steller sea lions estimated a total Alaska population (both pups and non-pups) of 49,320 (Sweeney et al. 2023). Between 2007 and 2022, Western DPS Steller sea lion pups increased by 0.50 percent per year and non-pups increased by 1.05 percent per year (Sweeney et al. 2023). While the data show the overall population trend is positive, abundance and trends are highly variable across regions and age classes.

Pup counts declined in the eastern and central Gulf of Alaska between 2015 and 2017, counter to the increases observed in both regions since 2002 (Sweeney et al. 2017). These declines may have been due to changes in prey availability from the marine heatwave that occurred in the northern Gulf of Alaska from 2014 to 2016 (Bond et al. 2015; Petersen et al. 2016; Muto et al. 2021). Pup counts rebounded to 2015 levels in 2019; however, non-pup counts in the eastern, central, and western Gulf of Alaska regions declined (Muto et al. 2021).

5.3.3.2 **Distribution**

Steller sea lions range along the North Pacific rim from northern Japan to California, with centers of abundance in the Gulf of Alaska and Aleutian Islands (Figure 14; Loughlin et al.

1984). Although Steller sea lions seasonally inhabit coastal waters of Japan in the winter, breeding rookeries outside of the U.S. are only located in Russia (Burkanov and Loughlin 2005). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late May to early July; Jemison et al. 2013; Muto et al. 2021).

Land sites used by Steller sea lions are referred to as rookeries and haulouts. Rookeries are used by adult sea lions for pupping, nursing, and mating during the reproductive season. Haulouts are used by all age classes of both sexes but are generally not where sea lions reproduce. At the end of the reproductive season, some females may move with their pups to other haulout sites and males may migrate to distant foraging locations (Spalding 1964; Pitcher and Calkins 1981). Sea lions may make semi-permanent or permanent one-way movements from one site to another (Chumbley et al. 1997; Burkanov and Loughlin 2005). Round trip migrations of greater than 6,500 km by individual Steller sea lions have been documented (Jemison et al. 2013).

Most adult Steller sea lions occupy rookeries during the pupping and breeding season (Pitcher and Calkins 1981; Gisiner 1985), and exhibit high site fidelity (Sandegren 1970). During the breeding season some juveniles and non-breeding adults occur at or near the rookeries, but most are on haulouts (Rice 1998; Ban 2005; Call and Loughlin 2005).

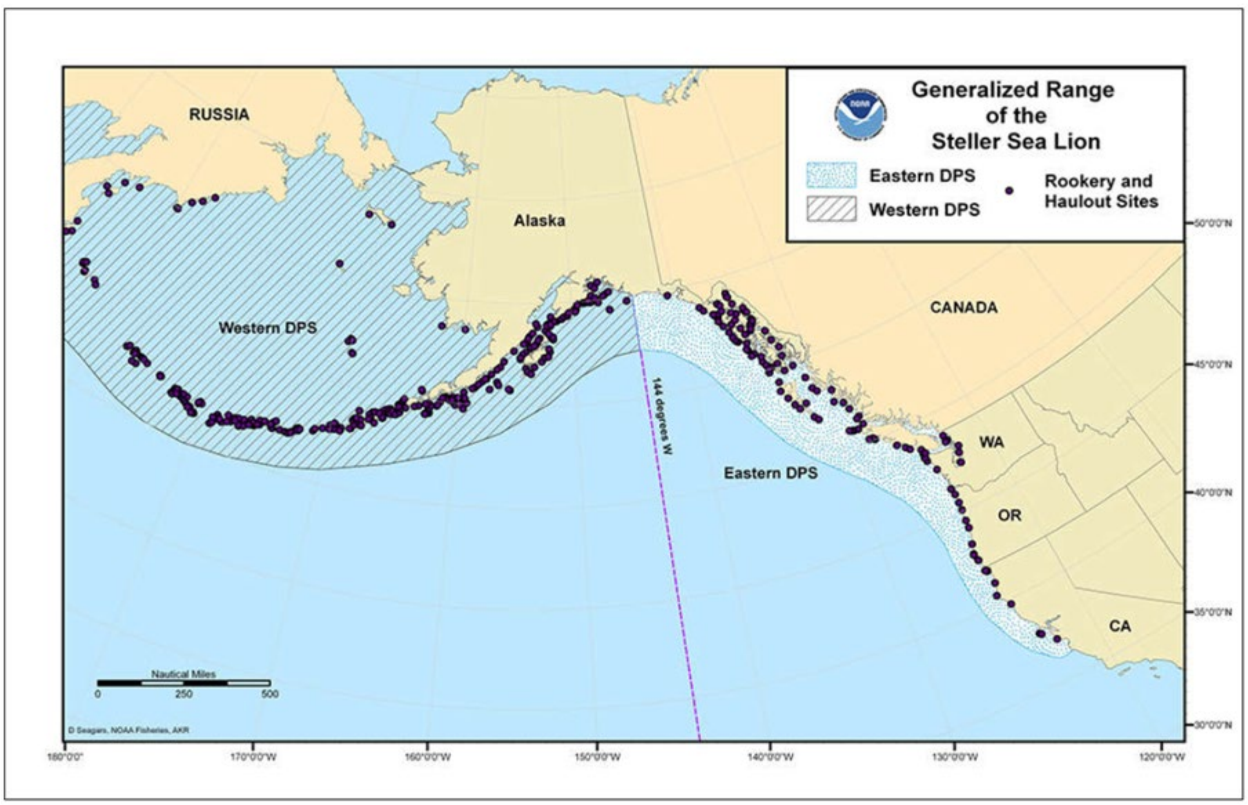

Figure 14. Ranges of Western and Eastern DPS Steller sea lions and rookery and haulout sites.

Presence in Cook Inlet

Sightings of Steller sea lions in middle and upper Cook Inlet are rare, and density data are not available for this region. The majority of Steller sea lion sightings recorded during NMFS aerial surveys for Cook Inlet belugas were located south of the Forelands (Rugh et al. 2005; Shelden et al. 2013).

POA projects in recent years have recorded several Steller sea lions during monitoring efforts. During Phase 1 PCT construction monitoring from the end of May to the end of June 2020, up to six Steller sea lions were observed; at least two of these observations may have been re-sightings of the same individual, as they occurred on the same day (61 North Environmental 2021). Between the end of May and the end of September 2021, nine Steller sea lions were observed during monitoring associated with Phase 2 PCT construction (61 North Environmental 2022a; Easley-Appleyard and Leonard 2022). An additional seven unidentified pinnipeds were observed in 2020 and another one in 2021, which could have been harbor seals or Steller sea lions (61 North Environmental 2021; 61 North Environmental 2022a). Three Steller sea lions were observed between mid-May and mid-June 2022 during the South Floating Dock construction monitoring (61 North Environmental 2022c).

About 3,600 Steller sea lions use terrestrial sites in the lower Cook Inlet area (Sweeney et al. 2017), with additional individuals foraging in the area. The nearest major rookery or haulout site to the POA is over 200 km away (Figure 15).

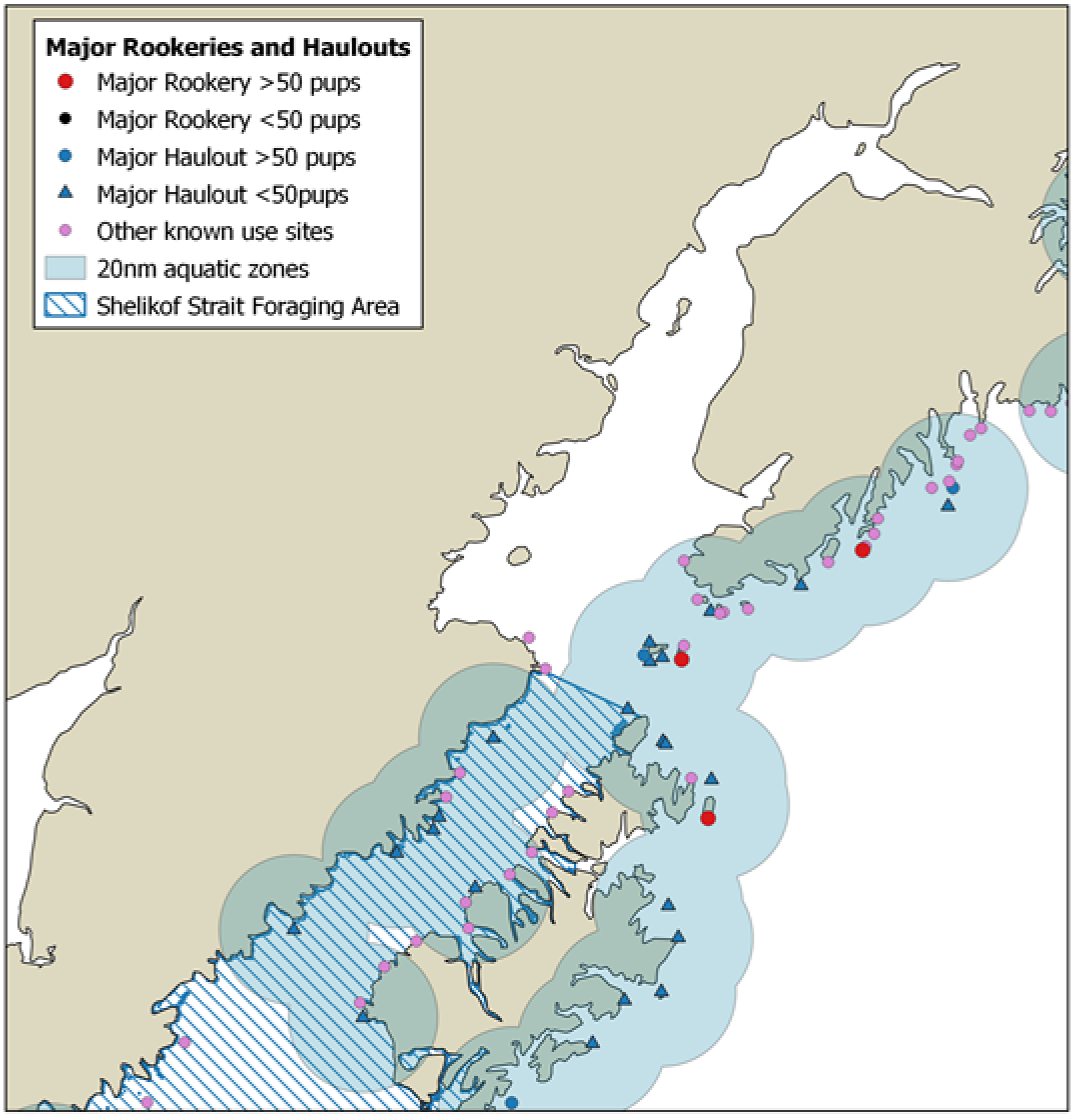

Figure 15. Steller sea lion major rookeries and haulouts in the lower Cook Inlet area.

5.3.3.3 Feeding, Diving, Hauling out, and Social Behavior

The foraging strategy of Steller sea lions is strongly influenced by seasonality of sea lion reproductive activities on rookeries and the seasonal presence of many prey species. Steller sea lions are generalist predators that eat a variety of fishes and cephalopods (Pitcher and Calkins 1981; Calkins and Goodwin 1988; NMFS 2008b), and occasionally other marine mammals and birds (Pitcher and Fay 1982; NMFS 2008b).

During summer, Steller sea lions feed mostly over the continental shelf and shelf edge. Females attending pups forage within 37 km of breeding rookeries (Merrick and Loughlin 1997), which is the basis for designated critical habitat around rookeries and major haulout sites. Steller sea lions tend to make shallow dives of less than 250 m but are capable of deeper dives (NMFS 2018e). Female foraging trips during winter tend to be longer in duration, farther from shore, and with deeper dives. Summer foraging dives, on the other hand, tend to be closer to shore and are shallower (Merrick and Loughlin 1997). Adult females begin a regular routine of alternating foraging trips at sea with nursing their pups on land a few days after birth.

Steller sea lions are gregarious animals that often travel in large groups of up to 45 individuals (Keple 2002), and rafts of several hundred animals are often observed adjacent to haulouts. Individual rookeries and haulouts may be comprised of hundreds of animals. At sea, groups usually consist of females and subadult males as adult males are usually solitary (Loughlin 2002).

5.3.3.4 **Reproduction**

Male Steller sea lions reach sexual maturity between ages three and seven, but do not reach physical maturity and participate in breeding until about eight to ten years of age (Pitcher and Calkins 1981). Female Steller sea lions reach sexual maturity and first breed between three and eight years of age, and the average age of reproductive females is about ten (Pitcher and Calkins 1981; Calkins and Pitcher 1982; York 1994).

After maturity, females normally ovulate and breed annually. There is a high rate of reproductive failure but, when successful, females give birth to a single pup between May and July. The sex ratio of pups at birth is assumed to be about 1:1, or slightly biased toward males. Newborn pups are wholly dependent upon their mother for milk during at least the first three months, and observations suggest they continue to be highly dependent through the first winter (Trites et al. 2006).

5.3.3.5 **Vocalization, Hearing, and Other Sensory Capabilities**

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz in water (NMFS 2018e). Studies of Steller sea lion auditory sensitivities have found that this species detects sounds underwater between 1 and 25 kHz (Kastelein et al. 2005), and in air between 250 Hz and 30 kHz (Mulsow and Reichmuth 2010). Sound signals from vessels are typically within the hearing range of Steller sea lions, whether the animals are in the water or hauled out.

5.3.3.6 **Threats**

Natural Threats

Killer whale predation on the Western DPS, under reduced population size, may cause significant reductions in the stock (NMFS 2008b). Steller sea lions are also vulnerable to predation from sleeper sharks. Juvenile Steller sea lions were found to underutilize foraging habitats and prey resources based on predation risk by killer whales and sleeper sharks (Frid et al. 2009).

Steller sea lions have tested positive for several pathogens, and parasites are common; however, disease levels and mortality resulting from infestation are unknown. Significant negative effects of these factors may occur in combination with stress, which may compromise the immune system. If other factors, such as disturbance, injury, or difficulty feeding occur, it is more likely that disease and parasitism can play a greater role in population reduction

The female spawning biomass of Pacific cod, an important prey species for Steller sea lions, was at its lowest point in 2018. The federal Pacific cod fishery in the Gulf of Alaska was closed by regulation to directed Pacific cod fishing in 2020 (Barbeaux et al. 2020), and the species has yet to recover from the decline that occurred during the 2014-2016 marine heatwave.[13] Pacific cod abundance remains at reduced levels; however, the spawning stock biomass is above the 20 percent minimum spawning stock size threshold.[14]

Anthropogenic Threats

Subsistence hunters removed 209 Western DPS Steller sea lions between 2014 and 2018 (Muto et al. 2021). Between 2016 and 2020, human-caused mortality and injury of the Western DPS Steller sea lions (n = 148) was primarily caused by entanglement in fishing gear, in particular, commercial trawl gear (n=113; Freed et al. 2022).

Concern also exists regarding competition between commercial fisheries and Steller sea lions for the same resource: stocks of pollock, Pacific cod, and Atka mackerel. Limitations on fishing grounds and removals, duration of fishing seasons, and monitoring have been established to prevent Steller sea lion nutritional deficiencies as a result of inadequate prey availability.

Metal and contaminant exposure remains a focus of ongoing investigation. Total mercury concentrations measured in hair samples collected from pups in the western-central Aleutian Islands were detected at levels that cause neurological and reproductive effects in other species (Rea et al. 2013).

6 ENVIRONMENTAL BASELINE

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action areas that have already

[13] https://apps-afsc.fisheries.noaa.gov/REFM/docs/2022/GOA-ESR-Brief.pdf accessed July 2023.
[14] https://www.npfmc.org/wp-content/PDFdocuments/SAFE/2024/GOApcod.pdf accessed May 2025.

undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

This section focuses on existing anthropogenic and natural activities within the action area and their influences on the listed species and critical habitat that may be adversely affected by the proposed action. Although some of the activities discussed below occur outside of the action area, they may still impact listed species and/or habitat in the action area.

The majority of Alaska's population lives in the combined Anchorage/Matanuska-Susitna Boroughs; 39 percent of Alaska's population was in the Municipality of Anchorage and 15 percent was in the Matanuska-Susitna Borough in 2022.[15] Anchorage's population is projected to grow by 5 percent and the Matanuska-Susitna Borough population is projected to increase 44 percent between 2019 and 2045.[16] Upper Cook Inlet is exposed to more anthropogenic activities than most other locations in Alaska and there are multiple paths of potential habitat alteration and/or degradation. Marine mammals may be affected by multiple threats concurrently, compounding the impacts of individual threats. Anthropogenic risk factors are discussed individually below.

6.1 Recent Biological Opinions in the Action Area

NMFS AKR has long been issuing biological opinions for projects in upper Cook Inlet. Most of these consultations analyzed stressors that caused harassment rather than harm or mortality. Effects of these Cook Inlet actions (e.g., actions that caused acoustic harassment) on individual marine mammals are not measurable in the years following the action, and are believed to not have affected those marine mammals or their populations in any measurable way in the subsequent years. Some of these actions (e.g., construction of new oil rigs or ship terminals, filling of critical habitat in Turnagain Arm), however, have had broader environmental effects that last many years. Recent biological opinions issued by NMFS AKR for projects in upper Cook Inlet, include:

- Hilcorp Cook Inlet Tugs Towing a Jack-up Rig (AKRO-2023-03574), September 2024
- Furie Cook Inlet Towing and Drilling (AKRO-2023-03569), December 2023
- Port of Alaska's North Extension Stabilization Project (AKRO-2022-03630), December 2023
- Hilcorp Cook Inlet Tugs Towing a Jack-up Rig (AKRO-2021-03484), September 2022
- Port of Alaska's South Floating Dock (AKRO-2021-01051), Port of Alaska, August 2021
- Port of Alaska's Petroleum and Cement Terminal (AKRO-2018-01332), Port of Alaska,

[15] https://live.laborstats.alaska.gov/pop/index.html Accessed May 2023.
[16] https://live.laborstats.alaska.gov/pop/estimates/pub/19popover.pdf Accessed May 2023.

March 2020

- Alaska Liquefied Natural Gas Project (AKRO-2018-01319), Alaska Gasoline Development Corporation, June 2020
- 2019 U.S. Environmental Protection Agency's Proposed Approval of the State of Alaska's Mixing Zone Regulation Section of the State of Alaska's Water Quality Standards (AKRO-2018-00362), U.S. Environmental Protection Agency, July 2019
- Hilcorp Alaska and Harvest Alaska Oil and Gas Activities (AKRO-2018-00381), June 2019

These documents are available on the NOAA Fisheries website at: https://www.fisheries.noaa.gov/alaska/consultations/section-7-biological-opinions-issued-alaska-region. We discuss them below under headings that group together similar project types.

6.2 Coastal Development

While the majority of the Cook Inlet shoreline is undeveloped, there are municipalities, port facilities, airports, wastewater treatment plants, roads, mixing zones, and railroads that occur along or close to the shoreline. These include:

- emergency repairs of the Port MacKenzie facilities
- construction of oil and gas development-related facilities in Nikiski
- runway extensions at JBER and additional military aircraft overflights of Knik Arm
- POA construction of petroleum and cement terminal facilities and a South Floating Dock
- Highway realignment and bridge repair along Turnagain Arm

These and other projects are addressed in more detail below.

6.2.1 Road Construction

The Alaska Department of Transportation (ADOT) began Seward Highway improvements from Mile 75 to 107 (along Turnagain Arm) in 2015. These activities included geophysical and geotechnical testing, on-shore blasting, pile removal and installation at stream crossings, fill placed into Turnagain Arm, and construction of a boat ramp at Windy Point. Activities also included resurfacing 15 miles of roadway, straightening curves, installing new passing lanes and parking areas, and replacing eight existing bridges along the Seward Highway between mileposts 75 and 90.

The Seward Highway Milepost 75 to 90 Bridge Replacement project completed three bridge replacements by the end of 2019 during Phase 1. Phase 2 began in June 2021 with bridge work at Portage Creek #1 and the Placer River. This work is ongoing as is bridge work at the Twentymile River. To avoid harassment of Cook Inlet beluga whales during the eulachon run, in-water work, including vibratory and impact pile installation and removal, will not occur from May 15 to June 15, and any work conducted below mean high water will require marine mammal monitoring.

Consultation on the Seward Highway mileposts 105-107 Windy Corner project was completed in 2015; however, the project has been delayed. The project plans to realign a 3.2 km segment of the highway and railroad, and includes land-based blasting and non-impulsive sound from fill placement. A Draft Environmental Assessment was made available to the public in March 2020, and ADOT extended the project north between Windy Corner and Rainbow Point (MP 105-109.5) after reviewing public comments. As of March 2023, the Seward Highway MP 105-109.5 Windy Corner to Rainbow Point project has been incorporated into the Seward Highway MP 98.5 to 118, Bird Flats to Rabbit Creek project, also known as the Safer Seward Highway project. Construction will be primarily seasonal and occur over multiple years.[17]

In 2020, NMFS completed consultation for a mitigation project in Portage Creek #2 to compensate for impacts expected to occur from the Windy Corner project. Work is expected to be completed by October 2023 and will remove forty deteriorating timber piles that once supported the Alaska Railroad bridge over Portage Creek #2. Project activities are restricted by seasonal timing to avoid the peak eulachon and salmon runs, and by daily tidal cycle to minimize potential interaction with belugas. Once the piles are removed, beluga whales will have unrestricted access to this salmon bearing creek.

In 2023, the Department of Transportation initiated steps necessary to obtain funding for Right of Way appraisals and acquisitions during the summer and fall (2023), including an environmental reevaluation. The funding to proceed with ROW appraisals and acquisitions became available in the summer of 2024 after delays in the process.

6.2.2 **Port Facilities**

Cook Inlet is home to port facilities at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham; barge landings are present at Tyonek and Anchor Point. Anchorage has a small boat ramp near Ship Creek, which was renovated in 2017, and is the only hardened public access boat ramp in upper Cook Inlet. However, numerous other boat launch sites (e.g., beach launch at Tyonek, Captain Cook State Recreation Area, City of Kenai boat launch, multiple boat launch locations near the mouth of the Kenai River, and Kasilof River State Recreation Site) provide small boats access to Cook Inlet.

6.2.2.1 **Port of Alaska**

The Port of Alaska is Alaska's largest seaport. The POA handles half of all Alaska inbound fuel and freight, moving more than four million tons of material across its docks annually, which is distributed statewide and consumed by 90 percent of Alaska's population. Operations began in 1961 with a single berth, and have since expanded to include three cargo terminals, two

[17] https://www.windycorner.info/ Accessed May 2023.

petroleum terminals, one dry barge berth, two miles of rail-spur connected to Alaska Railroad, and two floating, small-vessel docks, plus 220 acres of land at its facility located in Anchorage.[18]

NMFS AKR issued a Letter of Concurrence for the POA Terminal 3 repair in 2015, which involved removal of a fender panel and installation of two 24-inch round piles (NMFS 2015b). Mitigation measures were implemented to avoid take of marine mammals, and no take was authorized.

In 2016, NMFS AKR issued a biological opinion for the POA's Test Pile Program, which evaluated sound attenuation devices for potential use during port expansion projects (NMFS 2016a). The NMFS authorized Level B harassment takes for 26 Cook Inlet belugas and six Western DPS Steller sea lions. A single beluga whale was exposed to sound exceeding the Level B harassment threshold (Cornick and Seagars 2016).

NMFS AKR issued a Letter of Concurrence for the POA Fender Pile and Replacement Repair project in 2018, which included pile driving of 44, twenty-two-inch round piles (NMFS 2018d). Mitigation measures were implemented to avoid adverse effects of marine mammals. There were no sightings of protected species during pile driving activities.

The POA Modernization Program (PAMP) is comprised of multiple construction projects to update facilities for operational efficiency, accommodate modern shipping operations, and improve seismic resiliency. The Petroleum and Cement Terminal (PCT) is a pile-supported dock, comprised of an access trestle, loading platform, monopile breasting dolphins, monopile mooring dolphins, and related superstructure; Phase 1 was completed in 2020 and Phase 2 was completed in 2021. Fifty-five Level B harassment takes for Cook Inlet beluga whales were authorized and 26 exposures to sound exceeding the Level B harassment threshold were recorded during Phase 1 (61 North Environmental 2021). During Phase 2 activities, 27 of the 35 authorized Level B harassment takes were recorded (61 North Environmental 2022a).

In 2020 the POA applied for a USACE Nationwide Permit 3, Maintenance for the POA Fender Pile Replacement and Repair Project and NMFS AKR issued a Letter of Concurrence in 2021. The project will replace piles within the existing fendering system; inspections conducted before and after the 2018 Anchorage earthquake indicated the piles are in a state of imminent failure and require repair. The fendering system is comprised of 107 fender assemblies each supported by two pin piles. Twenty-three total fender assemblies were replaced in 2015 and 2019 (described above).

Another component of the PAMP involved relocating the existing South Floating Dock (SFD), which is a relatively small structure used to stage and support small vessels, such as first-responder rescue craft, small work skiffs, and occasionally tugboats, in an area close to the daily operations at the POA. The existing SFD structure was removed and a new dock was constructed in May and June of 2022. Twenty-four Level B harassment takes for Cook Inlet beluga whales

[18] https://www.portofalaska.com/about-us/ Accessed May 2023.

were authorized and two exposures to sound exceeding the Level B harassment threshold were recorded.

Maintenance dredging at the POA began in 1965, and is an ongoing activity from April through October in most years, affecting about 100 acres of substrate per year. The POA is dredged to the depth of -35 ft below MLLW and dredged materials are dumped 3,000 ft abeam of the POA dock face at the Anchorage in-water disposal site. To accommodate vessels berthing at the PCT location, transitional dredging to a depth of -40 ft MLLW began in 2018, and dredged material was dumped in the offshore disposal area (NMFS 2018b). Dredging at the POA has not been identified as a source of re-suspended contaminants (USACE 2009), and belugas often pass near the dredge (USACE 2008; ICRC 2012; POA 2019b; USACE 2019). NMFS continues to analyze data to assess whether belugas react to dredging operations.

Dredging operations also occur annually at the Ship Creek Boat Ramp, located approximately 1.4 km southwest of the POA. The dredging at this site is done in three to four days when the area is dewatered. Heavy machinery pushes the accumulated sediment around the boat ramp seaward. NMFS AKR issued a Letter of Concurrence for Ship Creek dredging in 2020.

The North Extension Stabilization (NES) project will remove the failed sheet pile structure and reconfigure and realign the shoreline within the North Extension. Approximately 1.35 million cubic yards of fill material from below the high tide line will be removed to re-create approximately 13 acres of intertidal and subtidal habitat. Following excavation and initial dredging work, in-water pile driving is expected to occur over approximately 246.5 hours on 110 nonconsecutive days. The exact number of sheet piles in the existing structure is not known with certainty, but the POA estimates that 4,216 sheet piles will be removed using vibratory and impact pile driving methods. Excavating, dredging, and stabilizing the new shoreline will be completed in 2025. It is anticipated that the 2025 construction season will commence in May and extend through July. In March of 2025, the monitoring report was submitted to NMFS and contained sightings from the 2024 work season per the Incidental Harassment Authorization. The Level B takes recorded included: Cook Inlet belugas (n=49), harbor seals (n=19) and harbor porpoise (n=3). No Level A takes were authorized and no Level B authorizations were exceeded. On October 1, 2024, PSOs for the NES project spotted a CIBW entangled in an unknown object (possibly a tire inner-tube) near the POA (61N Environmental, 2025). The whale was sighted again on October 2 but was not seen after that time. Video footage of the individual was taken, and the whale was determined to be a subadult, at least 7 years old (NMFS 2024b). The entanglement was determined to be life-threatening, but the whale was not seen after October 2, and no disentanglement effort was possible. This is the third known entanglement of a free-swimming CIBW; the others were observed in 2005 and 2010.

6.2.2.2 **Port MacKenzie**

Port MacKenzie is located along western, lower Knik Arm. Coastal development began with the construction of a barge dock in 2000. Additional construction and bulkhead repair activity has occurred since then; Port MacKenzie consists of a 152 m bulkhead barge dock, a 366 m deep draft dock with a conveyor system, a landing ramp, and more than 8,000 acres of adjacent uplands. Current operations may include dry bulk cargo movement and storage, depending on the current state of the port and existing demand for its facilities. The seawall to this port failed twice (in the winter of 2015-2016 and 2016-2017), necessitating emergency pile driving and other repair measures. Emergency NMFS consultations occurred after much of the repair work was completed. Marine mammal monitoring occurred on-site during pile driving operations in April 2016, and observers recorded belugas in or near the pile driving exclusion zone on 12 occasions. Pile driving was not occurring during these close approaches and no takes or shut-downs were recorded (Nuka Research and Planning Group 2016). Multiple groups of belugas were observed in this area between April and September 2020 and 2021 during monitoring for the POA PCT construction (61 North Environmental 2021; 61 North Environmental 2022a). In 2024, the dredging crews for the Port of Alaska documented 45 groups of belugas totaling 155 individuals during the North Extension Stabilization project (May through October)[19].

Other Ports

The next closest port is located in Nikiski, approximately 95 km to the southwest. Nikiski is home to several privately-owned docks including the Offshore Systems Kenai dock. Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquefied natural gas, sulfuric acid, petroleum products, caustic soda, and crude oil. In 2014, the Arctic Slope Regional Corporation expanded and updated its Rig Tenders Dock in Nikiski, in anticipation of increased oil and gas activity.

Western DPS Steller sea lions are affected by activities at ports throughout their range, especially where fish processing and noise overlap. In Cook Inlet, port activities in Homer, Port Graham, and Nikiski are most likely to affect Western DPS Steller sea lions. Ladd Landing Beach, located near Tyonek, serves as public access to the Three Mile subdivision and a staging area for various commercial fishing sites in the area.

6.3 Oil and Gas Development

Cook Inlet is estimated to have 500 million barrels of oil and over 19 trillion cubic feet of natural gas that are undiscovered and technically recoverable (Wiggin 2017). There may also be unconventional oil and gas accumulations of up to 637 billion cubic feet of gas and 9 million barrels of natural gas liquids (Schenk et al. 2015).

Lease sales for oil and gas development in Cook Inlet began in 1959 (Alaska Department of Natural Resources 2015), and there were attempts at oil exploration along the west side of Cook Inlet prior to that. Fourteen offshore oil production facilities were installed in upper Cook Inlet by the late 1960s, and today there are 17 offshore oil and gas platforms. Figure 16 shows the ongoing oil and gas activities in state waters as of December 2022. There are 203 active oil and gas leases in Cook Inlet that encompass approximately 416,573 acres of State leased land, of

[19] Port of Alaska Modernization Project, North Extension Stabilization Step 1 Marine Mammal Observation Report, 2024

which 331,971 acres are offshore (Figure 16).[20]

Approximately 3.3 million acres were up for bid in the state-owned lease sale in June 2021, and HEX Group and Strong Energy Resources successfully bid on nearly 21,000 acres of oil and gas tracts in Cook Inlet. Hilcorp successfully bid on nearly 23,000 acres of oil and gas tracts in the December 2022 state-owned lease sale.

BOEM held Lease Sale 244 in Cook Inlet in 2017 (NMFS 2017b). Hilcorp was the only responding company and their successful bids on 14 of 224 tracts/blocks encompassed 31,005 acres. NMFS issued Incidental Take Regulations for Hilcorp's oil and gas activities (NMFS 2019b); the seismic surveys, and other activities are discussed below. Lease Sale 258 in Cook Inlet was cancelled in May 2022 due to lack of industry interest; however, BOEM was directed by the Inflation Reduction Act of 2022 to hold Lease Sale 258 by the end of 2022 (Figure 18). One bid on one block was received and awarded to Hilcorp in March 2023.

6.3.1 **Kenai Liquefied Natural Gas Plant**

The Kenai liquefied natural gas (LNG) liquefaction and terminal complex began operating in 1969 and, until 2012, was the only facility in the United States authorized to export LNG produced from domestic natural gas. LNG shipments from the terminal began declining and the plant has been in a warm-idle state since 2015. In early 2019, NMFS was informed that there were plans to bring the plant back into operation in the next few years. The Federal Energy Regulatory Commission (FERC) approved the Trans-Foreland Pipeline Company's request to convert the facility to an importing plant in December 2020 and gave the company until December 2022 to place it into service. Trans-Foreland requested an extension to complete the facility by December 2025, which FERC approved in August 2022.[21]

Oil and gas development will likely continue in Cook Inlet; however, the overall effects on listed marine mammals are unknown (NMFS 2008a; NMFS 2008b). The Cook Inlet Beluga Recovery Plan identified potential impacts from oil and gas development, including increased noise from seismic activity, vessel traffic, air traffic, and drilling; discharge of wastewater and drilling muds; habitat loss from the construction of oil and gas facilities; and, contaminated food sources and/or injury resulting from an oil spill or natural gas blowout (NMFS 2016b).

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[20] https://dog.dnr.alaska.gov/Documents/Leasing/PeriodicReports/Lease_LASActiveLeaseInventory.pdf Accessed May 2023.

[21] https://www.reuters.com/business/energy/marathon-gets-more-time-build-lng-import-project-alaska-2022-08-16/ Accessed May 2023.

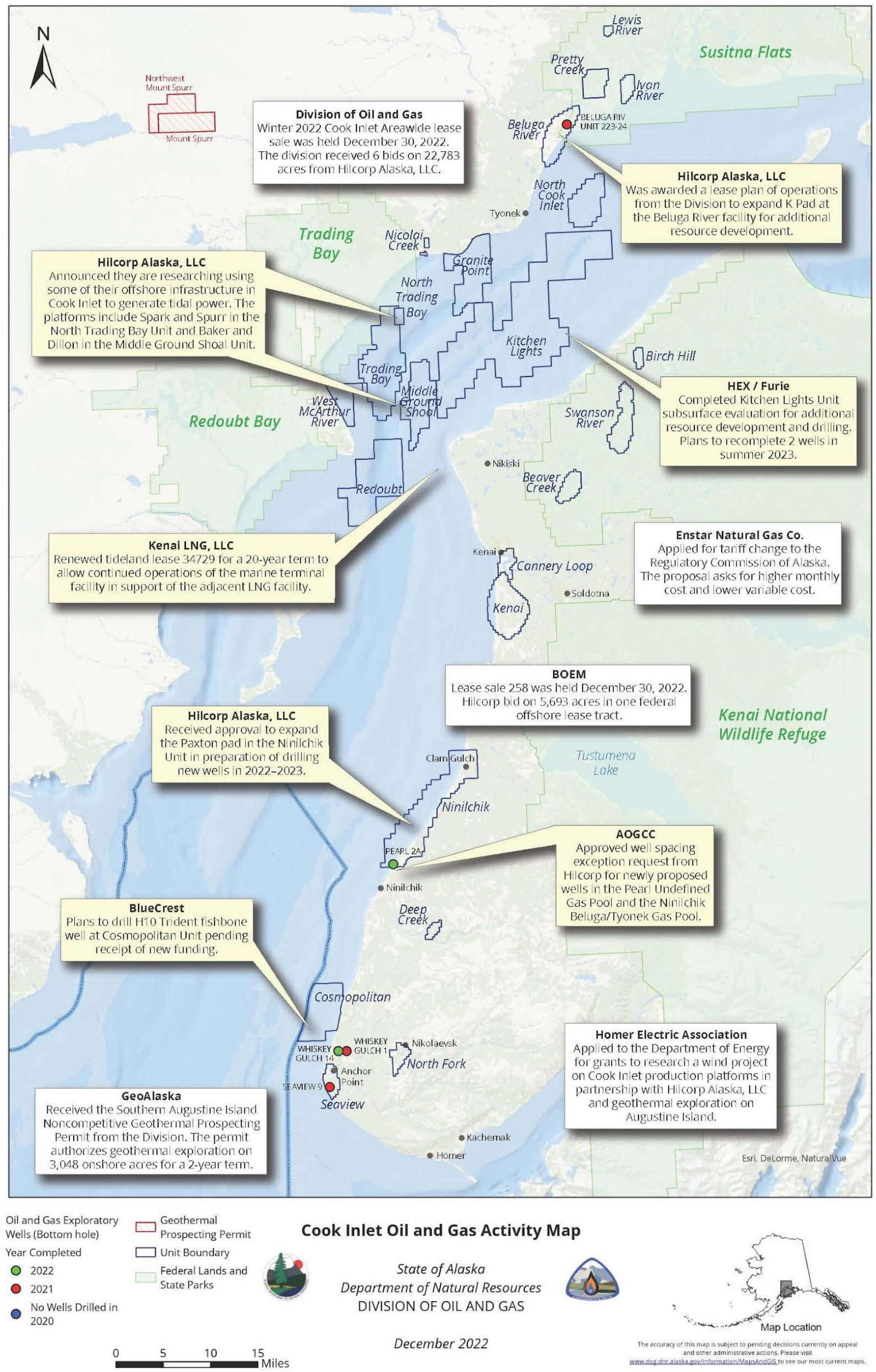

Figure 16. Oil and gas activity in Cook Inlet as of December 2023.

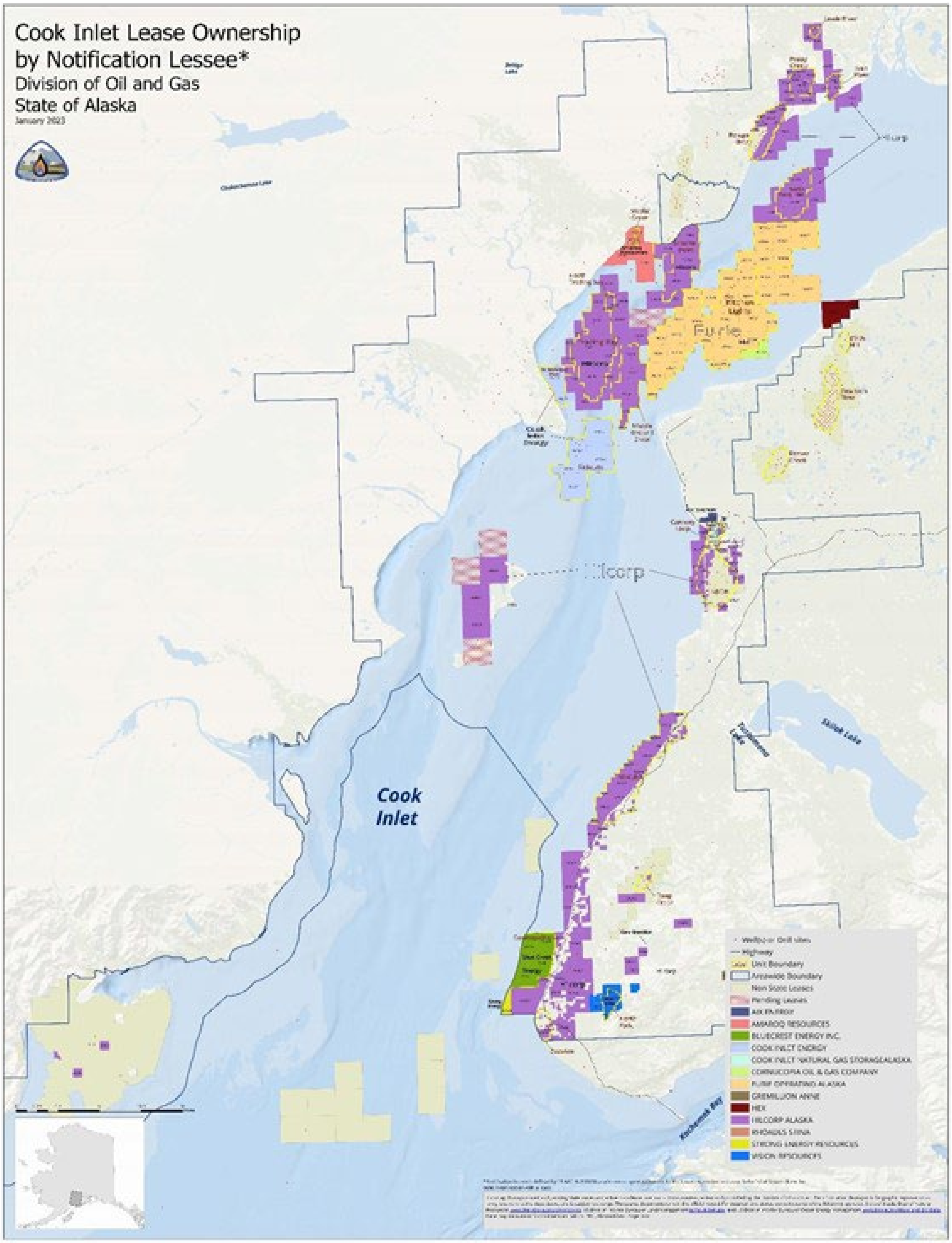

Figure 17. Cook Inlet lease ownership by notification lessee.

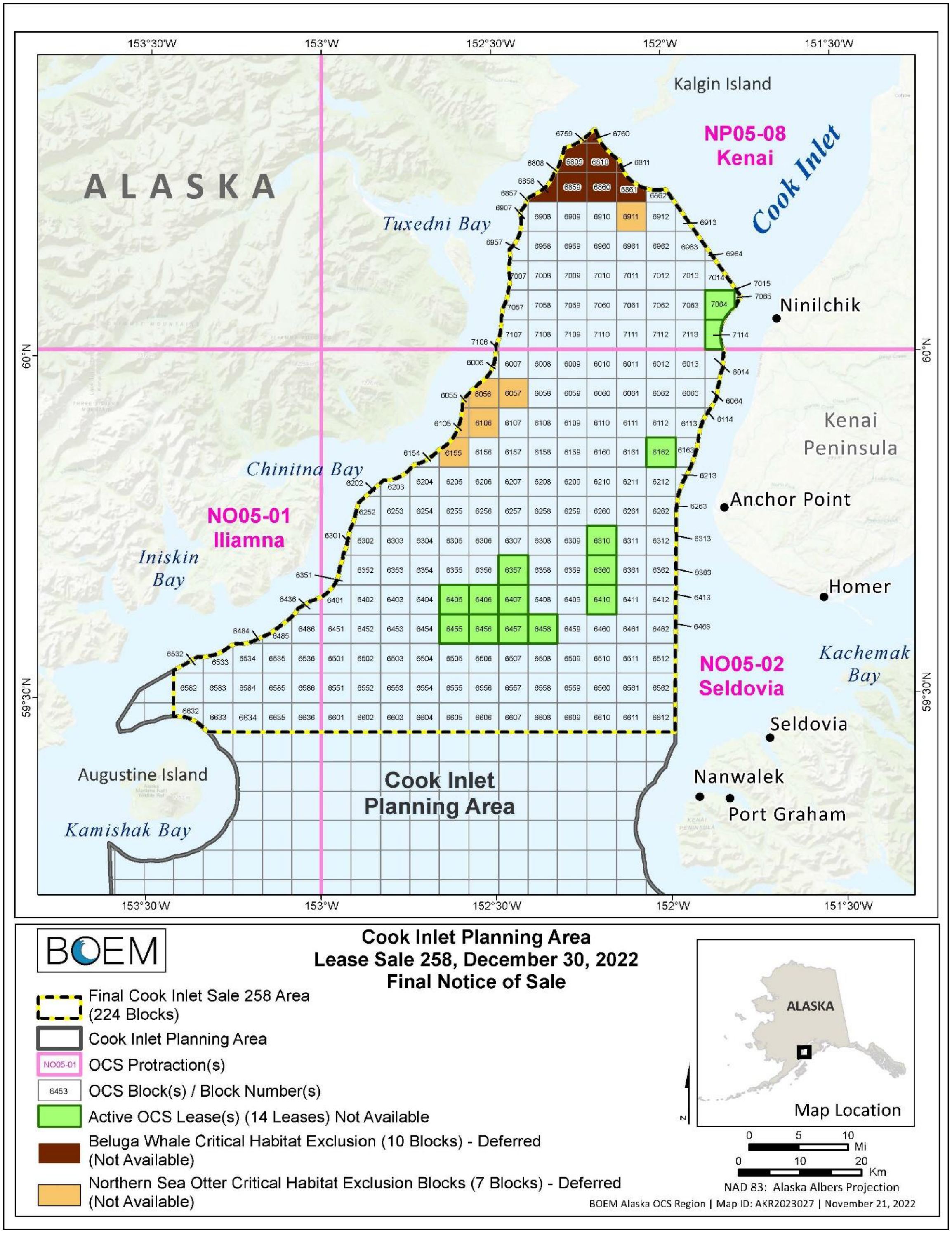

Figure 18. Lease Sale 258 Blocks.

6.3.2 **Underwater Installations**

The majority of underwater installations in Cook Inlet are oil and gas pipelines, which are an essential part of oil and gas activities in the area. The Cook Inlet basin is the source for all natural gas used in south-central Alaska. Communication cables have also been laid and a project to harness tidal energy is in the initial stages of development.

Installation of pipelines involves multiple vessels; anchor-handling tugs are used to reposition the anchors of a non-motorized pipe-laying barge, which is used to weld the pipeline that is laid over the back of the barge and into the trench. The tugs rely on their bow-thrusters while repositioning the anchors to keep the barge properly positioned and moving along. These projects involve disturbance to the substrate, increased turbidity in the vicinity of the trenching, and increased sound from the tugboats and pipe-laying equipment.

There is always a possibility of pipeline failures associated with oil and gas development, with resultant oil spills, gas leaks, or other sources of marine petrochemical contamination. Spills and contaminants are discussed below.

6.3.3 **Hilcorp Cook Inlet Pipeline Cross Inlet Extension**

Harvest, Alaska LLC, a subsidiary of Hilcorp Alaska, extended the existing undersea pipeline network in Cook Inlet and connected the Tyonek platform to the land-based pipeline located about 6.4 km north of the village of Tyonek in 2018. The cross-inlet extension included two steel subsea pipelines 25 cm and 20 cm in diameter, and 8.9 km in length. The existing 25 cm subsea pipeline that crosses Cook Inlet between Kaloa Junction and the East Forelands Facility was also converted from natural gas service to oil service. The IHA authorized Level B harassment of 40 Cook Inlet beluga whales, six Steller sea lions, and five humpback whales (NMFS 2018c). PSOs observed 814 beluga whales, three humpback whales, and two Steller sea lions during project activities; however, of the 819 listed animals observed, only one humpback was considered exposed to sound exceeding the Level B harassment threshold (Sitkiewicz et al. 2018).

6.3.4 **Alaska LNG Project**

The Alaska LNG Project proposes to carry natural gas from the North Slope to southcentral Alaska for export internationally, eventually shipping up to 2.4 billion cubic feet of liquefied natural gas (LNG) per day. The proposed infrastructure includes an approximately 1,290 km long pipeline from the North Slope that would cross Cook Inlet north of the Forelands and terminate at a proposed liquefaction facility in the Nikiski area on the Kenai Peninsula. Five years of construction are anticipated for the Cook Inlet portion of the project. ESA consultation was completed in June 2020; the project is expected to result in Level B harassment of 61 Cook Inlet beluga whales, one WNP DPS humpback whale over five years of work. One Mexico DPS humpback whale may also be exposed to sound levels exceeding the injury threshold. No effects to Steller sea lions are expected. The 2020 Biological Opinion was challenged by the Center for Biological Diversity and the Sierra Club in 2024. Litigation began in the 9th Circuit Court in

2024 and a stay was granted through December 2025.

6.3.5 Tidal Energy Project

Ocean Renewable Power Company (ORPC), a developer of renewable power systems that harness energy from free-flowing rivers and tidal currents, submitted a preliminary permit application to FERC in May 2021 for a project in Cook Inlet. ORPC previously conducted site characterization and environmental studies in the region, and intends to develop a five megawatt pilot project near East Foreland to verify the technical performance and environmental compatibility of its proposed project. Project results will assist in planning a phased build-out of up to a 100 megawatt commercial-scale project.[22] ORPC will collaborate with Homer Electric Association, Inc. to sell the tidal energy produced. Work on this project has not begun, nor have proposed construction dates been conveyed to NMFS.

ORPC is also partnering with the Matanuska-Susitna Borough to test its RivGen Power System at Port MacKenzie.[23] They plan to evaluate the ability to harness the tidal current of upper Knik Arm to power the cathodic protection systems at the port, which prevent the metal structures from corroding.

6.4 Natural and Anthropogenic Sound

Because sound is a primary source of disturbance to marine mammals, this opinion considers it as a separate category of the Environmental Baseline, although it is generally attributable to other factors in the Baseline, such as coastal and off-shore development.

Underwater sound in Cook Inlet is categorized as physical sound, biological sound, and human-caused sound. Natural physical sound originates from wind, waves at the surface, currents, earthquakes, ice movement, tidal currents, and atmospheric sound (Richardson et al. 1995). Tidal influences in Cook Inlet are a predominant contributor of physical sound to the acoustic environment (Burgess 2014; BOEM 2016).

Biological sound includes sounds produced by marine mammals (particularly whales and dolphins, but also pinnipeds), fish (Maruska and Mensinger 2009), and invertebrates (Chitre et al. 2005). Human-caused sound includes vessel motor sounds, oil and gas operations, maintenance dredging, aircraft overflights, construction noise, and infrastructure maintenance noise. Much of upper Cook Inlet is a poor acoustic propagation environment due to shallow depths and sand and mud bottoms.

6.5 Seismic Surveys in Cook Inlet

Cook Inlet has a long history of oil and gas activities including seismic exploration, geophysical

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[22] https://www.renewableenergymagazine.com/ocean_energy/orpc-plans-to-advance-tidal-energy-in-20210526 Accessed May 2023.

[23] https://www.akbizmag.com/industry/energy/testing-tidal-power-in-knik-arm/ Accessed May 2023.

and geological surveys, exploratory drilling, increased vessel and air traffic, and platform production operation. Seismic surveys use high energy, low frequency sound in short pulse durations to characterize subsurface geology, often to determine the location of oil and gas reserves. Geophysical seismic activity has the potential to harass or harm marine mammals (Nowacek et al. 2015).

Large airgun arrays of greater than 3,000 in^3, which can produce sound source levels exceeding 240 dB re 1 µPa rms, were previously used for seismic exploration in Cook Inlet. Smaller arrays are now being used because of the generally shallow water environment and the increased use of ocean-bottom cable and ocean-bottom node technology (Boman 2012). Shallow water surveys have employed 440, 620, and 880 in^3 arrays with source sound pressure levels less than 230 dB re 1 µPa rms. Measured radii to the 160 dB harassment isopleths have ranged from 3 to 9.5 km.

6.5.1 Apache Seismic Exploration

Apache Alaska Corporation conducted over 1,800 hours of seismic activity in 2012 and reported zero takes of beluga whales and Steller sea lions; however, observations of protected marine mammals within ensonified zones prior to equipment power-down or shutdown occurred on numerous occasions (Lomac-MacNair et al. 2013).

In 2014, observers recorded takes of 12 beluga whales and two humpback whales during 3,029 hours of observation effort. Additionally, four beluga whale groups were recorded less than 500 m from the source vessel during seismic operations (Lomac-MacNair et al. 2013). The monitoring report is ambiguous, and it is unclear if the seismic guns were firing during those sightings. If the airgun array was operating, the groups were exposed to sounds exceeding the Level A injury threshold. A humpback whale was observed 1.5 km from the sound source when the airgun array was at full volume. Seismic operations were shut down immediately; however, it is estimated that the whale was exposed to at least 19 shots exceeding the Level A injury threshold. Regardless of immediate power-down or shutdown actions, an animal is considered exposed if it is within the respective Level A or Level B isopleths while sound is occurring.

6.5.2 SAE 3D Seismic Exploration

Eight vessels were deployed during SAE seismic operations in upper Cook Inlet in 2015. Of the total number of visual observations and acoustic detections, 194 animals were exposed to sounds exceeding the harassment threshold and 13 animals were exposed to sounds exceeding the injury threshold (Kendall et al. 2015). Species exposed to sounds exceeding the harassment threshold included an unidentified large cetacean, two belugas, and a Steller sea lion. A Steller sea lion was also exposed to sounds exceeding the injury threshold. Mitigation measures (clearance, ramp-up, and shut down procedures) prevented take during an additional 70 sightings (Kendall et al. 2015).

6.5.3 **Hilcorp 3D Seismic – Lower Cook Inlet, Outer Continental Shelf**

Hilcorp conducted a 3D seismic survey of approximately 790 km^2 over eight Outer Continental Shelf lease blocks in Lower Cook Inlet in 2019. One source, two support, and one marine mammal mitigation vessel were deployed. A Steller sea lion and a fin whale were observed in the Level A zone during seismic activity; however, permanent threshold shift or Level A take was unlikely because shut downs were implemented within a one-shot period. Level A injury thresholds are set at the lowest level at which an animal would be expected to suffer permanent threshold shift after 24 hours of cumulative exposure. Based on actual observed take and extrapolated estimates of take in light of those observations, 10.9 fin whales, 31.5 humpback whales, and 4.9 Steller sea lions were exposed to sounds exceeding the Level B harassment threshold during the project (Fairweather Science 2020).

Hilcorp submitted an IHA application to the NMFS Permits Division in September 2023 to conduct a 2D seismic survey using a 1,760 in^3 airgun array during the open water season of 2024. The in-water survey will be conducted in the marine and intertidal waters on the eastern side of Cook Inlet from Anchor Point to Nikiski. The survey design includes 15 survey lines, approximately 4 km in length, running perpendicular to the shoreline from the Alaska state water boundary toward shore. Hilcorp plans to collect one source line per day, for an estimated 15 days of survey effort, with seismic activity occurring 1 to 2 hours in each 24-hour period.

6.5.4 **Military Detonations**

NMFS consulted on winter live-fire weapons training on the Eagle River Flats (ERF) Impact Area at JBER in 2016. Live-fire training uses firing positions on a designated range facility, at predetermined targets, in a controlled access area known as an impact area. ERF has been used as a dudded impact area since about 1945. A dudded impact area is an area having designated boundaries within which all dud producing ordnance will detonate on impact. This area may include vehicle bodies that serve as targets for artillery/mortar direct and indirect fire. The current winter-only firing restriction has been in place since 1991.

Cook Inlet beluga whales may be able to hear sounds from JBER while they are in coastal waters near the firing range; however, NMFS determined that low frequency impulses from exploding ordnance are not expected to cause noise levels of concern. Adverse effects are extremely unlikely because belugas are not expected to be present in the winter when firing occurs, no measurable effects on their prey base are expected, and mitigation measures are in place to further lessen the chances of any take by harassment. JBER measured the acoustic propagation and developed buffer zones to ensure sound that reaches Eagle Bay falls below 160 dB_{rms} re 1μPa, the Level B take threshold for non-continuous sound for cetaceans. NMFS concluded that acoustic effects on belugas associated with the action were discountable.

6.6 Oil and Gas Exploration, Drilling, and Production Noise

With frequencies generally below 10 kHz, operating sounds from the oil platform itself are louder than the sound generated by drilling. Noise from the platform is thought to be weak due to the small surface area (the four legs) in contact with the water (Richardson et al. 1995), and that the majority of the machinery is on the deck of the platform above the water surface. Blackwell and Greene (2003) recorded underwater sound produced at Phillips A oil platform (now the Tyonek platform) at distances ranging from 0.3 to 19 km from the source. The highest recorded sound level was 119 dB at a distance of 1.2 km. Sound between two and 10 kHz was measured as high as 85 dB as far out as 19 km from the source. This noise is audible to beluga and humpback whales, and Steller sea lions.

6.6.1 ExxonMobil Alaska LNG, LCC

In 2016, ExxonMobil Alaska conducted geophysical and geotechnical surveys in upper Cook Inlet within the Susitna Delta Exclusion Zone (SUDEX). Two sightings of beluga whales (four individuals) and one sighting of a harbor seal were observed within the SUDEX. The sightings occurred during non-operational periods (e.g., when no vibracore operations were occurring), and both beluga sightings were observed outside of the harassment zone (Smultea Environmental Sciences 2016).

6.6.2 Furie Exploration Drilling

NMFS completed formal consultation in 2017 for Furie to conduct oil and gas exploratory drilling operations in the Kitchen Lights Unit in upper Cook Inlet between 2017 and 2021 (NMFS 2017a). Actions included tugs towing a jack-up rig from winter storage in lower Cook Inlet to the drilling sites, high-resolution geophysical surveys, pile driving at the drilling locations, drilling operations, vessel and air traffic associated with rig operations, fuel storage, and well completion activities. Furie did not conduct exploratory drilling in 2017 and requested reinitiation in late 2017 after modifying the proposed actions. NMFS completed an informal consultation on the updated action, concurring that that action was not likely to adversely affect listed species or critical habitat and no take was authorized (NMFS 2018a). PSOs monitored during pile driving in June 2018 and observed one beluga carcass unrelated to project activities (Jacobs Engineering Group 2019). The Kitchen Lights Unit was purchased by HEX LLC at a December 2019 bankruptcy auction.

In 2024, NMFS assessed Cook Inlet Furie drilling proposed actions involving the issuance of permits related to ongoing natural gas production activities including, tugs towing, holding, and positioning a jack-up rig, production drilling, vessel support operations, and aircraft support operations. NMFS anticipates that the proposed Year 1 IHA would be effective for 1 year beginning mid-to-late 2024, and the proposed Year 2 IHA would be effective for one year beginning mid-to-late 2025. The final effective dates would be determined based upon when Furie anticipates being able to secure the rig from another operator in Cook Inlet. As noted above, Furie expects to conduct the rig towing and pile driving activities between April 1 and

November 15 each year, but if favorable ice conditions occur outside of that period, it may tow the rig or pile drive outside of that period. The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) issued Furie Operating Alaska, LLC (Furie) two sequential Incidental Harassment Authorizations (IHAs) valid September 13, 2024 through September 12, 2025 (Year 1) and September 13, 2025 through September 12, 2026 (Year 2).

The IHAs authorized take of small numbers of specified marine mammals by Level B harassment. Furie's 2024 activities covered under the Year 1 IHA are reported herein and include two (2) jack-up rig transports in middle Cook Inlet.

The Year 1 IHA authorized a small number of takes for 12 species: humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), gray whale *(Eschrichtius robustus*), fin whale (*Balaenoptera physalus*), killer whale (*Orcinus orca*), beluga whale (*Delphinapterus leucas*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), harbor seal (*Phoca vitulina*), Steller sea lion (*Eumetopias jubatus*), and California sea lion (*Zalophus californianus*). Other marine mammal species were to be recorded if observed.

In-water activities requiring protected species observers took place on October 2, 2024, October 3, 2024, November 13, 2024 and November 14, 2024. No Level A or Level B takes occurred of any species during this period as no marine mammals were spotted.

6.6.3 **Hilcorp Oil and Gas**

The Hilcorp Incidental Take Regulations issued in 2019 included oil and gas exploration, development, production, and decommissioning activities in Cook Inlet between 2019 and 2024. As discussed above, Hilcorp completed seismic operations in 2019. Hilcorp completed routine pipeline maintenance operations in 2020 and did not observe any marine mammals. In 2021, three tugs transported the *Spartan 151* jack-up rig for plug and abandonment activities and production drilling. Hilcorp also completed a shallow hazard survey over lower Cook Inlet Outer Continental Shelf leases in 2021 to evaluate potential hazards, document any potential cultural resources, identify shallow hazards, obtain engineering data for placement of structures, and detect subsurface geologic hazards.

Hilcorp transported the jack-up rig from the Rig Tender's Dock in Nikiski to the Tyonek platform in middle Cook Inlet in June 2022 and back to the Rig Tender's Dock in September 2022. In 2023, Hilcorp transported the jack-up rig from the Rig Tender's Dock to the subsea Well Site 17589 in June and to the Tyonek platform in July. NMFS Permits Division concurred with Hilcorp's assessment that take of marine mammals by Level B harassment was unlikely to occur during the transport.

Hilcorp and Harvest also received a Letter of Concurrence from NMFS AKR in 2022 for routine oil and gas pipeline and infrastructure maintenance. Routine maintenance activities include:

subsea pipeline inspections, pipeline stabilization, and repair and replacement; platform leg inspections and repairs; and anode sled installations. Work under the informal consultation will occur over a five-year period from 2022 – 2027.

Hilcorp submitted an IHA application to the NMFS Permits Division in September 2023 for oil and gas exploration, development, production, and decommissioning activities in Cook Inlet from April 1, 2024 to November 30, 2024. The application includes production drilling at existing platforms in middle Cook Inlet and Trading Bay using a jack-up rig towed by tugs. As discussed above, the IHA application also includes a 2D seismic survey.

6.7 Vessel Traffic

Cook Inlet is a regional hub of marine transportation throughout the year, and is used by various classes of vessels, including containerships, bulk cargo freighters, tankers, commercial and sport-fishing vessels, and recreational vessels. Vessel traffic density is concentrated along the eastern margin of the Inlet between the southern end of the Kenai Peninsula north to Anchorage. Vessel traffic in Cook Inlet transits through the ports Homer and Anchorage. Kachemak Bay, near Homer, typically has high levels of traffic with larger vessels entering the mouth of the bay to pick up a marine pilot or await U.S. Coast Guard inspection. The Bay also acts as a port of refuge for vessels sheltering from weather. On the west side of Cook Inlet, a substantial source of tanker traffic transported oil from the Drift River Terminal to the refineries on the east side, before being decommissioned.

Blackwell and Greene (2003) recorded underwater sound produced by both large and small vessels near the POA. The tugboat *Leo* produced the highest broadband levels of 149 dB re: 1 µPa at a distance of approximately 100 m, while the docked cargo freight ship *Northern Lights* produced the lowest broadband levels of 126 dB re: 1 µPa at 100 to 400 m. Continuous sound from ships generally exceeds 120 dB re 1 µPa rms to distances between 500 and 2,000 m (Jacobs Engineering Group 2017).

Cook Inlet belugas may be affected by the sound associated with shipping and transportation. There are anecdotal reports of belugas having varying reactions to vessel traffic; observers recorded diving, direction changes, and groups splitting when vessels and whales crossed paths in close proximity (HDR 2015 unpublished data). During other observations, beluga behavior suggested the whales were habituated to the vessels. Blackwell and Greene (2003) speculated belugas may habituate and become tolerant of vessels in areas subjected to perennial boat traffic.

Belugas may also decrease or cease vocalizations in response to sounds from ships and other activities, or their vocalizations may be masked (Castellote et al. 2016b). Scheifele et al. (2005) studied a population of belugas to determine whether beluga vocalizations showed intensity changes in response to shipping noise, and found that shipping noise caused belugas to vocalize louder. Lesage et al. (1999) described more persistent vocal responses when whales were exposed to a ferry as opposed to a small-boat, including a progressive reduction in calling rate while vessels were approaching, an increase in the repetition of specific calls, and a shift to higher frequency bands when vessels were close to the whales. Belugas altering their vocal behavior is indicative of an increase in energy costs, and long-term adverse energetic consequences could occur, if noise exposure is chronic. The degradation of the beluga acoustic communication and echolocation space, as well as the noise-induced chronic increase of signaling costs and stress, could lead to negative biological consequences at the population level (NMFS 2016b).

Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects from anthropogenic sounds such as shipping traffic. Baleen whales may also exhibit behavioral changes in response to vessel noise. Marine mammals that have been disturbed by anthropogenic noise and vessel approaches are commonly reported to shift from resting behavioral states to active behavioral states, suggesting an energetic cost to the affected animal. Humpback cow-calf pairs significantly reduced the amount of time spent resting and milling when vessels approached, as compared to undisturbed whales (Morete et al. 2007). Responding to vessels is likely stressful to humpback whales, but the biological significance of that stress is unknown (Bauer and Herman 1986).

Potential impacts of vessel disturbance on Steller sea lions have not been well studied, and the responses will likely depend on the season and stage in the reproductive cycle (NMFS 2008b). Steller sea lions are more likely to be disturbed at haulouts and near rookeries, where in-air vessel noise or visual presence could cause behavioral responses such as avoidance of the sound source, spatial displacement from the immediate surrounding area, trampling, and abandonment of pups (Calkins and Pitcher 1982; Kucey 2005). Repeated disturbances that result in abandonment or reduced use of rookeries by lactating females could negatively affect body condition and survival of pups through interruption of normal nursing cycles (NMFS 2008b). Increases in ambient noise from vessel traffic, however temporary, also have the potential to mask communication between sea lions and affect their ability to detect predators (Richardson and Malme 1993; Weilgart 2007).

6.8 **Aircraft Sound**

There is significant air traffic over Cook Inlet. Ted Stevens Anchorage International Airport, located adjacent to lower Knik Arm, is the largest air cargo hub in the U.S. and also has high volumes of commercial air traffic. Joint Base Elmendorf-Richardson (JBER) has a runway near Knik Arm and airspace directly over it. Lake Hood in Anchorage is the largest and busiest seaplane base in the world, and the only seaplane base in the U.S. with primary airport status (Federal Aviation Administration 2016). Small public runways are located in Birchwood, Goose Bay, Merrill Field, Girdwood, Kenai, Ninilchik, Homer, and Seldovia. Oil and gas operators frequently utilize helicopters and fixed-winged aircraft to transport personnel and goods, as well as for surveys.

Airborne sounds do not transfer well to water; much of the sound is attenuated at the surface or reflected where angles of incidence are greater than 13°. However, loud aircraft sound can be heard underwater when aircraft are within or near the 13° overhead cone and surface conditions are calm (Richardson et al. 1995). The sound and visual presence of aircraft may result in behavioral changes in whales, including diving, altering course, vigorous swimming, and breaching (Patenaude et al. 2002).

NMFS consulted on a proposed action to improve F-22 aircraft operational efficiency at JBER in 2016. The Air Force modeled the in-water sound pressure level of an F-22 overflight and determined the maximum predicted in-water sound was 136.8 dB re 1 µPa rms for a duration of a few seconds. The estimated total time per flight event in flight configurations that result in underwater sound levels greater than 120 dB re 1 µParms was between 3 and 136 seconds, with the number of seconds depending on the flight procedure being conducted. Due to the airspeed of the F-22, at any given point within the overflown portion of Cook Inlet waters, exposures to underwater sound levels greater than 120 dB re 1 µParms would be very brief—approximately 2 to 5 seconds. The number of beluga behavioral reactions associated with the proposed action was estimated at 0.012 to 0.047 per year. Based on the short time during which any increased noise would be detectable to belugas, and the low probability of belugas occurring within the path of maximum sound pressure level, NMFS concluded that acoustic effects on belugas associated with the proposed action were insignificant and discountable.

Observers reported little or no change in swimming direction of beluga whales in Cook Inlet in response to the survey aircraft flying at approximately 244 m (Rugh et al. 2000). Beluga whales in the Beaufort Sea were observed diving or swimming away when low-flying aircraft passed above (500 m; Richardson et al. 1995). Individual responses of belugas may vary depending on previous experiences, beluga activity at the time of the sound, and sound characteristics.

The responsiveness of baleen whales (i.e., humpbacks) to aircraft is also variable and may depend on behavioral state, habitat, and age class of the animal. Responses include diving and turning, as well as other changes in behavior. Whales actively engaged in feeding or social behavior often appear less sensitive, and typically do not exhibit a reaction. Whales with calves or in confined waters may be more sensitive. Single or occasional aircraft overflights do not seem to cause long-term displacement or abandonment by whales (Richardson et al. 1995).

Aircraft may also disturb Steller sea lions, especially if hauled out. Disturbance of a rookery or haulout has the potential to result in serious injury or death, predominantly from trampling. Over 1,000 sea lions were observed stampeding off a beach in response to a large helicopter over a mile away (Withrow 1982). There are no rookeries or haulouts within Cook Inlet.

6.9 Sound and Habitat

A wide variety of anthropogenic sound sources are present in and around Cook Inlet beluga whale habitat. Anthropogenic sound occurs year-round; however, many of the sources are seasonal and only present during the ice-free months. Sound sources include tugs, tankers, cargo ships, fishing vessels, small recreational vessels, dredging, pile-driving, military detonations, and seismic surveys (NMFS 2016b).

6.10 Water Quality and Water Pollution

The Cook Inlet region is the most populated and industrialized region of the state. Its waters receive various pollutant loads through activities that include urban runoff, oil and gas activities, municipal sewage treatment effluents, oil and other chemical spills, fish processing, and other regulated discharges. The main sources of pollutants likely include the 10 wastewater treatment facilities, stormwater runoff, airport de-icing, military training at Eagle Bay, and discharge from oil and gas development (Moore et al. 2000; NMFS 2008a). Emerging pollutants of concern from municipal sewage include endocrine disruptors (substances that interfere with the functions of hormones), pharmaceuticals, personal care products, prions (infectious proteins that cause neurodegenerative disease), and other bacterial and viral agents that are found in wastewater and biosolids (NMFS 2016b). Many pollutants are regulated by the Environmental Protection Agency (EPA) or the Alaska Department of Environmental Conservation (ADEC), who may authorize certain discharges under the National (or Alaska) Pollution Discharge Elimination System (NPDES/APDES; section 402 of the Clean Water Act of 1972).

Chemical concentrations in belugas can vary by region. Polychlorinated biphenyls, dichlorodiphenyltrichloroethane (more commonly known as DDT), chlordanes, chlorobenzenes, mirex, and mercury were significantly higher in belugas from the eastern Chukchi Sea than from Cook Inlet; in contrast, PBDE and α-HBCD concentrations were significantly lower ($p < 0.0001$) in belugas from the eastern Chukchi Sea than from the Cook Inlet (Hoguet et al. 2013). Levels of heavy metals, pesticides, petroleum hydrocarbons, and polychlorinated biphenyl compounds found in Cook Inlet's water column and sediments were below detection limits; and heavy metal concentrations were below management levels (KABATA 2004; NMFS 2008a; USACE 2008). The comparatively low levels of contaminants documented in the Cook Inlet water and sediment samples, as well as in the belugas themselves suggests that the magnitude of the pollution threat appears low.

6.10.1 Petrochemical Spills

According to the ADEC, oil spills in marine waters consist mostly of harbor and vessel spills, and spills from platform and processing facilities. A spill baseline study conducted as part of the Cook Inlet Risk Assessment estimated a historical vessel spill rate of 3.4 spills (regardless of size) per year, with rates ranging from 0.7 spills per year for tank ships to 1.3 spills per year for non-tank/non-workboat vessels (Nuka Research and Planning and Pearson Consulting LLC 2015). Between 1966 and 2015, eight large vessel spills (≥ 1,000 bbl) were documented in Cook Inlet (BOEM 2016). The ADEC Statewide Oil Spills Database[24] provides public access to data on all the spills reported in Cook Inlet or in tributaries to Cook Inlet. The types of spills recorded include jet fuel, crude oil, ethylene glycol, and produced water. Spills of as little as one gallon are reported and most spills are contained and disposed of properly. Two spills have been recorded so far in 2025, 16 in 2023, 14 in 2022, 21 in 2021, 12 in 2020, and 18 in 2019. An oil

[24] https://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/SpillSearch Accessed May 2023.

spill in Cook Inlet could also result in widespread habitat degradation, impacting beluga whales and putting the population at risk. Population level effects to the Western DPS of Steller sea lions and listed humpback whales within Cook Inlet would be far less likely; however, individual animals may also be put at risk from a spill.

The amount of oil and gas development and vessel traffic in and around Cook Inlet suggests that spills are inevitable. As a consequence, marine mammals and their prey may be exposed to a range of contaminants in varying concentrations. The long-term consequences of this exposure remain unknown. However, the statistical probability of large, and especially very large, oil spills occurring is very small (BOEM 2016). A number of regulatory changes have been put in place since the Deepwater Horizon oil spill in an effort to reduce the risk of spills associated with oil and gas development and production activities (e.g., prescriptive and performance based regulations and guidance, as well as OCS safety and environmental protection requirements) (BOEM 2012). Small spills are expected to rapidly disperse due to tide-induced turbulence and mixing; large condensate and diesel fuel spills in Cook Inlet are expected to evaporate and disperse, generally within one to ten days, depending on size of spill (BOEM 2017).

6.10.2 **Wastewater Discharge**

Wastewaters entering treatment facilities may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria and viruses, and other emerging pollutants of concern; and, undergo primary, secondary, or tertiary treatment prior to being discharged into a body of water. Primary treatment involves sedimentation. In general, this includes removing 50 to 70 percent of the solid particulate from the wastewater prior to discharge (Sonune and Ghate 2004). In addition to sedimentation, secondary treatment involves adding a biological component to remove the remaining organic matter. Tertiary treatment involves both primary and secondary treatment as well as additional processes to increase the water quality of the discharge (Sonune and Ghate 2004).

Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewater from the Municipality of Anchorage, Nanwalek, Port Graham, Seldovia, and Tyonek receive primary treatment, wastewaters from Homer, Kenai, and Palmer receive secondary treatment, and wastewaters from Eagle River and Girdwood receive tertiary treatment.

The Anchorage John M. Asplund Wastewater Treatment Facility (AWTF) is the largest wastewater facility in Alaska and is located in upper Cook Inlet. AWTF provides primary treatment, and removes approximately 80 percent of solids prior to discharge. The facility was built in 1972, upgraded in 1982 and again in 1989. The Environmental Protection Agency (EPA) issues AWTF a waiver for secondary treatment because of the levels of sediment they are able to extract and the extreme tides and currents of Cook Inlet (Kinnetic Laboratories Incorporated 2017). Once the sediment is removed from the wastewater, the sludge is incinerated. The effluent is tested regularly, including bioassays on fish and invertebrates, and has shown very low levels of contaminants (Jokela et al. 2010).

The Village of Tyonek wastewater treatment facility operates on a gravity fed sewer that drains into a community septic tank. The solids are transferred to a sludge lagoon for dewatering twice a year and the liquid effluent is then discharged into Cook Inlet near an area heavily used by feeding Cook Inlet beluga whales. The City of Kenai wastewater facility is one of the larger plants and is located near the largest runs of salmon in Cook Inlet. Secondary-treated wastewater is discharged directly into Cook Inlet, and the sludge is taken to the Soldotna landfill.

Wastewater discharge from oil and gas development could also increase pollutants in Cook Inlet (NMFS 2008a.) Discharge includes, but is not limited to, drilling fluids (muds and cuttings), produced water (water phase of liquid pumped from oil wells), and domestic and sanitary waste (NMFS 2008a; EPA 2015). Oil and gas facilities are required to monitor effluent for pollutants and meet specific standards stipulated in their EPA-issued NPDES permit before wastewater is discharged into Cook Inlet (EPA 2015).

6.10.3 **Mixing Zones**

In 2010, the EPA consulted with NMFS on the approval of ADEC's Mixing Zone Regulation section (18 AAC 70.240), including the most recent revisions of the Alaska Water Quality Standards (18 AAC 70; WQS), relative to the endangered Cook Inlet beluga whale (NMFS 2010c). The biological opinion concluded that there was insufficient information to determine whether belugas could be harmed by the elevated concentrations of substances present in mixing zones, but that the action was not likely to jeopardize the continued existence of the species. In 2019, NMFS issued a biological opinion on the effects of EPA approval of the Mixing Zone Regulation following designation of Cook Inlet beluga whale critical habitat and concluded that the Mixing Zone Regulation is not likely to destroy or adversely modify designated Cook Inlet beluga whale critical habitat.

6.10.4 **Stormwater Runoff**

Stormwater pollutants may include street and aircraft de-icer, oil, pesticides and fertilizers, heavy metals, and fecal coliform bacteria. Public Works and the Alaska Department of Transportation and Public Facilities are responsible for identifying, monitoring, and controlling pollutants in stormwater. The effects of stormwater on the Cook Inlet beluga whale have not been studied and are unknown (NMFS 2008a).

Numerous releases of petroleum hydrocarbons have been documented from the POA, JBER, and the Alaska Railroad Corporation (ARRC). The POA transfers and stores petroleum oils, as well as other hazardous materials. Since 1992, all significant spills and leaks have been reported. Past spills have been documented at each of the bulk fuel facilities within the POA and also on JBER's property (POA 2003). Joint Base Elmendorf-Richardson (JBER) is listed on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, because of known or threatened releases of hazardous substances, pollutants, or contaminants. Spills have also been reported at the ARRC rail yard. In 1986, petroleum seeped into Ship Creek from the nearby rail yard, and several oil spills occurred in 2001 (U. S. Army

2010). Freight handling activities have historically caused numerous surface stains and spills at the rail yard.

6.10.5 **Aircraft De-icing**

The Federal Aviation Administration requires de-icing and anti-icing of aircraft and airfield surfaces, when necessary, to ensure passenger safety. De-icing and anti-icing chemicals are used from October through May and may be used on aircraft, tarmacs, and runways. De-icing material is comprised of different chemicals depending on the application; ethylene glycol and propylene glycol are used on aircraft for anti-icing and de-icing purposes, whereas potassium acetate is used to de-ice tarmacs and runways.

The Ted Stevens Anchorage International Airport and Joint Base Elmendorf-Richardson airport are the largest airports in the Cook Inlet region. Other smaller airports exist throughout the Cook Inlet watershed, including Merrill Field, Lake Hood, Kenai, and Homer (NMFS 2008a). It is likely that they all regularly contribute pollutants to Cook Inlet through stormwater runoff; one of the stormwater outfalls from the Ted Stevens Anchorage International Airport enters Knik Arm directly. ADEC conducted inspections of the discharge from the outfall that discharges into Knik Arm in April 2009, May 2012, and April 2017 after complaints were received from the public (ADEC 2019). A frothy white foam with a sweet odor was determined to be deicing chemicals, and a Notice of Violation was recorded in all three years (ADEC 2019).

The current permit for the Ted Stevens Anchorage International Airport requires monthly sampling and reporting of several water quality standards, and an annual report for the outfall entering Knik Arm. Belugas primarily use the waters near the outfall as a transit corridor and their exposure to elevated levels of contaminants in April and May when the majority of runoff occurs is likely limited (ADEC 2019).

6.10.6 **Ballast Water Discharges**

Globally, shipping has been found to be responsible for 69 percent of marine invasive species (Molnar et al. 2008). The impact of nonnatives in marine systems includes extirpation of native species through competition or predation, shifts in ecosystem food webs, and changes to the physical structure of the habitat (Norse and Crowder 2005). The National Invasive Species Act of 1996 mandates that all ships arriving in U.S. waters complete and submit a ballast water information report to the National Ballast Water Information Clearinghouse.

Discharges of wastes from vessels are regulated by the United States Coast Guard (USCG) and, by law, no discharges of any kind are allowed within three miles of land. The USCG established rules for controlling discharged ballast water in U.S. waters through publication of 33 CFR Part 151 and 46 CFR Part 162 in 2004. Ships must manage their ballast water by the following treatment methods and good practices:

- Perform ballast water treatment through installation and operation of an approved Ballast

Water Treatment System

- Perform ballast water exchange 200 miles from shore
- Avoid or minimize ballast water exchanges in risky or preserved areas
- Clean ballast tanks regularly to remove sediments, rinse anchors and chains, and remove fouling from hull and piping
- Maintain an approved Ballast Water Management Plan, as well as the written records of ballast water movements (uptake, transfer, discharge)
- Submit vessel and ballast water management information to USCG prior arrival in US harbors

Before the problems with ballast water were fully recognized and regulated, untreated ballast water was released in Cook Inlet. The National Ballast Water Information Clearinghouse reported that more than five million metric tons of, likely untreated, ballast water were released in Cook Inlet between Homer and Anchorage from 1999 to 2003. Surveys conducted in Kachemak Bay and Cook Inlet in 2000 found 13 invasive species in diverse taxonomic groups, including 3 hydroids, 1 bryozoan, 2 bivalves, and 7 species of vascular plants (Hines and Ruiz 2000). When compared to similar surveys along the West Coast, there are relatively few invasives in Alaska's coastal waters (Ruiz et al. 2006). Dueñas et al. (2018) conducted a systematic literature review on invasive species' interactions with all ESA-listed species, and did not find any studies indicating that ESA-listed marine mammals were negatively impacted by invasive species.

The effects of discharged ballast water and the possible introduction of invasive species on Western DPS Steller sea lions, humpback whales, Cook Inlet beluga whales, and their designated critical habitat are unknown and any ecosystem level impacts will take many years to be manifested.

6.10.7 **Contaminants Found in Listed Species**

Studies conducted in upper Cook Inlet found polychlorinated biphenyls (PCB), pesticides, and petroleum hydrocarbon levels below detectable limits in the water column and sediment, and heavy metals were below management levels (KABATA 2004; NMFS 2008a; USACE 2008).

Becker et al. (2000) compared levels of PCBs, chlorinated pesticides, heavy metals, and other elements between beluga populations in Greenland, the St. Lawrence Estuary and Arctic Canada, and Cook Inlet, Point Hope, and Point Lay, Alaska. The Cook Inlet population had the lowest concentrations of PCBs, pesticides, cadmium, and mercury of all the populations, but had higher concentrations of copper than the other two Alaska populations. The lower levels might be related to differences in contaminant sources, food web differences, or different age distributions of the animals sampled. Concentration values of previously reported legacy organic contaminants in the Cook Inlet beluga whale population did not significantly change with the analysis of more recent samples; however, chemicals of emerging concern (e.g., polybrominated diphenyl ether, hexabromocyclododecane, and perfluorinated compounds) were identified. While the contaminant levels found in the Cook Inlet beluga whale population are lower than the levels in other populations, the effects of these contaminants on this population are unknown (Becker et al. 2000; NMFS 2008a).

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous in the environment, from both natural and anthropogenic sources, and are of special concern where they have the potential to be introduced at elevated concentrations from urban run-off, oil spills, municipal discharges, and oil and gas activities. High levels of PAHs have cytotoxic, genotoxic, immunotoxic, and carcinogenic effects on aquatic wildlife. In Cook Inlet, anthropogenic sources of hydrocarbons include oil and gas activities (e.g., produced water discharges), municipal wastewater discharge, stormwater runoff from roads and industrial areas, vessels, and spills (Saupe et al. 2014). The main, known natural sources in Cook Inlet include coal, oil seeps, peat, and hydrocarbon bearing source rock that enter Cook Inlet directly from rivers and coastal erosion, as well as from advection into the inlet (Saupe et al. 2014).

Beluga whales spend significant time in intertidal and nearshore areas, where the risk is often highest for exposure to PAHs (Saupe et al. 2014). Belugas may be exposed to PAHs through inhalation, direct contact with oil slicks or dissolved plumes, direct contact with contaminated sediments, or ingesting contaminated prey. Samples from belugas from the St. Lawrence Estuary, Cook Inlet, Arctic, and aquaria were analyzed, and significantly higher levels of intestinal PAH–DNA adducts were found in the St. Lawrence Estuary and Cook Inlet samples (Poirier et al. 2019). The presence of such an adduct indicates prior exposure to a potential carcinogen but does not by itself indicate the presence of cancer in the animal. Reynolds and Wetzel (2010) found elevated levels of PAHs in the livers of Cook Inlet beluga males, blubber of females, and in two fetuses. Thus far, necropsies on Cook Inlet belugas have not shown the high incidence of cancers that have been documented for the St. Lawrence Estuary population.

Concentrations of organochlorine and metal contaminants in baleen whales are low, and there is no firm evidence that levels of organochlorines, organotins, or heavy metals are high enough to cause toxic or other damaging effects (O'Shea and R. L. Brownell 1994). Baleen whales can accumulate lipophilic compounds (e.g., halogenated hydrocarbons) and pesticides (e.g., DDT) in their blubber as a result of feeding on contaminated prey or inhalation in areas of high contaminant concentrations (Barrie et al. 1992; Wania and Mackay 1993). Some contaminants may be passed on to young during gestation and lactation (Aguilar and Borell 1994). The health effects of different doses of contaminants on marine mammals are currently unknown; however, there is evidence of detrimental health effects from these compounds in other mammals, including disease susceptibility, neurotoxicity, and reproductive and immune system impairment (Reijnders 1986; de Swart et al. 1996; Eriksson et al. 1998). Although there has been substantial research on the identification and quantification of such contaminants on individual whales, no detectable effect from contaminants has been identified in baleen whales. There may be chronic, sub-lethal impacts that are currently unknown.

Steller sea lions are exposed to local and system-wide contaminants and pollutants as they traverse the North Pacific basin. Effects on other pinnipeds have included acute mortality, reduced pregnancy rates, immuno-suppression, and reduced survival of first born pups (NMFS 2008b). There are no published reports of contaminants or pollutants, other than spilled oil, resulting in mortality of Steller sea lions (NMFS 2008b).

6.11 **Fisheries**

Cook Inlet supports several commercial fisheries, all of which require permits. Commercial fisheries are divided into the upper and lower Cook Inlet regions.[25] The upper region contains all waters north of Anchor Point and is further divided into the Northern (north of the West and East Foreland) and Central Districts (south of the Forelands to Anchor Point Light). Species commercially harvested in upper Cook Inlet include all five Pacific salmon species (drift and set gillnet), eulachon or smelt (dipnet), Pacific herring (gillnet), and razor clams (hand-digging). Sockeye salmon are the most economically valuable,[26] accounting for 91 percent of the total ex-vessel value over the past 10 years.[27]

The average annual commercial harvest of salmon in upper Cook Inlet from 1966-2016 was 3.5 million (Shields and Dupuis 2017). The most recent 10-year average annual commercial salmon fishery harvest is 2.5 million fish, and the 2022 harvest of 1.4 million was 44 percent less than the 10-year average. The 2022 upper Cook Inlet commercial harvest compared to the recent 10-year average was down 34 percent for chum, 43 percent for sockeye, 44 percent for coho, 58 percent for Chinook, and 72 percent for pink salmon. At this point, it is hard to know if these results are a short-term reflection of natural variation or are an indicator of a more systematic shift and downward trend. Salmon are the primary prey item for Cook Inlet beluga whale and these numbers may be a cause for concern; at best, they indicate there are fewer salmon available for commercial fisheries, recreational, personal and subsistence use, and beluga whales.

The North Pacific Fishery Management Council first developed the Salmon Fishery Management Plan (FMP) under the Magnuson-Stevens Act more than 40 years ago. It excluded designated federal waters in Cook Inlet, which allowed the State of Alaska to manage commercial salmon fishing in the area. Currently, there are no federal fishing regulations governing salmon fishing in the Federal waters of Cook Inlet. In the absence of federal regulations, the State of Alaska regulates state-permitted vessels when fishing for salmon in both the State and Federal waters of Cook Inlet. However, NMFS recently published a proposed rule amending the Salmon FMP, which would establish Federal fishery management for all salmon fishing that occurs in the Cook Inlet EEZ, including commercial drift gillnet and recreational salmon fishery sectors (88 FR 72324, Oct. 19, 2023).

Recreational fisheries exist in the river systems on the western Kenai Peninsula for salmon (Chinook, sockeye, pink, and coho), both freshwater and marine Dolly Varden char, and rainbow

[25] http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareacookinlet.main Accessed May 2023.
[26] http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareauci.main Accessed May 2023.
[27] https://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1447206643.pdf Accessed May 2023.

trout/steelhead trout. In the marine waters throughout Cook Inlet, recreational fishing occurs for salmon (Chinook and coho), Pacific cod, and halibut. Many of the charter fishing vessels targeting salmon and halibut operate out of Homer in lower Cook Inlet. A new recreational dipnet fishery on the Susitna River for all species other than Chinook salmon began in 2020.

Sport fishing for Chinook salmon in Cook Inlet salt waters was closed from May 15 through July 31, 2023.[28] In conjunction with this closure, additional emergency orders prohibited the retention of wild Chinook salmon in the Ninilchik and Kasilof Rivers and restricted other Chinook salmon fisheries in the Susitna River, Northern Cook Inlet, and West Cook Inlet areas. Based on escapement monitoring in the Kenai, Anchor, and Deshka Rivers, the Chinook salmon runs were forecast to be below the lower end of their escapement goals, which triggered the in-river sport fishery preseason closures in these streams. Additionally, all of these stocks failed to achieve their escapement goals in 2022. The low productivity period was expected to continue for Cook Inlet Chinook salmon in 2023.

An important remaining unknown is the extent to which Cook Inlet marine mammal prey is made less available due to commercial, subsistence, personal use, and sport fishing either by direct removal of the prey or by human-caused habitat avoidance.

Potential impacts from commercial fishing on Cook Inlet beluga whales, humpback whales, and Steller sea lions include ship strikes, harassment, gear entanglement, reduction of prey, and displacement from important habitat. For example, the Kenai River is the most heavily-fished river in Alaska;[29] belugas no longer use waters near the river during salmon fishing season, despite the fact that it has the largest salmon run in Cook Inlet and was heavily used beluga foraging habitat in the past (Ovitz 2019).

6.12 **Entanglement**

Prior to the mid-1980s, there were only two reports of fatal takes of belugas incidental to entanglement in fishing gear in Cook Inlet (Murray and Fay 1979; Burns and Seaman 1986). There have been sporadic reports of single belugas entangled in fishing nets since then; however, the only confirmed mortality was a young Cook Inlet beluga carcass recovered from a subsistence set net in 2012. Non-lethal entanglements have been documented; in 2005, a beluga entangled in an unknown object, perhaps a tire rim or a culvert liner, was photographed in Eagle Bay (McGuire et al. 2014), and another was repeatedly photographed in 2010–2013 with what appeared to be a rope entangled around the upper portion of its body near the pectoral flippers (McGuire et al. 2014). It is unknown if these animals were able to disentangle themselves or if they died as a result of the entanglements (NMFS 2016b).

Humpback whales have been killed and injured during interactions with commercial fishing

[28] https://www.adfg.alaska.gov/sf/EONR/index.cfm?ADFG=region.NR&Year=2023&NRID=3455 Accessed May 2023.
[29] http://www.adfg.alaska.gov/index.cfm?adfg=ByAreaSouthcentralUpperKenai.fishingInfo Accessed May 2023.

gear; however, the frequency of these interactions does not appear to have a significant adverse consequence for humpback whale populations. In Alaska, most humpbacks become entangled with gear between early June and early September while foraging in nearshore waters. A photographic study of humpback whales in Southeast Alaska found at least 53 percent of individuals showed some kind of scarring from fishing gear entanglement (Neilson et al. 2005).

Human-caused mortality and injury reported for humpback whales in Alaska from 2016 to 2020 was 65 animals, 47 of which were entanglements (Freed et al. 2022). In 2015, a humpback whale was entangled in a salmon purse seine net in Cook Inlet but was cut free by the fisherman, and was assumed to be unharmed (Delean et al. 2020). A minke whale or small humpback whale was reported entangled near the Lands End hotel in Homer in 2017, and a humpback whale was reported entangled near the Homer Spit in 2019 (NMFS unpublished data). These are the only known humpback whale entanglements in Cook Inlet.

ADFG analyzed data from 1,439 individually marked Steller sea lions that were re-sighted from 2001 through 2015, and found that animals that had ingested salmon hook and line fishing gear had lower survival than comparable animals that had not ingested fishing gear (Freed et al. 2022). The minimum estimated mean annual mortality and serious injury rate in U.S. commercial fisheries between 2014 and 2018 was 37 Western DPS Steller sea lions, and this is likely an underestimate of the actual level (Muto et al. 2021). Between 2016 and 2020 human-caused mortality and injury of the Western DPS Steller sea lions (n = 148) was primarily caused by entanglement in fishing gear, in particular, commercial trawl gear (n=113; Freed et al. 2022). This mortality and serious injury estimate results from an actual count of verified human-caused deaths and serious injuries, and is a minimum because not all entangled animals strand nor are all stranded animals found, reported, or have the cause of death determined. Overall, the relative impact on the recovery of the Western DPS of Steller sea lion due to entanglement is ranked as low (NMFS 2008b).

On October 1, 2024, PSOs working on the POA's North Extension Stabilization (NES) project spotted a CIBW entangled in an unknown object (possibly a tire inner-tube) near the POA (61N Environmental, 2025). The whale was sighted again on October 2 but was not seen after that time. Video footage of the individual was taken, and the whale was determined to be a subadult, at least 7 years old (NMFS 2024b). The entanglement was determined to be life-threatening, but the whale was not seen after October 2, and no disentanglement effort was possible. This is the third known entanglement of a free-swimming CIBW; the others were observed in 2005 and 2010.

6.13 **Competition for Prey**

Fisheries in Cook Inlet have varying likelihoods of competing with marine mammals for fish, depending on gear type, species fished, timing, and fisheries location and intensity. Cook Inlet beluga whales may experience reduced prey availability and/or habitat displacement due to commercial and recreational fishing activity. Watercraft operating near the mouths and deltas of rivers entering Cook Inlet, Turnagain Arm, and Knik Arm can deter beluga whales from pursuing eulachon and salmon prey in these waters. For example, belugas have not been observed in recent times in or near the Kenai River when salmon runs are strong and fishing activity is high; however, there are numerous reports of whales in the river before and after the summer salmon fishing season (Castellote et al. 2015; Shelden et al. 2015b).

Cook Inlet belugas are dependent on access to relatively dense concentrations of high value prey species, particularly in the spring and throughout the summer months. Norman (2011) estimated that 350 Cook Inlet beluga whales would consume a total biomass of approximately 1,250 metric tons of fish during the summer. Chum, coho, and other salmonid species constitute >54 percent of their summer diet (Hobbs and Shelden 2008). The 2022 upper Cook Inlet commercial salmon fishery harvest was 1.4 million fish, 44 percent less than the most recent 10-year average. A reduction in the amount of available prey could impact Cook Inlet beluga whale energetics and delay recovery.

The operation of watercraft near the mouths and deltas of rivers entering Cook Inlet, Turnagain Arm, and Knik Arm may result in beluga whale habitat displacement, if pursuit of eulachon and salmon prey in these waters is impeded. NMFS has numerous reports of beluga whales in the Kenai River prior to and after the summer salmon fishing season; however, the whales have not been observed in or near the river in recent times when salmon runs are strong and fishing activity is high (Castellote et al. 2015; Shelden et al. 2015b).

There has been considerable debate among the scientific community as to whether fisheries reduce Steller sea lion prey biomass and quality at local and/or regional spatial scales, which then leads to a reduction in Steller sea lion survival and reproduction (NMFS 2008b). The most recent minimum total annual direct mortality of Western DPS Steller sea lions associated with commercial fisheries is 37 individuals (Muto et al. 2021).

Important foraging areas for humpback whales are outside of Cook Inlet and prey competition is unlikely to occur.

6.14 **Tourism**

There are no commercial whale-watching companies operating in upper Cook Inlet. Aerial tours, such as guided hunting trips, may affect belugas by flying at low altitudes or circling the whales. NMFS has conducted outreach to local pilots and encouraged them to maintain an altitude of 1,500 feet or higher over belugas and to avoid circling over the animals.

Tourism continues to grow in lower Cook Inlet, and a number of commercial vessel-based tour companies operate primarily out of Homer. The tour vessels range in size and capacity from 6 to over 100 passengers, and include fishing and wildlife viewing tours. There are also a number of commercial flight-seeing tour operators based in Homer. Flights occur over land on the Kenai Peninsula, the waters of lower Cook Inlet (Kachemak Bay), and across the Inlet to places such as Katmai National Park and McNeil River State Game refuge. Aircraft have the potential to disturb marine mammals, particularly pinnipeds hauled out.

6.15 Direct Mortality

Within the proposed action area there are several potential sources of direct anthropogenic mortality, including shootings, strandings, fishery/gear/debris interactions, vessel collisions, predation, and research activities. NMFS is not aware of any illegal shootings of listed marine mammals in Cook Inlet (NMFS Alaska Regional Office Stranding Database, accessed September 2024).

6.16 Subsistence Harvest

The ESA and MMPA allow for the harvest of marine mammal species by Alaska Natives for subsistence purposes and for creating and selling authentic native articles of handicrafts and clothing. Subsistence harvest of Western DPS Steller sea lions is regulated by co-management agreements with NMFS, and occurs at or well below sustainable levels of harvest. Annual statewide data on community subsistence harvest of Steller sea lions are no longer collected as of 2009; therefore, the best available statewide subsistence harvest estimates for Western DPS Steller sea lions are those from 2004 to 2008. The mean annual subsistence take (harvested plus struck-and-lost) from the Western DPS from 2004 through 2008, combined with the mean annual take between 2014-2018 from St. Paul, St. George, and Atka Island, was 209 sea lions per year (Muto et al. 2021).

Subsistence hunters in Alaska are not authorized to take humpback whales. However, one humpback whale was unlawfully harvested in Kotlik in October 2006, and another in Toksook Bay in May 2016.

Previous Cook Inlet beluga subsistence harvests have had a significant effect on the population. While an unknown amount of harvest occurred for decades or longer, the subsistence harvest increased substantially to unsustainable levels in the 1980s and 1990s. Harvests from 1994 to 1998 likely account for the population decline during that time period. Cook Inlet beluga whale subsistence harvest ceased in 1999 as a result of both a voluntary moratorium by the hunters, and passage of Public Law 106–31, section 3022 (later made permanent by Public Law 106-553, section 627), which required any taking of Cook Inlet beluga whales by Alaska Natives to occur pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations. The law did not specify a harvest level or a harvest management plan. In May 2000, NMFS designated Cook Inlet belugas as a depleted stock under the MMPA (65 FR 34590, May 31, 2000). Subsequently, NMFS promulgated interim harvest regulations that provided a harvest management plan (69 FR 17973, April 6, 2004). The co-management agreement developed pursuant to these regulations allowed the harvest of two whales in 2005 and one whale in 2006; however, no whales were taken in 2006 due to poor weather and the avoidance of females with calves. In 2008, NMFS issued regulations (73 FR 60976, October 15, 2008; 50 CFR § 216.23(f)) establishing long-term limits on the maximum number of Cook Inlet beluga whales that may be taken for subsistence by Alaska Natives. These long-term harvest limits, developed for five-year intervals, require that the abundance estimates reach a minimum five-year average of 350 belugas (50 CFR 216.23(f)(2)(v)). No hunt has been authorized since 2006.

6.17 **Poaching and Illegal Harassment**

Due to their distribution within the most densely populated region in Alaska and their approachable nature, the potential for poaching beluga whales in Cook Inlet exists. NMFS maintains an enforcement presence in upper Cook Inlet; however, effective enforcement across such a large area is difficult. NMFS Enforcement has investigated several reports of Cook Inlet beluga whale harassment, but there have been no confirmed poaching incidents.

Historically, Steller sea lions have been poached and illegally harvested throughout their range. The NMFS Alaska Marine Mammal Stranding Program documented 60 Steller sea lions with suspected or confirmed firearm injuries in Southeast and Southcentral Alaska from 2000–2019 (Wright 2016; Wright 2021). Western DPS Steller sea lions with gunshot wounds have been found stranded on shore along the outer Copper River Delta in recent years (Wright 2016; Wright 2021), and seven of nine pinnipeds stranded in the surveyed area in 2019 were shot (Wright 2021).

Few illegal harvests of humpback whales have occurred in Alaska. There are only two known cases involving subsistence hunters in western Alaska, both of which incorrectly believed they could legally harvest large whales other than bowheads (e.g., humpback, gray, and minke whales).

6.18 **Stranding**

Cook Inlet beluga whales are likely predisposed to stranding because they breed, feed, and molt in the shallow waters of upper Cook Inlet where extreme tidal fluctuations occur. Strandings may be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then becoming trapped by receding tide), or a result of injury, illness, or death. Stranding events that last more than a few hours may result in mortalities. An estimated 876 to 953 live beluga strandings and 214 dead beluga beachings have been documented in Cook Inlet from 1988 through 2015 (NMFS 2016b). Patterns of mortality for the population were analyzed and live stranding was the predominant assigned cause of death; however, this only represented approximately 33 percent of the deaths of known cause (McGuire et al. 2021). Causal factors for the majority of deaths and live strandings are unknown.

An unusually high number of beluga live stranding events occurred in Turnagain Arm in 2003 (Vos and Shelden 2005). The number of animals stranded ranged from 2 to 46 and led to 5 confirmed deaths (Vos and Shelden 2005). Stranding is a stressful event and, if the beluga survives, health after the event may be affected. Stranding events may represent a significant threat to the conservation and recovery of this population.

Live strandings are uncommon among sea lions; however, pinniped strandings and mortality resulting from entanglement in fishing gear have been documented (Loughlin and York 2000; Raum-Suryan et al. 2009; Muto et al. 2021).

Nearly all known cases of humpback whale strandings involve animals that died at sea of various other causes and washed ashore. A young humpback live stranded on the mud in Turnagain Arm in April 2019 and, while it freed itself on an incoming tide at one point, the whale later died. Two dead humpbacks washed ashore in Cook Inlet (one in 2023, one in 2024) with unknown causes of death.

6.19 Predation

Killer whales are the only natural predators of beluga whales, Steller sea lions, and humpback whales in Cook Inlet (Muto et al. 2021). Killer whale sightings were not well-documented prior to the mid-1980s and were likely rare in the upper Inlet. Alaska Native beluga hunters reported that killer whales were rarely seen in the upper Inlet or near belugas (Huntington 2000). Sightings from systematic surveys, observer databases, and anecdotal accounts from 1975 to 2002 were compiled and there were only 18 documented sightings north of Kalgin Island (Shelden et al. 2003). Killer whales were not observed in upper Cook Inlet during approximately 4,000 hours of land- and vessel-based surveys conducted from 2005 to 2017, and there were no scars consistent with killer whale attacks in the photographs taken during these surveys (McGuire et al. 2020). Monitoring efforts during the POA PCT construction project (2020-2021) detected two transient killer whales in Knik Arm in September 2021. Two to three killer whales were observed in close proximity to belugas in Knik Arm near Cairn Point on September 27, 2023.

Prior to 2000, it was estimated that an average of one Cook Inlet beluga whale was killed annually by killer whales (Shelden et al. 2003). From 1982-2014, between 9 and 12 beluga whale deaths were suspected to be a direct result of killer whale predation (NMFS 2016b). From 2011 through 2020, NMFS received no reports of possible predation attempts in upper Cook Inlet.

Predation may potentially have a significant impact on the Cook Inlet beluga whale population (Shelden et al. 2003). Killer whale predation of belugas is likely underestimated, as remains of preyed-upon belugas may sink and go undetected by humans. Beluga whale stranding events have also been correlated with killer whale presence; Native hunters report that beluga whales intentionally strand themselves in order to escape killer whale predation (Huntington 2000). However, the very low number of killer whale sightings or acoustical detections in the upper Inlet over the last 20 years indicate that the threat may be less than initially hypothesized or may have been greater when the beluga population was more robust. The contraction of Cook Inlet beluga summer range to the shallow waters of the upper Inlet may also reduce the opportunity for killer whales to pursue belugas (NMFS 2016b).

The risk to Western DPS Steller sea lions from killer whale predation is considered potentially high (Muto et al. 2021), and may be one of the causes contributing to population declines in areas outside of Cook Inlet (Barrett-Lennard et al. 1995). An unsuccessful killer whale attack on a humpback whale was recorded in lower Cook Inlet in 2008 (Matkin 2011). The numbers of Steller sea lions and humpback whales are very low in Cook Inlet and any isolated predation event that may occur would not have a population level effect.

6.20 Vessel Strikes

Cook Inlet beluga whales are susceptible to vessel strike mortality. In an examination of 106 individuals, 37.7 percent had scars classified as either confirmed or from possible anthropogenic origin; 14 percent had signs of confirmed or possible vessel strike (McGuire et al. 2020).

Beluga whales may be more susceptible to strikes from commercial and recreational fishing vessels (as opposed to cargo ships, oil tankers, and barges) because both belugas and fishing activities occur where salmon and eulachon congregate. A number of beluga whales have been photographed with propeller scars (McGuire et al. 2014), suggesting that small vessel strikes are not rare, but such strikes are often survivable. Small boats are able to quickly approach and disturb these whales in their preferred shallow coastal habitat. Vessel strike and the resultant injury or death continue to be a threat to Cook Inlet beluga whales.

Although risk of vessel strike has not been identified as a significant concern for Steller sea lions, the recovery plan for this species states that Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated, e.g., near rookeries or haulouts (NMFS 2008b). In 2007, a Steller sea lion with two separate wounds consistent with blunt trauma that may have been from a vessel strike was found in Kachemak Bay (NMFS Alaska Regional Office Stranding Database accessed May 2023). A vessel strike of a Steller sea lion is highly unlikely to occur due to their maneuverability, very low numbers in upper Cook Inlet, and the slow vessel speeds in and around the POA.

From 1978-2011, there were at least 108 recorded whale-vessel collisions in Alaska, with the majority occurring in Southeast Alaska (Neilson et al. 2012b). Between 2013 and 2017, 29 humpback whales were struck, resulting in 11.92 mortalities or serious injuries in Alaska (Delean et al. 2020). Eighteen humpback whales were struck in Alaska, resulting in 9.66 mortalities or serious injuries between 2016 and 2020 (Freed et al. 2022). Among larger whales, humpback whales are the most frequent victims of ship strikes in Alaska, accounting for 86 percent of all reported collisions (Neilson et al. 2012b). There have been three documented large cetacean vessel collisions in Cook Inlet since 2001; one humpback whale, one fin whale, and one unidentified large cetacean. In 2001, a humpback whale was discovered on the bulbous bow of a 710-foot container ship as it docked in the POA; where the vessel may have collided with the whale is unknown. In 2005, a 28-foot charter boat hit an unidentified large cetacean (NMFS Alaska Regional Office Stranding Database accessed May 2023). In 2015, a dead fin whale was discovered at the POA on the bulbous bow of a ship traveling from Seattle; it is unknown where the strike occurred (NMFS Alaska Regional Office Stranding Database accessed May 2023). The very low number of humpback whales in upper Cook Inlet greatly reduces the probability of vessel strike in this area.

6.21 Research

Research often assists in the recovery of threatened and endangered species; however, research activities may also disturb, harm, or kill the studied animal. Marine mammal research often requires the use of boats, which adds to vessel traffic, sound, and pollution in the area. Boat-based surveys, such as photo-identification studies, often require the boat to closely approach whales or whale groups. Deployment and retrieval of passive acoustic monitoring devices requires a boat, which temporarily increases noise in the immediate area. However, once the instruments are deployed, passive acoustic monitoring is noninvasive. Aerial surveys may also disturb whales, especially when circling at low-altitudes to obtain accurate group counts.

Scientific research and enhancement permits that authorize take of ESA listed marine mammals are issued as joint permits under section 104 of the MMPA and section 10(a)(1)(A) of the ESA. From 2017 through 2021, 11 MMPA/ESA research and enhancement permits authorized take of Cook Inlet beluga whales. In 2019, the Office of Protected Resources completed a programmatic biological opinion, which analyzed research impacts on endangered cetaceans; proposed research efforts on endangered or threatened cetacean populations were thought unlikely to cause a change in abundance or reproduction (NMFS 2019a).

More invasive research activities include animal capture, collecting blood and tissue samples, and attaching tracking devices such as satellite tags. Between 1999 and 2002, NMFS placed satellite tags on 18 beluga whales in upper Cook Inlet (Hobbs et al. 2005). In 2002, a tagged beluga was found dead 32 hours after being tagged. Another two tagged beluga whales, with similar dive patterns and tagged in the same manner as the deceased whale, transmitted data for less than 48 hours; it is unknown if these whales also perished or were fitted with defective tags (NMFS, unpublished data).

The Cook Inlet beluga whale photo identification project, started in 2005, identified many of the tagged belugas; five of the 14 tagged whales in the photo-id catalog had visible signs of tag-site infection, eight had signs of concavity of the dorsal crest above the tag site, and two showed damage to the left pectoral fins, likely caused by flipper bands applied during tagging (McGuire and Stephens 2016). In 2015, a previously tagged whale washed up dead with a significant infection at the tag attachment site, potentially the cause of death. Another whale photographed with serious infection at the tag site has not been documented since 2007 (McGuire and Stephens 2016). The satellite tags provided data on the movement within Cook Inlet and dive behavior (Shelden et al. 2018); however, it is unlikely that this type of project will be repeated. Research will continue but will focus on minimally invasive research techniques.

It has been suggested that an increase in the authorized number of Cook Inlet beluga whale takes projected to occur through 2025 is statistically correlated with the decreasing population size (Migura and Bollini 2022). However, 99 percent of the total authorized take in any year are for non-invasive methods, such as photo-identification during vessel surveys. When permitted researchers approach animals closer than the NMFS wildlife viewing guideline distances,[30] it is counted as a "take" because those animals may be harassed by the activities. The potential impacts from these research methods are ephemeral harassment at worst. The programmatic biological opinion prepared for NMFS's cetacean research and enhancement permitting program

[30] https://www.fisheries.noaa.gov/topic/marine-life-viewing-guidelines/guidelines-&-distances Accessed May 2023.

(NMFS 2019a) mentioned above, determined that these methods (e.g., aerial and vessel surveys) are not likely to adversely affect any ESA-listed populations or species, including Cook Inlet beluga whales.

The number of authorized research takes is typically significantly larger than the number of actual takes that occur. For example, 22,090 takes were authorized for Cook Inlet beluga research occurring in 2019; 2,405 takes mostly by harassment occurred. Managers have simplified how take numbers in research permits are determined, in order to provide a more consistent approach to counting take across incidental and directed take permitting programs. NMFS Permits Division continues to closely analyze the number of takes requested and used by researchers each year.

In addition to research activities involving free-ranging Cook Inlet belugas, a single whale is housed in captivity. "Tyonek" live-stranded near Trading Bay as a young calf in 2017. The Alaska Sealife Center and partners provided rehabilitative care; however, the animal was determined to be non-releasable due to underlying medical problems. Pursuant to a scientific research and enhancement permit, which includes an educational component, Tyonek is permanently located at SeaWorld San Antonio, Texas. This is a unique incident, and there are no plans to house additional Cook Inlet beluga whales in captivity.

With the low occurrence of humpback whales and Steller sea lions in upper Cook Inlet, this area is not a high priority for research of these species. However, they may be indirectly affected or harassed by other non-invasive research projects, such as the Cook Inlet beluga aerial surveys. Aircraft may disturb Steller sea lions, especially if hauled out. Disturbance of a rookery or haulout has the potential to result in serious injury or death, predominantly from trampling. However, there are no rookeries or haulouts within Cook Inlet, and NMFS has no knowledge of any stampedes associated with research in the action area. Also, there have been no known instances of research-related deaths of humpbacks in the action area.

6.22 Climate and Environmental Change

The impacts of climate change are especially pronounced at high latitudes and in polar regions. Average temperatures have increased across Alaska at more than twice the rate of the rest of the United States.[31] In the past 60 years, average air temperatures across Alaska have increased by approximately 3°F, and winter temperatures have increased by 6°F (Chapin et al. 2014). Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014). Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton 2001; McCarthy et al. 2001). The impacts of these changes and their interactions on listed species in Alaska are hard to predict.

[31] https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-alaska_.html Accessed May 2023.

Indirect threats associated with climate change include increased human activity as a result of regional warming. Less ice could mean increased vessel activity or construction activities with an associated increase in sound, pollution, and risk of ship strike. Human fishing pressure could change the abundance, seasonality, or composition of prey species. Fisheries in Alaska are managed with the goal of sustainability; however, not all fish stocks are assessed, and it is unknown whether management of fisheries for optimal returns provides sufficient densities in feeding areas for efficient foraging by ESA-listed marine mammal species.

Cook Inlet beluga whales likely rely on the combined salmon escapement from multiple watersheds. Changes in prey availability to belugas may result from changes in the total availability, quality, species composition, and seasonality of prey. The greatest climate change risks may be potential changes in salmon and eulachon abundance. These changes could occur through regime shifts and changes in ocean ecosystems and/or through changes in these species' freshwater habitat. Temperature and hydrology control several critical stages in the life cycle of salmonids in their freshwater habitats. During periods of rapid climate change, these can have significant effects on anadromous salmonid populations (Bryant 2009).

Temperature is the most important abiotic factor influencing the physiology of fishes and the pathogenicity of their disease organisms (Brett 1971; Marcogliese 2001). Fish are particularly vulnerable to mortality during periods of increased water temperatures, and mortality may occur through several mechanisms, including increased virulence of pathogens, increases in metabolic rate that outstrip energy resources, and an oxygen demand that exceeds the heart's capacity to deliver oxygen (von Biela et al. 2020). Stream temperatures are closely related to air temperatures (Mohseni and Stefan 1999), and the annual surface air temperatures (north of 60° N) from October 2021-September 2022 were the sixth warmest dating back to 1900.[32] Surface air temperatures were 33°F warmer than the 1991-2020 mean, continuing the common, recent pattern where annual temperatures have both exceeded the 30-year Arctic mean and been warmer than the global mean.

In June and July 2019, air temperatures over much of Alaska and the southern Yukon Territory reached record highs[33] and salmon dying before they could spawn were recorded in the Yukon River (von Biela et al. 2020), the Koyukuk River (Westley 2020), the Igushik River (a tributary to Bristol Bay where it was estimated that a minimum of 100,000 salmon died),[34] and the Kuskokwim River.[35] The parasites *Ichthyophonus* (a protozoan) and *Henneguya* (a cnidarian), which cause tapioca disease were prevalent in the salmon from the Kuskokwim. Pre-spawning mortality has also been documented in several Pacific Northwest watersheds, including the Fraser River in British Columbia (Hinch et al. 2012; Martins et al. 2012) and streams in the

[32] https://arctic.noaa.gov/Report-Card/Report-Card-2022/ArtMID/8054/ArticleID/992/Surface-Air-Temperature Accessed May 2023.
[33] https://www.ncei.noaa.gov/news/national-climate-201912 Accessed May 2023.
[34] https://alaskapublic.org/2020/01/15/in-some-bristol-bay-rivers-the-hottest-month-on-record-was-deadly-for-salmon/ Accessed May 2023.
[35] https://www.kyuk.org/hunting-fishing/2019-07-12/record-warm-water-likely-gave-kuskokwim-salmon-heart-attacks Accessed May 2023.

Lake Washington Basin in Washington (Barnett et al. 2020). The warming conditions during migration and spawning, in concert with other factors such as infections with pathogens, were responsible for the increased pre-spawning mortality of adult sockeye salmon, and were high enough to threaten the viability of the population (Barnett et al. 2020).

Mauger et al. (2017) monitored temperatures in 48 non-glacial streams across the Cook Inlet basin during open-water periods from 2008 to 2012 and found that numerous watersheds exceeded maximum weekly maximum temperature (MWMT) threshold ranges for the protection of salmon life stages. MWMT at most sites exceeded the established criterion for spawning and incubation during every year of the study, which suggests salmon are experiencing thermal stress in the Cook Inlet region (Mauger et al. 2017). The Deshka River, an important tributary to the Susitna River, had MWMT temperatures above 64°F during four years of the study period and above 68°F for three years (Mauger et al. 2017). As stream temperatures increase in response to increasing air temperatures, critical thresholds will likely be exceeded more often, especially when warm air temperature anomalies occur.

Population modeling linked Cook Inlet beluga reproductive success with salmon abundance in the Deshka River (Norman et al. 2020). Simulations showed that if salmon runs remained at their current levels, the Cook Inlet beluga whale population would likely continue its current slow decline and per capita births would continue to be low. However, Cook Inlet beluga whales forage at several streams throughout the summer and likely rely on the combined escapement from multiple watersheds. The concept of food resources limiting a cetacean population is not new though, and reduced prey availability (Chinook salmon) has been directly linked to increased mortality and reduced health and survival of the Southern Resident killer whale population (Ward et al. 2009; Wasser et al. 2017).

In summary, the effects of climate change will likely impact Cook Inlet beluga whales, primarily through their primary prey species, salmon. Warmer ocean temperatures, warmer stream temperatures, and warmer air temperatures will likely lead to many challenges and changes to the freshwater and marine ecosystems that salmon depend on. Pre-spawning salmon mortalities, reductions in returns, and shifts in run timing have already been documented. It remains to be seen how adaptable both salmon and belugas can be in the face of rapidly changing conditions.

Cook Inlet beluga whale critical habitat may be affected by climate change and other large-scale environmental phenomena, including the Pacific Decadal Oscillation (PDO; a long-lived El Niño-like climate variability that may persist for decades) and ecological regime shifts. Climate change can potentially affect prey availability, glacial output and siltation, and salinity and acidity in downstream estuarine environments (NMFS 2010a; NMFS 2016b). PDO may influence rainfall, freshwater runoff, water temperature, and water column stability. Ecological regime shifts, in which species composition is restructured, have been identified in the North Pacific (Hollowed and Wooster 1992; Anderson and Piatt 1999; Hare and Mantua 2000) and are believed to have affected prey species availability in Cook Inlet and the North Pacific. These events may result in seasonal and spatial changes in prey abundance and distribution and could affect the conservation value of designated critical habitat for Cook Inlet beluga whales.

An Unusual Mortality Event (UME) of large cetaceans occurred in Alaska waters in 2015-2016. Reports of dead whales included 22 humpback, 12 fin, 2 gray, 1 sperm, and 6 unidentified whales. There was an unusually large number of dead whales found in British Columbia during this time as well. The strandings were concurrent with the arrival of the Pacific marine heatwave, one of the strongest El Nino weather patterns on record, decreasing ice extent in the Bering Sea, and one of the warmest years on record in Alaska in terms of air temperature.

Recent studies and observations have shown changes in distribution (Brower et al. 2018), body condition (Neilson and Gabriele 2020), and migratory patterns of humpback whales, likely in response to climate change. The indirect effects of climate change on humpback whales over time would likely include changes in the distribution of ocean temperatures suitable for many stages of their life history, the distribution and abundance of prey, and the distribution and abundance of competitors or predators.

The Pacific marine heatwave is also likely responsible for poor growth and survival of Pacific cod, an important prey species for Steller sea lions. The 2018 Pacific cod stock assessment estimated that the female spawning biomass of Pacific cod was at its lowest point in the 41-year time series considered. This assessment was conducted following three years of poor recruitment and increased natural mortality during the Gulf of Alaska marine heat wave from 2014 to 2016 (Barbeaux et al. 2018).

The Steller Sea Lion Recovery Plan ranks environmental variability as a potentially high threat to recovery of the Western DPS (NMFS 2008b). The Bering Sea and Gulf of Alaska are subjected to large-scale forcing mechanisms that can lead to basin-wide shifts in the marine ecosystem resulting in significant changes to physical and biological characteristics, including sea surface temperature, salinity, and sea ice extent and amount.

Physical forcing affects food availability and can change the structure of trophic relationships by impacting climate conditions that influence reproduction, survival, distribution, and predator-prey relationships at all trophic levels. Warmer waters could favor productivity of some species of forage fish, but the impact on recruitment of important prey fish of Steller sea lions is unpredictable. Recruitment of large year-classes of gadids (e.g., pollock) and herring has occurred more often in warm than cool years, but the distribution and recruitment of other fish (e.g., osmerids) could be negatively affected (NMFS 2008b). Populations of Steller sea lions in the Gulf of Alaska and Bering Sea have experienced large fluctuations due to environmental and anthropogenic forcing (Mueter et al. 2009).

7 EFFECTS OF THE ACTION

"Effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

This biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS aims to minimize the likelihood of false negative conclusions (i.e. concluding that adverse effects are not likely when such effects are, in fact, likely to occur).

We organize our effects analysis using a stressor identification – exposure – response – risk assessment framework for the proposed activities.

We conclude this section with an *Integration and Synthesis of Effects* that integrates information presented in the *Status of the Species* and *Environmental Baseline* sections of this opinion with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to endangered and threatened species.

NMFS identified and addressed all potential stressors and considered all consequences of the proposed action, individually and cumulatively, in developing the analysis and conclusions in this opinion regarding the effects of the proposed action on ESA-listed species.

7.1 **Project Stressors**

Stressors are any physical, chemical, or biological phenomena that can induce an adverse response. The effects section starts with identification of the stressors produced by the constituent parts of the proposed action. Based on our review of the data available, the POA CTR project may cause the following stressors:

- Acoustic disturbance from intertidal activities
- Vessel noise, presence, and strikes
- Sea floor disturbance and turbidity
- Effects on prey
- Trash and debris
- Pollutants and contaminants
- Acoustic disturbance from pile driving and removal

7.1.1 **Minor Stressors on ESA-Listed Species**

Based on a review of available information, we determined the following stressors are unlikely to cause impacts or result in exposure to listed species, and/or are likely to have minimal impacts on Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and Western DPS Steller sea lions.

7.1.1.1 Acoustic disturbance from intertidal activities

Some project activities will take place in the dry (i.e., in the area above HTL or intertidal areas that are dewatered due to low tide). These include welding, cutting, wiring, concrete work, and setting of a prefabricated gangway and ramp. No in-water noise is anticipated in association with these activities.

Pile cutting will take place at mudline, in the dry. Some pile installation and removal will also take place in the dry. These activities are not expected to produce elevated in-water sound pressure levels.

Dredge and fill activities will take place during the shoreline expansion and protection component (see Table 1). This will take place in the dry to the extent possible. Mitigation measures in Section 2.1.2 will be used for any in-water dredging that may occur.

7.1.1.2 Vessel Noise, Presence, and Strikes

As described in the proposed activities, the project will use a small number of tugs and barges during construction. Movement of project vessels will be localized within the vicinity of the POA, which is an industrialized area where vessels are always present otherwise. The proposed action is not expected to increase the number of vessels that transit to and from the POA.

Auditory or visual disturbance to listed species could occur during vessel activities associated with the project. A listed species could react to project activities by either investigating or being startled by vessels. Disturbance from vessels could temporarily increase stress levels or displace an animal from its habitat. Underwater noise from vessels may temporarily disturb or mask communication of marine mammals. Behavioral reactions from vessels can vary depending on the type and speed of the vessel, the spatial relationship between the animal and the vessel, the species, and the behavior of the animal prior to the disturbance from the vessel. Response also varies between individuals of the same species exposed to the same sound.

Behavioral responses of beluga whales to vessels include changing swimming direction, increasing swim speed, altering diving, surfacing, and breathing patterns, and changes in vocalizations (Wartzok et al. 2003). Past experiences with vessels, age, and activity during the vessel encounter appear to be important factors when considering the response of an animal (Wartzok et al. 2003, (McQuinn et al. 2011). Older animals respond more often than younger animals, and belugas respond less often when engaged in feeding or traveling than during other activities. However, when those whales did respond, the response was typically more pronounced (Fish and Vania 1971), (Stewart et al. 1982), (Blane and Jaakson 1994).

Belugas have been found to change their vocalization frequency and intensity in response to noise in their environment (Au et al. 1985a). Cetaceans, including belugas, have also been documented altering their calling rates and duration in noisy environments (Finley et al. 1990; Wright et al. 2007; Dunlop et al. 2014; Erbe et al. 2018). In the St. Lawrence River, vessel noise affected beluga vocalizations with changes observed in calling rates, repetition of calls, increase in call duration, and upward shift in frequency (Lesage et al. 1999; Scheifele et al. 2005). Vocal responses were more persistent when whales were exposed to noise from a ferry compared to a small motorboat (Lesage et al. 1999). Repetition of calls in high Arctic belugas has been reported to be an alarm response (Sjare and Smith 1986). Individual belugas photographed between 2005 and 2017, along with stranding records, were examined to determine prevalence of scars indicative of anthropogenic trauma (McGuire et al. 2020). Out of 78 whales examined, 14 percent had signs of confirmed or possible vessel strikes. Vessel strikes of belugas have also been documented in the St. Lawrence River Estuary (Lair et al. 2015). Smaller boats traveling at higher speeds with frequent changes in direction frequently present a greater threat than larger, slower vessels moving in straight lines.

There are only four records of stranded Steller sea lions with injuries indicative of vessel strike in Alaska; three occurred in Sitka and one in Kachemak Bay (NMFS Alaska Regional Office Stranding Database accessed June 2023). Steller sea lions are likely more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated, e.g., near rookeries or haulouts (NMFS 2008b). The risk of vessel strike, however, has not been identified as a significant concern for Steller sea lions. Steller sea lions are not concentrated in any locations near the POA.

From 1978-2011, there were 108 recorded whale-vessel collisions in Alaska, with the majority occurring in Southeast Alaska between May and September (Neilson et al. 2012b). Small recreational vessels traveling at speeds over 13 knots were most commonly involved in ship strike encounters; however, all types and sizes of vessels were reported. The majority of vessel strikes involved humpback whales (86 percent) and the number of humpback strikes increased annually by 5.8 percent from 1978 to 2011. There have been two reported ship strikes of unidentified large cetaceans in Kachemak Bay, lower Cook Inlet between 2000 and 2021 (NMFS Alaska Regional Office Stranding Database accessed June 2023). Humpback whales are rarely observed in the action area and the POA will implement a 91-m shutdown zone around moving vessels for ESA-listed species. This will minimize the risk of collision for humpbacks that may be present in the action area.

Vessel speed is a principal factor in whether a strike results in serious injury or death of a whale. (Laist et al. 2001) determined that most lethal or severe injuries involved ships traveling 14 kts or faster. Serious injuries were found to occur infrequently at vessel speeds below 14 kts, and rarely at speeds below 10 kts. (Vanderlaan and Taggart 2007) found the greatest rate of change in the probability of a lethal injury to a large whale occurs between vessel speeds of 8.6 and 15 kts, and the probability of a lethal injury drops below 50 percent at 11.8 kts.

A very small proportion of primary prey species for listed marine mammals may be temporarily disturbed due to vessel effects (e.g., boat wakes, spinning propellers), such as exhibiting a startled or flight response (Popper and Hawkins 2019). These forms of disturbance would be temporary, with a geographic extent much smaller than the project action area. The risk of vessels striking prey species exists, but vessels will be operating at slow enough speeds for the prey to avoid collisions.

The slow operational speeds of project vessels and the implementation of mitigation measures, including staying 91 m away from listed marine mammals, avoiding changing direction and speed as well as reducing speed within 274 m of whales, and reducing speed when visibility is reduced, limit the risk of strike from the proposed action. The low number of humpback whales and Steller sea lions in the action area (see Sec 6.2 Exposure Analysis) also greatly reduces the probability of a vessel strike occurring.

7.1.1.3 **Sea Floor Disturbance and Turbidity**

Pile driving, dredging and excavation activities have the potential to cause sea floor disturbance and turbidity.

Pile driving activity may temporarily increase turbidity. In general, turbidity associated with pile installation is localized to about a 7.6 m radius around the pile (Everitt et al. 1980), and the POA must comply with state water quality standards during these operations by limiting the extent of turbidity to the immediate project area. Shutdown mitigation measures are likely to prevent cetaceans from being close enough to experience effects of turbidity from pile driving, and pinnipeds could avoid localized areas of turbidity.

Areas that are above the high-water line or below the tide line in a dewatered state will be excavated from the landward side to remove deposited silts before the areas are then filled with more dense, stable materials such as clean granular fill and rock. The disposal of dredged material is expected to be intermittent, with a period of hours or days between barge disposal events, and disposal will not occur at night. Depending on the tides, turbidity levels from suspended sediments are expected to return to background levels in durations of 18 minutes to three hours.

Increases in turbidity will be temporary, localized, and difficult to detect in waters that have a very high concentration of suspended solids because of glacial runoff and extreme tidal exchange. Impacts on zooplankton, fish, and marine mammals are expected to be brief, intermittent, and minor, if impacts occur at all. Any effects to ESA-listed species from seafloor disturbance and increased turbidity levels would be immeasurably small.

7.1.1.4 **Effects on Prey**

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.

Construction activities will produce non-impulsive (i.e., vibratory pile driving) and impulsive (i.e., impact pile driving) sounds. Impulsive sounds at received levels of 160 dB may cause subtle changes in fish behavior. Sound Pressure Levels (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, and mortality of fish (Popper et al. 2014). Pile driving associated barotrauma (i.e., damage to internal tissues) of fish has been found to occur at sound pressure levels of 205-215 dB re: 1 μPa_{peak} in experimental studies (Casper et al. 2012; Halvorsen et al. 2012). However, there are very few experimental examples of sound being sufficiently loud to result in death or mortal injury to fishes (Popper and Hawkins 2019).

Injury to fish depends more on the magnitude of particle motion than on sound levels as mammals perceive it (Popper and Hawkins 2019). It is likely that fish will avoid sound sources within ranges that may be harmful (McCauley et al. 2003). The most likely impact to fish from pile driving activities at the project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving ceases is unknown, but a rapid return to normal recruitment, distribution, and behavior is expected.

In general, impacts to marine mammal prey species are expected to be minor and temporary, given the small area of pile driving relative to known feeding areas of listed marine mammals. We expect fish will be capable of moving away from project activities to avoid exposure to noise. 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. We expect the area in which stress, injury, TTS, or changes in balance of prey species may occur will be limited to a few meters directly around the pile driving operations. We consider potential adverse impacts to prey resources from construction activities in the action area to be immeasurably small.

Studies on euphausiids and copepods, two of the more abundant and biologically important groups of zooplankton, have documented some sensitivity of zooplankton to sound (Chu et al. 1996; Wiese 1996); however, any effects of pile driving activities on zooplankton would be expected to be restricted to the area within a few feet or meters of the project and would likely be sub-lethal. Any mortality or impacts on zooplankton as a result of construction operations is immaterial as compared to the naturally occurring reproductive and mortality rates of these species.

Given the short daily duration of sound associated with individual pile driving events, the relatively small areas being affected, the localized response of prey species, and the rapid return of any temporarily displaced species, pile driving activities are unlikely to have a permanent adverse effect on any prey habitat or prey species. Any impacts to marine mammal prey species are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations.

Based on the above information, prey species may respond to noise associated with the proposed action by avoiding the immediate area. However, the expected impact of project activities on marine mammal prey is very minor, and thus effects to Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and western DPS Steller sea lions will be immeasurably small.

7.1.1.5 **Trash and Debris**

The CTR project may generate trash composed of paper, plastic, wood, glass, and metal from construction activities. The possibility exists that trash and debris could be released into the marine environment. This type of trash and debris discharge can pose risks to marine mammals.

The POA intends to comply with all applicable regulations, so the amount of project-generated trash and debris is expected to be minimal or non-existent. Consistent with AS 46.06.080, trash will be disposed of in accordance with state law. The POA will ensure that all closed loops (e.g., packing straps, rings, bands, etc.) will be cut prior to disposal. In addition, the project proponent will secure all ropes, nets, and other marine mammal entanglement hazards so they cannot enter marine waters.

The expected impact of trash and debris resulting from the CTR project is very minor, and thus effects to ESA-listed species will be immeasurably small.

7.1.1.6 **Pollutants and Contaminants**

Marine mammals could be exposed to authorized discharges through project vessels. Discharges associated with some marine commercial vessels are covered under a national NPDES Vessel General Permit (VGP) for Discharges Incidental to the Normal Operation of Vessels.

Accidental spills could occur from a vessel leak or onboard spill. The size of the spill influences the number of individuals that will be exposed and the duration of that exposure. Contact through the skin, eyes, or inhalation and ingestion could result in temporary irritation or long-term endocrine or reproductive impacts, depending on the duration of exposure. The greatest threat to cetaceans is likely from inhalation of volatile toxic hydrocarbon fractions of fresh oil, which can damage the respiratory system (Hansen 1985; Neff 1990b), cause neurological disorders or liver damage (Geraci and St. Aubin 1990), have anesthetic effects (Neff 1990), and cause death (Geraci and St. Aubin 1990). However, toxic fumes from small spills are expected to rapidly dissipate into the atmosphere as fresh refined oil ages quickly, limiting the potential exposure of whales.

Cook Inlet beluga whales have lower contaminant loads than other populations of belugas (Becker et al. 2000). An increase in polycyclic aromatic hydrocarbons (PAHs) from an accidental spill could cause adverse effects on Cook Inlet belugas. High levels of PAHs have been considered as a factor in illness and mortality among beluga whales in the Saint Lawrence Estuary (Martineau et al. 1994; Martineau et al. 2002); however, no definitive causal relationship has been demonstrated. Maternal exposure to crude oil during pregnancy may negatively impact the birth weight of young, and ingestion can decrease nutrient absorption (St. Aubin 1988). Decreased food absorption could be especially problematic for very young animals, those feeding seasonally, and those needing to develop large amounts of fat for survival.

Based on the localized nature of small spills, the relatively rapid weathering and dispersion, and the safeguards in place to avoid and minimize spills, NMFS concludes that exposure of Cook Inlet beluga whales, humpback whales, Steller sea lions, or their prey to a small spill is extremely unlikely to occur. If exposure were to occur, NMFS does not expect detectable responses from listed marine mammals due to the ephemeral nature of small, refined spills.

7.1.2 Major Stressors on ESA-Listed Species

The following sections analyze the stressors likely to adversely affect ESA-listed species due to underwater anthropogenic sound. Construction activities will produce non-impulsive (i.e., vibratory pile driving) and impulsive (i.e., impact pile driving) sounds. First we provide a brief explanation of the sound measurements and acoustic thresholds used in the discussions of acoustic effects in this opinion.

7.1.2.1 Acoustic Thresholds

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater and in-air sounds that might result in impacts to marine mammals (70 FR 1871, 1872; January 11, 2005). NMFS has developed comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary thresholds shifts (PTS and TTS) (89 FR 84872; October 24, 2024, 83 FR 28824; June 21, 2018; 81 FR 51693; August 4, 2016). NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels,[36] expressed in root mean square[37] (rms), from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the MMPA (16 U.S.C 1362(18)(A)(ii)):

- impulsive sound: 160 dB_{rms} re 1 μPa
- non-impulsive sound: 120 dB_{rms} re 1μPa

Under the Underwater and In-Air Criteria for Onset of Auditory Injury (AUD INJ) and TTS Technical Guidance, NMFS uses the following thresholds (Table 11) for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (16 U.S.C 1362(18)(A)(i)) (NMFS 2024). Different thresholds and auditory weighting functions are provided for different marine mammal hearing groups, which are defined in the Technical Guidance (NMFS 2024). The generalized hearing range for each hearing group is in Table 12 .

These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (L_E) and peak sound level (PK) for impulsive sounds and L_E for non-impulsive sounds. Level A

[36] Sound pressure is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in acoustics is 1 μPa, and the units for underwater sound pressure levels are decibels (dB) re 1 μPa.
[37] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.

harassment radii can be calculated using the optional user spreadsheet[38] associated with NMFS Acoustic Guidance or through modeling.

NMFS considers received levels above those of the measured ambient noise Level B harassment of marine mammals incidental to continuous noise, including vibratory pile driving (non-impulsive sound). NMFS draws a distinction between ambient sound levels (natural sound levels in the absence of all anthropogenic sound) and background sound (sound levels that include routine anthropogenic sound), and does not consider background sounds, including routine anthropogenic sounds, in the calculation of the area affected by project sound.

Ambient noise levels within Knik Arm are above the 120-dB threshold. The most recent acoustic monitoring in the absence of pile driving at the POA was conducted in May 2016 during the PAMP Test Pile Program (TPP) at two locations: "Ambient-Dock" and "Ambient-Offshore" (Austin et al. 2016; Denes et al. 2016). The "Ambient-Offshore" measurements are the most applicable, as this location complies with a NMFS 2012 memo providing guidance on characterizing underwater background sound.[39] The median noise level collected at the "Ambient-Offshore" hydrophone was 122.2 dB, and we consider this value representative of the average ambient sound level (non-anthropogenic sound) at this location. The 122.2 dB isopleth will be used to define the threshold distance beyond which project-generated sound no longer causes Level B harassment of marine mammals. NMFS may adjust the 122.2 dB rms Level B harassment threshold for this location in the future, if warranted by additional data.

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]" (16 U.S.C. 1362(18)(A)).

While the ESA does not define "harass," NMFS issued guidance interpreting the term "harass" under the ESA as to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016).

Exposure to sound capable of causing Level A or Level B harassment under the MMPA often, but not always, constitutes "take" under the ESA. For the purposes of this consultation, we have determined construction activities that produce non-impulsive (i.e., vibratory pile driving) and impulsive (i.e., impact pile driving) underwater sounds have sound source levels capable of

[38] The Optional User Spreadsheet can be downloaded from the following website: http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.
[39] On January 31, 2012, NMFS Northwest Regional Office issued guidance to characterize underwater background sound (overall sound levels absent those from the proposed activity) in areas of proposed activities that have the potential to injure or disturb marine mammals. That guidance provides specific instructions for how to conduct the measurements. Included in this is spatial orientation of the hydrophones.

causing take under the MMPA and ESA.

As described below, we anticipate that exposures to listed marine mammals from noise associated with the proposed action may result in disturbance and potential injury. However, no mortalities or permanent impairment to hearing are anticipated.

Table 11. Acoustic Thresholds Identifying the Onset of Auditory Injury based on 2024 Technical Guidance (NMFS 2024a).

	AUD INJ Onset Criteria* (Received Level)	
Hearing Group	**Impulsive**	**Non-impulsive**
Low-Frequency (LF) Cetaceans	$L_{p,0\text{-pk,flat}}$: 222 dB $L_{E,p,\text{ LF,24h}}$: 183 dB	$L_{E,p,\text{ LF,24h}}$: 197 dB
High-Frequency (HF) Cetaceans	$L_{p,0\text{-pk,flat}}$: 230 dB $L_{E,p,\text{ HF,24h}}$: 193 dB	$L_{E,p,\text{ HF,24h}}$: 201 dB
Very High-Frequency (VHF) Cetaceans	$L_{p,0\text{-pk,flat}}$: 202 dB $L_{E,p,\text{VHF,24h}}$: 159 dB	$L_{E,p,\text{ VHF,24h}}$: 181 dB
Phocid Pinnipeds (PW)	$L_{p,0\text{-pk.flat}}$: 223 dB $L_{E,p,\text{PW,24h}}$: 183 dB	$L_{E,p,\text{PW,24h}}$: 195 dB
Otariid Pinnipeds (OW)	$L_{p,0\text{-pk,flat}}$: 230 dB $L_{E,p,\text{OW,24h}}$: 185 dB	$L_{E,p,\text{OW,24h}}$: 199 dB

*Dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating AUDINJ onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds are recommended for consideration.

Note: Peak sound pressure level (Lp,0-pk) has a reference value of 1 µPa, and weighted cumulative sound exposure level (LE,p) has a reference value of 1µPa2s. In this Table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 165 kHz). The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, HF, and VHF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The weighted cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle).

Table 12. Underwater marine mammal hearing groups (NMFS 2024a).

Hearing Group^	**ESA-listed Marine Mammals in the Project Area**	**Generalized Hearing Range***
Low-frequency (LF) cetaceans *(Baleen whales)*	Humpback whales	7 Hz to 36+ kHz
High-frequency (HF) cetaceans *(dolphins, toothed whales, beaked whales)*	Beluga whales	150 Hz to 160 kHz
Very High-frequency (VHF) cetaceans *(true porpoises)*	none	200 Hz to 165 kHz
Phocid pinnipeds (PW) *(true seals)*	none	40 Hz to 90 kHz
Otariid pinnipeds (OW) *(sea lions and fur seals)*	Steller sea lion	60 Hz to 68 kHz

^ (Southall et al. 2019) indicates that as more data become available there may be separate hearing group designations for Very Low-Frequency cetaceans (blue, fin, right, and bowhead whales) and Mid-Frequency cetaceans (sperm, killer, and beaked whales). However, at this point, all baleen whales are part of the LF cetacean hearing group, and sperm, killer, and beaked whales are part of the HF cetacean hearing group. Additionally, recent data indicate that as more data become available for Monachinae seals, separate hearing group designations maybe appropriate for the two phocid subfamilies (Ruscher et al. 2021; Sills et al. 2021)

* Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges may not be as broad. Generalized hearing range chosen based on ~65 dB threshold from composite audiogram, previous analysis in NMFS 2018, and/or data from Southall et al. 2007; Southall et al. 2019. Additionally, animals can detect very loud sounds above and below that generalized hearing range.

+ NMFS is aware that the National Marine Mammal Foundation successfully collected preliminary hearing data on two minke whales during their third field season (2023) in Norway. These data have implications for not only the generalized hearing range for low-frequency cetaceans but also on their weighting function. However, at this time, no official results have been published. Furthermore, a fourth field season (2024) is proposed, where more data will likely be collected. Thus, it is premature for us to propose any changes to our current Updated Technical Guidance. However, mysticete hearing data is identified as a special circumstance that could merit re-evaluating the acoustic criteria in this document. Therefore, we anticipate that once the data from both field seasons are published, it will likely necessitate updating this document (i.e., likely after the data gathered in the summer 2024 field season and associated analysis are published).

In addition, NMFS uses the following thresholds for in-air sound pressure levels from broadband sounds that cause Level B behavioral disturbance under section 3(18)(A)(ii) of the MMPA (16 U.S.C. § 1362(18)(A)(ii)):

- 100 dB_{rms} re 20μPa for non-harbor seal pinnipeds.

For construction Year 6, impact installation of 144-inch monopiles will produce the highest in-air sound levels. Because no data could be found on in-air noise estimates from impact installation of 144-inch piles, a proxy sound source based on 96-inch steel piles from the San Francisco-Oakland Bay Bridge East Space Project (Illingworth & Rodkin and Denise Duffy and Associates 2001) was used. In-air noise levels ranging from 90 to 105 dBA were measured at a distance of 100 meters (328 ft) during impact installation of 96-inch piles. Based on the 50% increase in diameter between 96- and 144-inch piles, it is estimated that in-air sound source levels for 144-inch piles would be 2 dB above what was measured for 96-inch piles. Therefore, it is assumed that 107 dBA would be the highest anticipated in-air sound source level for the CTR.

7.2 Exposure Analysis

As discussed in the APPROACH TO THE ASSESSMENT section of this opinion, exposure analyses are designed to identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence. In this step of our analysis, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent.

As discussed in Section 2.1.2 above, the POA proposed mitigation measures that should avoid or minimize exposure of Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and Western DPS Steller sea lions to one or more stressors from the proposed action.

NMFS expects that Cook Inlet beluga whales, humpback whales, and Steller sea lions will be exposed to underwater noise from pile driving activities (including vibratory pile driving and impact pile driving).

7.2.1 Ensonified Area

This section describes the operational and environmental parameters of each construction activity that allow NMFS to estimate the area ensonified above the acoustic behavioral thresholds, based on the construction activity occurring, as proposed by the POA.

The sound field in the action area is the existing background noise plus additional construction noise from the proposed project. Marine mammals may be affected via sound generated by the primary components of the project (i.e., vibratory pile driving and impact pile driving). NMFS used acoustic monitoring data from previous POA projects and other locations to develop the proxy source levels used to calculate distances to the Level A and Level B thresholds for different sizes of piles and installation/removal methods. The values used and the source from which they were derived are summarized below and in Tables 12-14.

7.2.1.1 Vibratory Driving

The proposed sound levels for vibratory removal are based on an analysis done for the POA's NES1 IHA (89 FR 2832, January 16, 2024) and are partially based on sound source verification data measured at the POA during the PCT project (Reyff et al. 2020).

The TPP found that for vibratory installation of 48-in piles, an air bubble curtain provided about a 9-dB reduction at 10 meters. An 8-dB reduction at close-in positions was estimated for vibratory pile driving that occurred during the PCT project in 2021 (Reyff et al. 2020). The PCT 2020 measurements indicated 2 to 8 dB reduction for the 48-in piles at 10 meters, but no apparent broadband reduction was found in the far-field at about 2,800 meters (Reyff et al. 2020). Far-field sound levels were characterized by very low frequency sound at or below 100 Hz, causing broadband measurements to remain above the ambient RMS level at approximately 2.8km from the source. However, levels at frequencies above 100 Hz were effectively reduced by the bubble curtain system. Because CIBW are most sensitive to frequencies over 100 Hz, NMFS considers the use of bubble curtains during vibratory driving to be an effective and important mitigation measure for CIBW.

Based on the measurements conducted at POA, for vibratory driving during the CTR Project, it is assumed that a well-designed and robust bubble curtain system will achieve a mean reduction of 7 dB at the source and will also reduce sound levels at frequencies over 100 Hz at longer ranges. The POA proposes to use a bubble curtain when water depth is greater than 3 meters during vibratory installation of all permanent (72-in and 144-in) piles during all months of construction. The POA may, at its discretion, employ bubble curtains during vibratory driving of temporary piles to reduce the size of the required shutdown zones.

7.2.1.2 Impact Driving

Impact driving of temporary piles (24-in and 36-in piles) is not currently proposed; however, in the unlikely event that vibratory driving is insufficient to stabilize a temporary pile, impact driving may be necessary. Sound source verification studies at the POA during the PCT project did not measure unattenuated impact driving of 24-in or 36-in piles; therefore, proxy sound levels from (U.S. Navy 2015) are proposed.

The TPP measured reductions of 9 to 12 dB for a 48-in pile installed with an impact hammer using a confined air bubble curtain. The PCT 2020 measurements (Reyff et al. 2020) found reductions of about 10 dB when comparing the attenuated conditions that occurred with that project to unattenuated conditions for the TPP. The TPP did not report the reduction in sound levels in the acoustic far field; however, the computed distances to 125 dB RMS isopleths were essentially reduced by half with the bubble curtain (from 1,291 to 698 meters).

During impact pile installation for the CTR Project, a well-designed and robust bubble curtain system will achieve a mean reduction of 7 dB from the source. The POA will use a bubble curtain system on all permanent piles in all months, which will be installed with both vibratory and impact hammers. The bubble curtain by necessity will be installed around each permanent pile as it is moved into position, and therefore, the bubble curtain will be available as a mitigation measure to reduce sound levels throughout each driving event for permanent 72-in and 144-in piles when water depth is greater than 3 meters. To account for piles driven in water less than 3m deep, NMFS Permits Division has estimated approximately half an unattenuated 72-in pile will be driven (approximately 43 minutes of impact driving and 5 minutes of vibratory driving) each month.

7.2.1.3 Calculations

NMFS developed a spreadsheet tool[40] to help implement the 2024 Technical Guidance (NMFS 2024a) that incorporates the duration of an activity into the estimation of a distance to the Level A isopleth. This estimation can then be used in conjunction with marine mammal density or occurrence to help predict exposures. NMFS notes that because of some of the assumptions included in the methods used for these tools, the isopleths estimated may be overestimates, and the resulting estimate of Level A harassment almost certainly overestimates the number of marine mammals that actually experience PTS if they should cross the Level A isopleth for fairly brief amounts of time. However, these tools offer the best available way to conservatively predict appropriate isopleths until more sophisticated modeling methods are widely available. NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For stationary sources such as vibratory and impact pile driving, the NMFS User Spreadsheet predicts the distance at which a marine mammal would incur PTS if it remained at that distance for the duration of the activity.

Inputs used in the User Spreadsheet are shown in Tables 12, 13, and 14, and the resulting Level A isopleths are shown in Table 15. Level A harassment thresholds for impulsive sound sources are defined for both cumulative sound exposure levels (SELcum) and peak sound pressure level (SPLPK), with the threshold that results in the largest modeled isopleth for each marine mammal hearing group used to establish the Level A harassment isopleth.

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. 2012). Based on the available science and the practical need to use a threshold 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 when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa rms for non-impulsive sources (e.g., vibratory pile-driving) and above 160 dB re 1 μPa rms for non-explosive impulsive (e.g., impact pile-driving) or intermittent sources. The POA's proposed construction activity for the CTR project includes the use of non-impulsive and impulsive sources, and therefore the 122.2 (average ambient sound level measured at the POA; see Section 6.1.2.1) and 160 dB re 1 μPa rms thresholds for behavioral harassment are applicable for this project.

[40] NMFS User Spreadsheet Tool, version 2.2 (updated December 2020), available at https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance, accessed June 2023.

Table 13. NMFS User Spreadsheet Inputs for 72-in Permanent Piles.

	Impact Pile Driving		Vibratory Pile Driving	
	Attenuated	Unattenuated[1]	Attenuated	Unattenuated[1]
Spreadsheet Tab Used	E.1) Impact pile driving		A.1) Non-Impul, Stat, Cont.	
Source Level	184 dB SEL	191 dB SEL	164 dB RMS	171 dB RMS
Transmission Loss Coefficient	15	15	15	16.5
Weighting Factor Adjustment (kHz)	2		2.5	
Time to install single pile (minutes)	--		10	
Number of strikes per pile	5,743		--	
Piles per day	1 - 3	1	3	
Distance of sound pressure level measurement (m)	10			

[1]To account for piles driven in water less than 3m deep, NMFS has estimated approximately 0.5 unattenuated 72-in piles will be driven (approximately 43 minutes of impact driving and 5 minutes of vibratory driving) each month.

Table 14. NMFS User Spreadsheet Inputs for 144-in Permanent Piles.

	Impact Pile Driving		Vibratory Pile Driving	
	Attenuated	Unattenuated	Attenuated	Unattenuated
Spreadsheet Tab Used	E.1) Impact pile driving		A.1) Non-Impul, Stat, Cont.	
Source Level	193 dB SEL	198 dB SEL	153 dB RMS	160 dB RMS
Transmission Loss Coefficient	15	15	15	15
Weighting Factor Adjustment (kHz)	2		2.5	
Time to install single pile (minutes)	120		15	
Number of strikes per pile	5,000		--	
Piles per day	0.5	0.5	0.5	
Distance of sound pressure level measurement (m)	10			

Table 15. NMFS User Spreadsheet Inputs for Temporary (24- or 36-in) Piles.

Vibratory Pile Driving								
	24-in (61-cm) steel pipe				36-in (91-cm) steel pipe			
	Installation		Removal		Installation		Removal	
	Atten.	Unatten.	Atten.	Unatten.	Atten.	Unatten.	Atten.	Unatten.
Spreadsheet Tab Used	A.1) Non-Impul, Stat, Cont.							
Source Level (dB RMS)	158.5	161	157	169	160.5	166	154	159
Transmission Loss Coefficient	15	16.5	15	16.5	15	16.5	15	16.5
Weighting Factor Adjustment (kHz)	2.5							
Time to install or remove single pile (minutes)	30		45		30		45	
Number of strikes per pile	--							
Piles per day	4							
Distance of sound pressure level measurement (m)	10							

Impact Pile Driving				
	24-in (61-cm) steel pipe		36-in (91-cm) steel pipe	
	Attenuated	Unattenuated	Attenuated	Unattenuated
Spreadsheet Tab Used	E.1) Impact pile driving			
Source Level (dB RMS)	174 dB SEL	181 dB SEL	177 dB SEL	184 dB SEL
Transmission Loss Coefficient	15			
Weighting Factor Adjustment (kHz)	2			
Time to install or remove single pile (minutes)	-			
Number of strikes per pile	1,000			
Piles per day	1			
Distance of sound pressure level measurement (m)	10			

Table 16. NMFS User Spreadsheet Inputs for Concurrent Vibratory Driving

	24- or 36-in AND 24-in or 36-in			24- or 36-in AND 72-in	
	Attenuated / Attenuated	Attenuated / Unattenuated	Unattenuated / Unattenuated	Attenuated / Attenuated	Unattenuated / Attenuated
Spreadsheet Tab Used	A.1) Non-Impul, Stat, Cont.				
Source Level (dB RMS)	163.5	170	172	166	170
Transmission Loss Coefficient	15	15.75	16.5	15	15.75
Weighting Factor Adjustment (kHz)	2.5				
Time to install or remove a single pile (minutes)	45				
Number of strikes per pile	--				
Piles per day	8			7	
Distance of sound pressure level measurement (m)	10				

Table 17. Calculated Distance of Level A (based on NMFS's Proposed 2024 Updated Technical Guidance) and Level B Harassment Isopleths by Pile Type and Pile Driving Method

Activity	Pile Type / Size	Attenuated or Unattenuated	Level A harassment distance (m)			Level B harassment distance (m) all hearing groups
			Humpback whales	CIBWs	Steller sea lions	
Impact	24-in (61-cm)	Unattenuated	732	94	243	1,585
		Attenuated	250	32	83	541
	36-in (91-cm)	Unattenuated	1,160	148	385	1,585
		Attenuated	397	51	132	541
	72-in (182-cm)	Unattenuated	10,896	1,390	3,608	7,356
		Attenuated (1 pile per day)	3,720	474.7	1,232	2,512
		Attenuated (2 piles per day)	5,906	753.5	1,956	
		Attenuated (3 piles per day)	7,739	987.4	2,563	
	144-in (366-cm)	Unattenuated (1 pile per day)	29,094	3,712.1	9,634.3	3,415
		Attenuated (1 pile per day)	13,504.2	1,723	4,471.8	1,585
Vibratory Installation	24-in (61-cm)	Unattenuated	14.1	5.9	6.6	2,247
		Attenuated	10	3.8	4.3	2,630
	36-in (91-cm)	Unattenuated	28.4	11.9	13.3	4,514
		Attenuated	13.6	5.2	5.9	3,575
	72-in (182-cm)	Unattenuated	24.6	10.3	11.5	9,069
		Attenuated	9.2	3.5	4	6,119
	144-in (366-cm)	Unattenuated	197	201	199	2,656
		Attenuated	197	201	199	1,585

Activity	Pile Type / Size	Attenuated or Unattenuated	Level A harassment distance (m)			Level B harassment distance (m) all hearing groups
			Humpback whales	CIBWs	Steller sea lions	
Vibratory Removal	24-in (61-cm)	Unattenuated	55.2	23.1	25.8	6,861
		Attenuated	10.4	4	4.5	2,583
	36-in (91-cm)	Unattenuated	13.7	5.7	6.4	1,699
		Attenuated	6.6	2.5	2.8	1,318
Concurrent Vibratory / Vibratory	36-in AND 36-in	Attenuated / Attenuated	44.7	17.2	19.4	5,667
		Attenuated / Unattenuated	107.6	43.3	48.5	9,363
		Unattenuated / Unattenuated	127.7	53.5	59.7	9,069
	36-in AND 72-in	Attenuated / Attenuated	60	23.1	26	8,318
		Unattenuated / Attenuated	98.9	39.8	44.6	9,363
Concurrent Vibratory / Impact	36-in AND 72-in	Attenuated / Attenuated (1 pile per day)	3,720	474.7	1,232	3,575
		Attenuated / Attenuated (2 piles per day)	5,906	753.5	1,956	
		Attenuated / Attenuated (3 piles per day)	7,739	987.4	2,563	
		Unattenuated / Attenuated (1 pile per day)	3,720	474.7	1,232	4,514
		Unattenuated / Attenuated (2 piles per day)	5,906	753.5	1,956	
		Unattenuated / Attenuated (3 piles per day)	7,739	987.4	2,563	

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 * Log10 (R1/R2), where
TL = transmission loss in dB
B = transmission loss coefficient
R1 = the distance of the modeled SPL from the driven pile
R2 = the distance from the driven pile of the initial measurement

The POA proposed the default practical spreading value of 15, recommended for most nearshore environments, for impact pile driving (both attenuated and unattenuated) and attenuated vibratory installation. This value results in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions.

The *TL* coefficient that the POA proposed for unattenuated vibratory installation and removal of piles is 16.5 (*i.e.*, *TL* = 16.5*Log_{10}(range)). This value is an average of measurements obtained from two 48-in (122-cm) piles installed via an unattenuated vibratory hammer in 2016 (Austin et al. 2016). To assess the appropriateness of this *TL* coefficient to be used for the proposed project, NMFS Permits Division examined and analyzed additional *TL* measurements recorded at the POA. This includes a *TL* coefficient of 22 (deep hydrophone measurement) from the 2004 unattenuated vibratory installation of one 36-in (91-cm) pile at Port MacKenzie, across Knik Arm from the POA (Blackwell and Greene 2003), as well as *TL* coefficients ranging from 10.3 to 18.2 from the unattenuated vibratory removal of 24-in (61 cm) and 36-in (91-cm) piles and the unattenuated vibratory installation of one 48-in (122-cm) pile at the POA in 2021 (CH2M Inc. 2021). To account for statistical interdependence due to temporal correlations and equipment issues across projects, values were averaged first within each individual project, and then across projects. The mean and median value of the measured *TL* coefficients for unattenuated vibratory piles in Knik Arm by project are equal to 18.9 and 16.5, respectively. NMFS Permits Division therefore used the project median *TL* coefficient of 16.5 during unattenuated vibratory installation and removal of all piles[41] during the CTR project. This value is representative of all unattenuated vibratory measurements in the Knik Arm, *i.e.*, including data from POA and Port MacKenzie. Further, 16.5 is the mean of the 2016 measurements, which were made closer to the CTR proposed project area than other measurements and were composed of measurements from multiple directions (both north and south/southwest).

In certain scenarios, the POA may perform concurrent vibratory driving of two piles. The POA proposed, and NMFS concurs, that in the event that both piles are unattenuated, the *TL* coefficient will be 16.5; if both piles are attenuated, the *TL* coefficient will be 15. In the event that one pile is attenuated and one is unattenuated, the POA proposed a *TL* coefficient of 15.75 to be used in the acoustic modeling. NMFS Permits Division evaluated the contributions of one

[41] This TL is for all piles except 144 in, which use a TL of 15

attenuated and one unattenuated vibratory-driven pile to the sound field (assuming a 7-dB reduction in source level due to the bubble curtain for the attenuated source), and determined that the unattenuated source would likely dominate the received sound field. Therefore, the POA's proposed *TL* coefficient is conservative, and NMFS concurs with this value.

7.2.2 **Marine Mammal Occurrence in the Action Area**

Available information regarding marine mammal occurrence and abundance in the vicinity of the POA includes monitoring data from the PCT and SFD projects. These programs produced a unique and comprehensive data set of marine mammal sightings and for CIBWs, locations and movements near the POA (61N Environmental, 2021, 2022a, 2022b; (Easley-Appleyard and Leonard 2022). This is the most current data set available for Knik Arm. During the PCT and SFD projects, the POA's marine mammal monitoring programs included 11 PSOs working from four elevated, specially designed monitoring stations located along a 9-km stretch of coastline surrounding the POA. The number of days data was collected varied among years and projects, with 128 days during PCT Phase 1 in 2020, 74 days during PCT Phase 2 in 2021, and 13 days during SFD in 2022 (see table 6-15 in the POA's application for additional information regarding CIBW monitoring data). PSOs during these projects used 25-power "big-eye" and hand-held binoculars to detect and identify marine mammals and theodolites to track movements of CIBW groups over time and collect location data while they remained in view.

These POA monitoring programs were supplemented in 2021 with a NMFS-funded visual marine mammal monitoring project that collected data during non-pile driving days during PCT Phase 2 (Easley-Appleyard and Leonard 2022). NMFS replicated the POA monitoring efforts, as feasible, including use of two of the POA's monitoring platforms, equipment (Big Eye binoculars, theodolite, 7x50 reticle binoculars), data collection software, monitoring and data collection protocol, and observers; however, the NMFS-funded program utilized only four PSOs and two observation stations along with shorter (4- to 8-hour) observation periods compared to PCT or SFD data collection, which included 11 PSOs, four observation stations, and most observation days lasting close to 10 hours. Despite the differences in effort, the NMFS dataset fills in gaps during the 2021 season and is thus valuable in this analysis. NMFS's PSOs monitored for 231.6 hours on 47 non-consecutive days in July, August, September, and October.

Density data are not available for any of the relevant species in this area; therefore, we have used reasonable yearly, monthly, or hourly occurrence estimates based on the previous POA monitoring datasets for all species.

7.2.2.1 **Cook Inlet Beluga Whale**

CIBWs are regular and frequent visitors to Knik Arm, sometimes passing by the POA multiple times a day, as documented by the previous PAMP monitoring projects (61 North Environmental 2021; 61 North Environmental 2022d; 61 North Environmental 2022b; 61 North Environmental 2025b). Distances from CIBW sightings to the CTR project site from the POA and NMFS-funded monitoring programs ranged from less than 10 m up to nearly 15 km. The robust marine mammal monitoring programs in place at the POA from 2020 through 2022 located, identified, and tracked CIBWs at greater distances from the proposed project site than previous monitoring programs and has contributed to a better understanding of CIBW movements in upper Cook Inlet (Easley-Appleyard and Leonard 2022).

For the NES1 project, NMFS and the POA collaboratively developed a new sighting rate methodology that incorporates a spatial component for CIBW observations, which allows for more accurate estimation of potential take of CIBWs (89 FR 2832, January 16, 2024). We have used this same methodology in the analysis of estimated CIBW incidental take during the CTR project. A detailed description of the differences from the sighting-rate methods used in the PCT and SFD projects can be found in the notice of proposed IHA for the NES1 project (88 FR 76576, November 6, 2023).

During the POA's and NMFS's marine mammal monitoring programs for the PCT and SFD projects (Table 18), PSOs had an increased ability to detect, identify, and track CIBW groups at greater distances from the project work site when compared with previous years because of the POA's expanded monitoring program as described above. This meant that observations of CIBWs in the 2020-2022 dataset (Table 18) include sightings of individuals at distances far outside some of the ensonified areas estimated for the CTR project and at ranges close to the extent of the larger ensonified areas (Tables 15 and 16). Therefore, it would not be appropriate to group all CIBW observations from these datasets into a single sighting rate as was done for the PCT and SFD projects. Rather, we propose that CIBW observations should be considered in relation to their distance to the CTR project site when determining appropriate sighting rates to use when estimating take for this project. This will help to ensure that the sighting rates used to estimate take are representative of likely CIBW presence in the proposed ensonified areas.

Table 18. Marine Mammal Monitoring Data Used for CIBW Sighting Rate Calculations

Year	Monitoring Type and Data Source	Number of CIBW group fixes[1]	Number of CIBW groups	Number of CIBWs
2020	PCT: POA Construction Monitoring 61N Environmental, 2021	2,653	245	987
2021	PCT: NMFS Monitoring Easley-Appleyard and Leonard, 2022	694	109	575
2021	PCT: POA Construction Monitoring 61N Environmental, 2021, 2022a	1,339	132	517
2022	SFD: POA Construction Monitoring 61N Environmental, 2022b	151	9	41
[1]Group fix = sighting locations for CIBW.				

To incorporate a spatial component into the sighting rate methodology, the POA calculated each CIBW group's closest point of approach (CPOA) relative to the CTR proposed project site. The 2020-2022 marine mammal monitoring programs (Table 18) enabled the collection, in many cases, of multiple locations of CIBW groups as they transited through Knik Arm, which allowed for track lines to be interpolated for many groups. The POA used these track lines, or single recorded locations in instances where only one sighting location was available, to calculate each group's CPOA. CPOAs were calculated in ArcGIS software using the Geographic Positioning System (GPS) coordinates provided for documented sightings of each group (for details on data collection methods, see 61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022) and the CTR location midpoint, centered on the proposed project site. A CIBW group was defined as a sighting of one or more CIBWs as determined during data collection. The most distant CPOA location to CTR was 11,138 m and the closest CPOA location was six meters.

The cumulative density distribution of CPOA values represents the percentage of CIBW observations that were within various distances to the CTR project site (Figure 19). This distribution shows how CIBW observations differed with distances to the CTR site and was used to infer appropriate distances within which to estimate spatially-derived CIBW sighting rates (Figure 19). The POA implemented a piecewise regression model that detected breakpoints (*i.e.*, points within the CPOA data at which statistical properties of the sequence of observational distances changed) in the cumulative density distribution of the CPOA locations, which they proposed to represent spatially-based sighting rate bins for use in calculating CIBW sighting rates. The POA used the "Segmented" package (Muggeo, 2020) in the R Statistical Software Package (R Core Team, 2022) to determine statistically significant breakpoints in the linear distances of the CIBW data using this regression method (see section 6.5.5.3 of the POA's application for more details regarding this statistical analysis). This analysis identified breakpoints in the CPOA locations at 281, 2,213, 3,149, and 6,639 m (Figure 19).

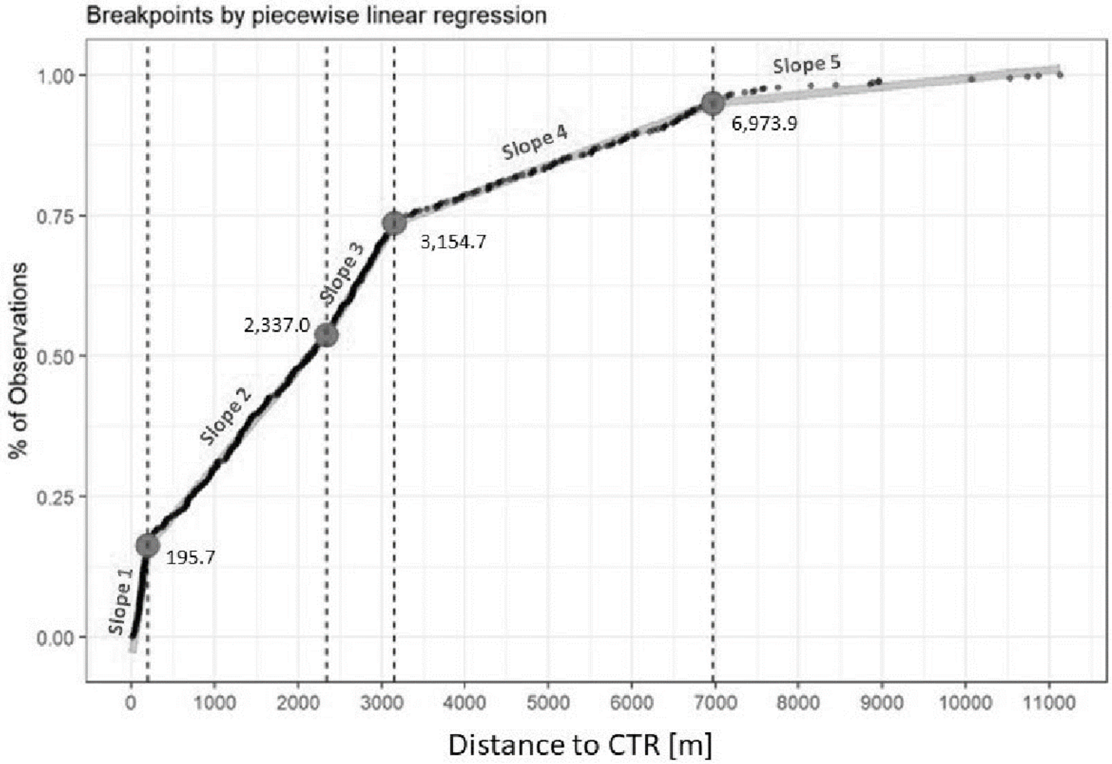

Figure 19. Percent of CIBW CPOA Observations in Relation to Distance from the CTR Project Site and Associated Breakpoints Determined by Piecewise Linear Regression

Piecewise regression is a common tool for modeling ecological thresholds (Lopez et al. 2020) (Whitehead 2016) (Atwood et al. 2016). In a similar scenario to the one outlined above, (Mayette et al. 2022) used piecewise regression methods to model the distances between two individual CIBWs in a group in a nearshore and a far shore environment. For the POA's analysis, the breakpoints (*i.e.*, 281, 2,213, 3,149, and 6,639 m) detect a change in the frequency of CIBW groups sighted and the slope of the line between two points indicates the magnitude of change. A greater positive slope indicates a greater accumulation of sightings over the linear distance (x-axis) between the defining breakpoints, whereas a more level slope (*i.e.*, closer to zero) indicates a lower accumulation of sightings over that linear distance (x-axis) between those defining breakpoints (figure 4; see table 6-16 in the POA's application for the slope estimates for the empirical cumulative distribution function).

The breakpoints identified by the piecewise regression analysis are in agreement with what is known about CIBW behavior in Knik Arm based on recent monitoring efforts (61 North Environmental 2021; 61 North Environmental 2022d; 61 North Environmental 2022b; 61 North Environmental 2025b) (Easley-Appleyard and Leonard 2022). Observation location data collected during POA monitoring programs indicate that CIBWs were consistently found in higher numbers in the nearshore areas, along both shorelines, and were found in lower numbers in the center of the Arm. Track lines of CIBW group movements collected from 2020 to 2022 and 2024 show that CIBWs displayed a variety of movement patterns that included swimming close to shore past the POA on the east side of Knik Arm (defined by breakpoint 1 at 281m), with fewer CIBWs swimming in the center of Knik Arm (breakpoints 1 to 2, at 281 to 2,213 m). CIBWs commonly swam past the POA close to shore on the west side of Knik Arm, with no CIBWs able to swim farther from the POA in that area than the far shore (breakpoints 2 to 3, at 2,213 to 3,149m). Behaviors and locations beyond breakpoint 4 (6,639 m) include swimming past the mouth of Knik Arm between the Susitna River area and Turnagain Arm; milling at the mouth of Knik Arm but not entering the Arm; and milling to the northwest of the POA without exiting Knik Arm. The shallowness of slope 5, at distances greater than 6,639 m, could be due to detection falloff from a proximity (distance) bias, which would occur when PSOs are less likely to detect CIBW groups that are farther away than groups that are closer.

The POA, in collaboration with NMFS, used the distances detected by the breakpoint analysis to define five sighting rate distance bins for CIBWs in the NES1 project area. Each breakpoint (281, 2,213, 3,149, and 6,639 m, and the complete data set of observations [> 6,639m]) was rounded up to the nearest meter and considered the outermost limit of each sighting rate bin, resulting in five identified bins (Table 19). All CIBW observations less than each bin's breakpoint distance were used to calculated that bin's respective monthly sighting rates (*e.g.*, all sightings from 0 to 281m are included in the sighting rates calculated for bin number 1, all sightings from 0 to 2,213m are included in the sighting rates calculated for bin number 2, and so on). For the CTR project, we use the same five sighting rate distance bins for CIBWs in the CTR project area. CTR construction is anticipated to take place in the months of April through November over the 5-year timeframe of the proposed rulemaking; therefore, monthly sighting rates were only derived for these months (Table 19).

Table 19. CIBW Monthly Sighting Rates for Different Spatially-Based Bin Sizes

		CIBW/Hour[1]							
Bin Number	Distance (m)	April	May	June	July	August	September	October	November
1	281	0.05	0.04	0.14	0.03	0.97	0.39	0.53	0.02
2	2213	0.32	0.16	0.36	0.11	1.97	1.35	1.18	0.65
3	3149	0.36	0.22	0.47	0.13	2.62	2.01	1.97	0.72
4	6639	0.64	0.31	0.57	0.16	2.88	2.30	2.35	0.73
5	>6639	0.71	0.39	0.58	0.16	2.94	2.35	2.48	0.73

[1] Observation hours have been totaled from the PCT 2020 and 2021 programs, the NMFS 2021 data collection effort, and the SFD 2022 program (61N Environmental 2021, 2022a, 2022b; 2025; Easley-Appleyard and Leonard, 2022).

7.2.2.2 Mexico and WNP DPS Humpback Whale

Sightings of humpback whales in the action area are rare, and few, if any, humpbacks are expected to approach the project area. While most humpback whales have been observed in lower Cook Inlet, there have been some sightings in the upper inlet in recent years.

Two humpbacks were observed north of the Forelands during marine mammal monitoring in May and June of 2015 (Jacobs Engineering Group 2017). Marine mammal monitoring near the mouth of Ship Creek also recorded two humpback whale sightings, likely of the same individual, in September 2017 (ABR 2017). Two sightings of three humpback whales were recorded near Ladd Landing, north of the Forelands, in 2018 during marine mammal monitoring (Sitkiewicz et al. 2018). One humpback was observed in July 2022 during transitional dredging at the POA (61 North Environmental 2022b). Deceased humpbacks were reported in upper Cook Inlet in 2015, 2017, and 2019.

The maximum number of humpback whale sightings observed in upper Cook Inlet within a single monitoring season was two and the maximum number of humpbacks observed in a sighting was two. Therefore, NMFS AKR expects that four humpback whales could be exposed to project related underwater noise per year during the CTR project, for a total of 24 exposures.

7.2.2.3 Western DPS Steller Sea Lion

Steller sea lions are anticipated to occur in low numbers within the proposed CTR project area. The POA used previously recorded sighting rates of Steller sea lions near the POA to estimate requested take for this species. During SFD construction in May and June of 2022, the hourly sighting rate for Steller sea lions was 0.028. The hourly sighting rate for Steller sea lions in 2021, the most recent year with observations across most months, was approximately 0.01. The highest number of Steller sea lions that have been observed during the 2020-2022 monitoring efforts at the POA was nine individuals (eight during PCT Phase 1 monitoring and one during NMFS's 2021 monitoring).

Recent counts of sightings of Steller sea lions around the POA may include multiple re-sights of single individuals. For instance, in 2016, Steller sea lions were observed on two separate days. On May 2, 2016, one individual was sighted, while on May 25, 2016, there were five Steller sea lion sightings within a 50-minute period, and these sightings occurred in areas relatively close to one another (Cornick and Seagars 2016). Given the proximity in time and space, it is believed these five sightings were of the same individual sea lion. The POA expressed concern that multiple re-sights of a single individual within a day may overestimate the true number of individuals exposed to sound levels at or above harassment thresholds over the course of the proposed project. Therefore, given the uncertainty around Steller sea lion occurrence at the POA and potential that occurrence is increasing, the POA estimated that approximately 0.14 Steller sea lions per hour (the May and June 2022 rate of 0.028 Steller sea lions per hour multiplied by a factor of 5) may be observed near the proposed CTR project areas per hour of hammer use. However, the highest number of Steller sea lion sightings during the 2020-2022 monitoring efforts at the POA was nine (eight during PCT Phase 1 monitoring and one during NMFS's 2021 monitoring).

Given the POA's estimate assumes a higher Steller sea lion sighting rate (0.14) than has been observed at the POA and results in an estimate that is more than double the maximum number of Steller sea lions observed in a year, NMFS believes that the sighting rate proposed by the POA overestimates potential exposures of this species. Based on the ensonified areas, which closely resemble the observable area from the PCT project, the potential for re-sightings of individual animals, and the uncertainty around increased occurrence of Steller sea lions in and around upper Cook Inlet, NMFS instead proposes that nine Steller sea lions (the maximum number observed in a single year between 2020 and 2022 during projects with similar sized harassment isopleths) may be exposed to project activities each year during the six years covered under this opinion, for a total of up to 54 individuals over the course of the project.

7.2.3 **Marine Mammal Exposure Estimates**

To quantitatively assess exposure of marine mammals to noise from pile driving activities, the occurrence estimate (number/ unit of time; Tables 17 and 19) and the estimated work hours per year (Table 20) were used to determine the number of animals potentially exposed to an activity. Because the size of the Level A harassment zones may exceed the shutdown zones (see Section 2.1.2) and the limits of PSO visibility during impact driving activities, the number of takes by Level A harassment was estimated based on the proportion of work hours allocated to impact pile driving (Table 20) for all species except CIBWs, which have larger proposed shutdown zones that are designed to prevent Level A take, described in further detail below.

Table 20. Estimated Predicted Number of Hours of Impact and Vibratory Hammer Use for Each Construction Year

Year	**Impact Duration (hrs)**	**Vibratory Duration (hrs)**	**Total Duration (hrs)**	**Proportion of Impact Hammer Use**
1	98.9	55.0	153.9	0.6
2	87.4	47.9	135.4	0.7
3	38.7	96.5	135.2	0.3
4	87.4	50.4	137.9	0.6
5	81.7	55.5	137.2	0.6
6	98.9	55.0	153.9	0.6

The equation used to calculate estimated take by Level A harassment for species with yearly occurrence estimates is:

Level A harassment estimate = occurrence x proportion of impact hammer use

Multiplying four humpback whales by each year's proportion of impact hammer use gives a total of 17. For humpback whales in Cook Inlet, 11 percent are expected to be from the ESA-listed Mexico DPS and <1 percent are expected to be from the ESA-listed WNP DPS (Wade 2021). Therefore, NMFS AKR expects that two humpback whales from the Mexico or WNP DPS may be exposed to Level A harassment from pile driving noise.

Multiplying nine Steller sea lions by each year's proportion of impact hammer gives a total of 29 Level A takes.

Proposed estimates of take by Level B harassment for non-CIBW species were calculated as the difference between the estimated Level A harassment exposures and total estimated yearly occurrence.

The total number of Level B take for all humpback whales is 24-17 = 7 Level B takes. Applying 11% and <1% for ESA listed DPS gives us a fraction of take, which we round to one Level B take. The total number of Level B take for Steller sea lions is 54-29 = 25 Level B takes.

Potential exposures above harassment thresholds of CIBWs, which we equate with takes, were calculated by multiplying the total number of vibratory installation or removal hours per month for each sized/shaped pile based on the anticipated construction schedule (see Table 4) with the corresponding sighting rate month and sighting rate distance bin (Table 19). The resulting estimated CIBW exposures were totaled for all activities in each month (Table 21). The percentage of potentially realized takes from the NES1 project was higher than previous projects at 68 percent (49 out of 72 authorized takes). NMFS Permits Division, therefore, has applied the highest previously observed take percentage as a conservative correction factor, and assumes that approximately 68 percent of the takes calculated for CTR may actually be realized.

Table 21. Calculated Level B harassment takes of CIBWs by Month, Year, and Activity[1]

	Apr	May	Jun	Jul	Aug[2]	Sep[2]	Oct[2]	Nov
Year 1[1]								
36" vibratory installation[3]	1.59	1.84	3.45	0.98	17.30	13.79	7.06	1.45
36" vibratory removal[3]	0.24	0.12	0.27	0.08	1.48	1.01	0.89	0.49

	Apr	May	Jun	Jul	Aug[2]	Sep[2]	Oct[2]	Nov
72" vibratory installation (attenuated)	0.48	0.54	1.01	0.29	4.08	3.26	3.33	0.06
72" vibratory installation (unattenuated)[4]	0.06	0.03	0.05	0.01	0.24	0.20	0.21	0.06
72" impact installation (attenuated)	2.35	3.36	7.11	1.97	31.93	24.48	24.02	3.62
72" impact installation (unattenuated) [4]	0.49	0.27	0.41	0.11	2.06	1.65	1.73	0.51
Year 1 total								173
With 68% Correction Factor[5]								118
Year 2[1]								
36" vibratory installation[3]	1.91	1.54	2.87	0.82	14.42	11.49	5.88	1.45
36" vibratory removal[3]	0.24	0.12	0.27	0.08	1.48	1.01	0.89	0.00
72" vibratory installation (attenuated)	0.48	0.44	0.81	0.23	4.08	2.87	2.94	0.42
72" vibratory installation (unattenuated)[4]	0.06	0.03	0.05	0.01	0.24	0.20	0.21	0.06
72" impact installation (attenuated)	2.35	2.72	5.76	1.59	31.93	21.60	21.20	3.62
72" impact installation (unattenuated) [4]	0.49	0.27	0.41	0.11	2.06	1.65	1.73	0.51
Year 2 total								156
With 68% Correction Factor[5]								107

	Apr	May	Jun	Jul	Aug[2]	Sep[2]	Oct[2]	Nov
Year 3[1]								
36" vibratory installation[3]	4.14	3.99	7.47	2.13	37.48	29.89	15.29	1.45
36" vibratory removal[3]	0.24	0.35	0.81	0.24	2.96	2.02	0.89	0.49
72" vibratory installation (attenuated)	0.37	0.18	0.34	0.07	1.20	0.96	0.98	0.30
72" vibratory installation (unattenuated)[4]	0.06	0.03	0.05	0.01	0.24	0.20	0.21	0.06
72" impact installation (attenuated)	1.83	1.12	2.37	0.47	9.42	7.22	7.09	2.59
72" impact installation (unattenuated) [4]	0.49	0.27	0.41	0.11	2.06	1.65	1.73	0.51
Year 3 total								155
With 68% Correction Factor[5]								106
Year 4[1]								
36" vibratory installation[3]	1.59	1.69	3.16	0.98	15.86	12.64	5.88	1.45
36" vibratory removal[3]	0.24	0.12	0.27	0.08	1.48	1.01	0.89	0.00
72" vibratory installation (attenuated)	0.27	0.44	0.81	0.23	3.60	2.87	2.94	0.30
72" vibratory installation (unattenuated)[4]	0.06	0.03	0.05	0.01	0.24	0.20	0.21	0.06
72" impact installation (attenuated)	2.35	2.72	5.76	1.59	31.93	21.60	21.20	3.62

	Apr	May	Jun	Jul	Aug[2]	Sep[2]	Oct[2]	Nov
72" impact installation (unattenuated) [4]	0.49	0.27	0.41	0.11	2.06	1.65	1.73	0.51
							Year 4 total	158
							With 68% Correction Factor[5]	108
Year 5[1]								
36" vibratory installation[3]	1.59	1.84	3.45	0.98	17.30	12.64	12.94	1.82
36" vibratory removal[3]	0.24	0.12	0.27	0.08	1.48	1.01	0.89	0.49
72" vibratory installation (attenuated)	0.27	0.44	0.81	0.23	3.60	2.87	2.94	0.30
72" vibratory installation (unattenuated)[4]	0.06	0.03	0.05	0.01	0.24	0.20	0.21	0.06
72" impact installation (attenuated)	1.31	2.72	5.76	1.59	28.18	21.60	21.20	2.59
72" impact installation (unattenuated) [4]	0.49	0.27	0.41	0.11	2.06	1.65	1.73	0.51
							Year 5 total	162
							With 68% Correction Factor[5]	111
Year 6								
36" vibratory installation[3]	1.59	1.54	2.87	0.82	14.4	11.5	4.71	1.45
36" vibratory removal[3]	0.24	0.12	0.27	0.08	1.48	4.05	8.88	4.89
72" vibratory installation (attenuated)	0.27	0.44	0.81	0.23	3.60	2.87	2.94	0.30

	Apr	May	Jun	Jul	Aug[2]	Sep[2]	Oct[2]	Nov
72" vibratory installation (unattenuated)[4]	0.06	0.03	0.05	0.01	0.24	0.20	0.21	0.06
72" impact installation (attenuated)	0.26	0.09	0.28	0.02	7.68	4.72	4.88	0.53
72" impact installation (unattenuated) [4]	0.49	0.27	0.41	0.11	2.06	1.65	1.73	0.51
144" vibratory installation[3]	0	0.08	0	0	0	0	0	0
144" impact installation[3]	0	1.55	0	0	0	0	0	0
Year 6 total								99
With 68% Correction Factor[5]								68
Years 1 – 6 Total								
Project Total Estimated Exposures								903
With 68% Correction Factor[5]								618

[1] Concurrent driving scenarios that would improve the production efficiency have been conservatively excluded from this analysis.
[2] Unattenuated vibratory driving of permanent piles during the months of August through October would be limited to the minimum possible of piles that must be driven in-water in depths < 3 m.
[3] Attenuated and unattenuated bins for this activity are the same.
[4] Unattenuated vibratory and impact installation of permanent (72-in) piles will be minimized to the extent possible by driving as many piles as possible in the dry for all months of the construction seasons. This calculation assumes 0.5 72-in piles per month may be driven in water depths < 3m and thus be unattenuated.
[5] Corrected exposure estimates have been rounded up for each year.

Table 22 summarizes the estimated exposures of Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and Western DPS Steller sea lions to pile driving sound.

Table 22. Expected exposures of ESA-listed species.

Species	**Level A**[1]	**Level B**[1]
Cook Inlet beluga whale	0	618[2]
Mexico and WNP DPS humpback whale	2	1
Western DPS Steller sea lion	29	25

[1] Exposure estimates are rounded up to the nearest whole number.
[2] Sum includes 68 percent correction factor.

7.3 Response Analysis

As discussed in the *Approach to the Assessment* section of this opinion, response analyses determine how listed species are likely to respond after being exposed to an action's effects on the environment or directly on listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (particular stress responses), behavioral responses, and social responses that might result in reducing the fitness of listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

Loud underwater noise can result in physical effects on the marine environment that can affect marine organisms. Possible responses by Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and Western DPS Steller sea lions to the impulsive and non-impulsive sound produced by pile driving activities include:

- Physical Response
    - Temporary or permanent hearing impairment (threshold shifts)
    - Non-auditory physiological effects
- Behavioral responses
    - Auditory interference (masking)
    - Tolerance or habituation
    - Change in dive, respiration, or feeding behavior
    - Change in vocalizations
    - Avoidance or displacement
    - Vigilance
    - Startle or fleeing/flight

The effects of pile driving and removal noise on marine mammals are dependent on several factors, including, but not limited to, sound type (e.g., impulsive vs. non-impulsive), the species, age and sex class (e.g., adult male vs. cow with calf), duration of exposure, the distance between the pile and the animal, received levels, behavior at time of exposure, and previous history with exposure (Wartzok et al. 2003) (Southall et al. 2007).

7.3.1 **Responses to Major Noise Sources (Pile Driving Activities)**

As described in the Exposure Analysis, Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and Western DPS Steller sea lions are expected to occur in the action area and to overlap with noise associated with pile installation and removal activities. We assume that some individuals are likely to be exposed and respond to these impulsive and non-impulsive noise sources.

7.3.1.1 **Threshold Shifts**

NMFS defines a noise-induced threshold shift (TS) as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual’s hearing range above a previously established reference level (NMFS 2024a). In other words, a threshold shift is a hearing impairment, and may be temporary (such as ringing in your ears after a loud rock concert) or permanent (such as the loss of the ability to hear certain frequencies or partial or complete deafness). There are numerous factors to consider when examining the consequence of TS, including: the signal’s temporal pattern (e.g., impulsive or non-impulsive); likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS; the magnitude of the TS; time to recovery; the frequency range of the exposure (i.e., spectral content); the hearing and vocalization frequency range of the exposed species relative to the signal's frequency spectrum (i.e., how an animal uses sound within the frequency band of the signal; Kastelein et al. 2014); and the overlap between the animal and the sound (e.g., spatial, temporal, and spectral (NMFS 2024a). The amount of threshold shift is customarily expressed in dB.

Temporary Threshold Shift

Temporary threshold shift (TTS) is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter 1970). While experiencing TTS, the hearing threshold rises, and a sound must be stronger in order to be heard. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the sound ends. Few data exist on the sound levels and durations necessary to elicit mild TTS in marine mammals, and none of the published data describe TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in (Southall et al. 2007).

Although some exposures to sound capable of causing harassment may occur during the course of the proposed action, not all instances will result in TTS because the estimated noise thresholds for the onset of TTS are conservative. If TTS does occur, it is expected to be mild and temporary and not likely to affect the long-term fitness of the affected individuals.

Permanent Threshold Shift

When permanent threshold shift (PTS) occurs, there is physical damage to the sound receptors in the ear. The animal will have an impaired ability to hear sounds in specific frequency ranges, and there can be total or partial deafness in severe cases (Kryter 1985). There is no specific evidence that exposure to pulses of sound can cause PTS in any marine mammal. However, given the possibility that mammals close to a sound source can incur TTS, it is possible that some individuals will incur PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated TTS or (in some cases) single exposures to a level well above that causing the onset of TTS might cause PTS.

Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial mammals, based on anatomical similarities. PTS might occur at a received sound level at least several decibels above that which induces mild TTS, if the animal were exposed to strong sound pulses with rapid rise time. For non-impulsive exposures (i.e., vibratory pile driving), a variety of marine mammal data sources indicate that threshold shift up to 40 to 50 dB may be induced without PTS, and that 40 dB is a conservative upper limit for threshold shift to prevent PTS. An exposure causing 40 dB of TTS is, therefore, considered equivalent to PTS onset (NMFS 2024a).

As stated in the mitigation section 2.1.2, the POA will implement shutdown zones that equal or exceed the Level A harassment isopleths for vibratory pile driving, and will maximize and prioritize practicability for impact pile driving shutdown zones while authorizing some take of marine mammals when mitigation is not feasible. Take by Level A harassment is proposed for authorization for humpback whales and Steller sea lions to account for the large Level A harassment zones for humpback whales and Steller sea lions from impact driving and the potential that one of these species could enter and remain unobserved within the estimated Level A harassment zone for a duration long enough to incur auditory injury.

Due to the levels and durations of likely exposure, it is likely that only a small number of humpback whales or Steller sea lions will experience auditory injury, and any that do will likely only receive minor injury (minor degradation of hearing capabilities within regions of hearing that align most completely with the frequency range of the energy received from POA's proposed in-water construction activities (*i.e.*, the low-frequency region below 2 kHz)). Severe hearing impairment or impairment in the ranges of greatest hearing sensitivity is not likely with expected levels and durations of exposure. If minor hearing impairment occurs, it is most likely that the affected animal will experience some loss in hearing sensitivity, which is not likely to meaningfully affect its ability to forage and communicate with conspecifics. There are no data to suggest that a single instance in which an animal incurs minor auditory injury (or TTS) would result in impacts to reproduction or survival. Additionally, some subset of the individuals that are behaviorally harassed could also simultaneously incur some small degree of TTS for a short duration of time. Because of the small degree anticipated, though, any auditory injury or TTS potentially incurred here is not expected to adversely impact individual fitness, nor annual rates of recruitment or likelihood of survival for the affected species or stocks.

Repeated, sequential exposure to pile driving noise over a long duration could result in more severe impacts to individuals that could affect a population (via sustained or repeated disruption of important behaviors such as feeding, resting, traveling, and socializing (Southall et al. 2007)). Alternatively, some marine mammals exposed to repetitious construction sounds may become habituated, desensitized, or tolerant after initial exposure to these sounds (Richardson et al. 1995) (Southall et al. 2007). However, given the absence of any pinniped haulouts, the lack of other known non-CIBW home-ranges in the proposed action area, and the relatively low abundance of marine mammals other than CIBWs in Knik Arm compared to the stock sizes, population-level impacts are not anticipated. Take by mortality, serious injury, or Level A harassment of CIBWs is not anticipated or exempted in the ITS.

(Ferrero et al. 2000; Rolland et al. 2012; Kendall and Cornick 2015; Forney et al. 2017; Shelden et al. 2018)

7.3.2 **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, internal 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 activities to cause auditory impairment or other physiological effects in marine mammals. Available data suggest that non-auditory physiological effects, if they occur at all, would be limited to short distances from the sound source and to activities that extend over a prolonged period of time. 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 are especially unlikely to incur auditory impairment or non-auditory physical effects.

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 (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 long-term effects on an animal’s fitness are unknown.

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 (Jessop et al. 2003) (Lankford et al. 2005) (Crespi et al. 2013). 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. 2002) and, more rarely, studied in wild populations. For example, noise reduction from reduced ship traffic in the Bay of Fundy following September 11, 2001 was linked to a significant decline in fecal stress hormones in North Atlantic right whales, suggesting that chronic exposure to increased noise levels, although not acutely injurious, can produce stress (Rolland et al. 2012). These stress hormones returned to their previous level within 24 hours after the resumption of shipping traffic. Exposure to loud noise can also adversely affect reproductive and metabolic physiology (Kight and Swaddle 2011). In a variety of factors, including behavioral and physiological responses, females appear to be more sensitive or respond more strongly than males (Kight and Swaddle 2011).

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).

Marine mammals that show behavioral avoidance of pile driving are especially unlikely to incur auditory impairment or non-auditory physical effects, like stress and distress, because they will be limiting the duration of their exposure.

7.3.3 **Behavioral Disturbance Reactions**

Behavioral responses are influenced by an animal’s assessment of whether a potential stressor poses a threat or risk. Behavioral responses may include: changing durations of surfacing and dives, number of blows per surfacing, or changing 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.

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Behavioral responses to sound are highly variable and context-specific, and reactions, if any, depend on species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day, and many other factors (Southall et al. 2007).

Tolerance 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 tolerate, and possibly habituate to, sounds that are predictable and unvarying. 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. Behavioral state may affect the type of response as well. 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 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 guns or acoustic harassment devices, but also pile driving) have been varied, but often consist of avoidance behavior or other behavioral changes, suggesting discomfort (Morton and Symonds 2002) (Wartzok et al. 2003) (Thorson and Reyff 2006) (Nowacek et al. 2007).

Beluga whales and other odontocetes have been shown to exhibit behavioral changes when exposed to very loud impulsive sound (Finneran et al. 2000) (Finneran et al. 2002b). Some whales may change their behavioral state – reduce the amount of time they spend at the ocean's surface, increase their swimming speed, change their swimming direction, change their respiration rates, increase dive times, reduce feeding behavior, and/or alter vocalizations and social interactions (Frid and Dill 2002; Koski et al. 2009) (Funk et al. 2010) (Melcon et al. 2012) (Kendall et al. 2014) (Kendall and Cornick 2015). Beluga whales were observed before and during pile driving activity at the POA; a decrease in sighting duration, an increase in traveling relative to other observed behaviors, and a change in group composition were documented during pile driving activity (Kendall and Cornick 2015). Baleen whales have shown strong overt reactions to impulsive noises at received levels between 160 and 173 dB_{rms} re 1 µPa (Richardson et al. 1986; Ljungblad et al. 1988; McCauley et al. 2000; Miller et al. 2005; Gailey et al. 2007). Humpbacks exposed to pile driving noise are most likely to respond by avoiding the area (Richardson et al. 1995); changes in vocal behavior could also occur. Steller sea lions exposed to pile driving noise may change their behavioral state by avoiding these sound fields or exhibiting vigilance by raising their heads above the water. In general, pinnipeds seem more tolerant of low frequency noise and less responsive to exposure to industrial sound than most cetaceans (Costa et al. 2003).

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 biologically significant if the change affects growth, survival, or fitness. Significant behavioral modifications that could potentially lead to effects on growth, survival, or fitness include drastic changes in diving/surfacing patterns, longer-term habitat abandonment due to loss of desirable acoustic environment, longer-term cessation of feeding or social interaction, and cow/calf separation.

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).

Monitoring data from the POA suggest pile driving does not discourage CIBWs from entering Knik Arm and traveling to critical foraging grounds such as those around Eagle Bay (*e.g.*, 61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). Sighting rates were not different in the presence or absence of pile driving (Kendall and Cornick 2015). In addition, large numbers of CIBWs have continued to forage in portions of Knik Arm and pass through the area near the POA during pile driving projects over the past two decades, including during the recent PCT, SFD, and NES1 construction projects (61N Environmental, 2021, 2022a, 2022b, 2025; Easley-Appleyard and Leonard, 2022). These findings are not surprising as food is a strong motivation for marine mammals, and preying on seasonal anadromous fish runs in Eagle and Knik Rivers necessitates CIBWs passing the POA. As described in (Forney et al. 2017), animals typically favor particular areas because of their importance for survival (*e.g.*, feeding or breeding) and leaving may have significant costs to fitness (reduced foraging success, increased predation risk, increased exposure to other anthropogenic threats). Consequently, animals may be highly motivated to maintain foraging behavior in historical foraging areas despite negative impacts (Rolland et al. 2012).

Previous monitoring data indicates CIBWs may be responding to pile driving noise but not through abandonment of primary foraging areas north of the port. Instead, they may travel faster past the POA, more quietly, and in smaller, tighter groups (Kendall and Cornick, 2015; 61N Environmental, 2021, 2022a, 2022b, 2025). CIBW presence at the POA has been extensively monitored during pile driving projects over the last several years, with data gathered during active pile driving activities and during periods of no construction noise. CIBWs are regularly observed in the vicinity of the POA even during active pile driving as discussed below.

During previous PAMP construction monitoring, little variability was evident in the behaviors recorded from month to month or between sightings that coincided with in-water pile installation and removal and those that did not (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). Of the 386 CIBWs groups sighted during PCT and SFD construction monitoring, 10 groups were observed during or within minutes of in-water impact pile installation and 56 groups were observed during or within minutes of vibratory pile installation or removal (61N Environmental, 2021, 2022a, 2022b). During the NES1 project, which included little to no impact pile driving, of the nearly 2,000 CIBW groups observed, 192 occurred during vibratory pile driving (61N Environmental, 2025). In general, CIBWs were more likely to display no reaction or to continue to move towards the PCT or SFD during pile installation and removal. In the situations during which CIBWs showed a possible reaction (6 groups during impact driving and 13 groups during vibratory driving), CIBWs were observed either moving away immediately after the pile driving activities started or were observed increasing their rate of travel.

NMFS funded a visual marine mammal monitoring project in 2021 to supplement sighting data collected by the POA monitoring program during non-pile driving days in order to further evaluate the impacts of anthropogenic activities on CIBWs (Easley-Appleyard and Leonard, 2022). Preliminary results suggest that group size ranged from 1 to 34 whales, with an average of 3 to 5.6, depending on the month. September had the highest sighting rate with 4.08 whales per hour, followed by October and August (3.46 and 3.41, respectively). Traveling was recorded as the primary behavior for 80 percent of the group sightings and milling was the secondary behavior most often recorded. Sighting duration varied from a single surfacing lasting less than 1 minute to 380 minutes. Preliminary findings suggest these results are consistent with the results from the POA's PCT and SFD monitoring efforts. For example, group sizes ranged from 2.38 to 4.32 depending on the month and the highest sighting rate was observed in September (1.75). In addition, traveling was the predominant behavior observed for all months and categories of construction activity (*i.e.*, no pile driving, before pile driving, during pile driving, between pile driving, or after pile driving), being recorded as the primary behavior for 86 percent of all sightings, and either the primary or secondary behavior for 95 percent of sightings.

Easley-Appleyard and Leonard (2022) also asked PSOs to complete a questionnaire post-monitoring that provided NMFS with qualitative data regarding CIBW behavior during observations. Specifically during pile driving events, the PSOs noted that CIBW behaviors varied; however, multiple PSOs noted seeing behavioral changes specifically during impact pile driving and not during vibratory pile driving. CIBWs were observed sometimes changing direction, turning around, or changing speed during impact pile driving, whereas there were numerous instances where CIBWs were seen traveling directly towards the POA during vibratory pile driving before entering the Level B harassment zone (61N Environmental, 2021, 2022a, 2022b). The PSOs also reported that it seemed more likely for CIBWs to show more cryptic behavior during active impact and vibratory pile driving (*e.g.*, surfacing infrequently and without clear direction), though this seemed to vary across months (Easley-Appleyard and Leonard, 2022).

We anticipate that disturbance to CIBWs will manifest in the same manner when they are exposed to noise during the CTR project: whales would move quickly and silently through the area in more cohesive groups. Exposure to elevated noise levels during transit past the POA is not expected to have adverse effects on reproduction or survival as the whales continue to access critical foraging grounds north of the POA. Potential behavioral reactions that have been observed, including changes in group distribution and speed, may help to mitigate the potential for any contraction of communication space for a group. CIBWs are not expected to abandon entering or exiting Knik Arm as this is not evident based on monitoring data (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022).

Finally, as described previously, both telemetry (tagging) and acoustic data suggest CIBWs likely stay in upper Knik Arm (*i.e.*, north of the CTR project site) for several days or weeks before exiting Knik Arm. Specifically, a CIBW instrumented with a satellite link time/depth recorder entered Knik Arm on August 18, 1999 and remained in Eagle Bay until September 12, 1999 (Ferrero et al. 2000). Further, a recent detailed re-analysis of the satellite telemetry data confirms how several tagged whales exhibited this same movement pattern: whales entered Knik

Arm and remained there for several days before exiting through lower Knik Arm (Shelden et al. 2018). This longer-term use of upper Knik Arm will avoid repetitive exposures from pile driving noise.

It is possible that exposure to pile driving at the POA could result in CIBWs avoiding Knik Arm and thereby not accessing the productive foraging grounds north of POA such as Eagle River flats. The data previously presented demonstrate CIBWs are not abandoning the area (*i.e*., continue to access the waters of northern Knik Arm during construction activities).

Given the overall estimated take, it is unlikely that any one CIBW will be disturbed on more than a few days. Further, the mitigation measures required for the CTR project are designed to avoid the potential that any animal will lose the ability to forage for one or more tidal cycles should they be foraging in the project area, which is not known to be a particularly important feeding area for CIBWs.

While Level B harassment (behavioral disturbance) is exempted, the required mitigation measures will limit the severity of the effects of that Level B harassment to behavioral changes such as increased swim speeds, tighter group formations, and cessation of vocalizations, not the loss of foraging capabilities. Regardless, this elicitation recognized that pregnant or lactating females and calves are inherently more at risk than other animals, such as males. Given that individuals in potentially vulnerable life stages, such as pregnancy, cannot be identified by visual observers, pile driving will shut down for all CIBWs to be protective of potentially vulnerable individuals, and to avoid more severe behavioral reactions.

The mitigation measures in Section 2.1.2 minimize exposure to CIBWs, specifically, shutting down pile driving should a CIBW approach or enter the Level B harassment zone. These measures are designed to reduce the intensity and duration of potential harassment CIBWs experience during the POA's construction activities. Additionally, the mitigation measures will help to ensure CIBWs will not experience degradation of acoustic habitat approaching the threshold set in the Critical Habitat designation (*i.e.,* in-water noise at levels resulting in the abandonment of habitat by CIBWs). The location of the PSOs will allow for detection of CIBWs and behavioral observations prior to CIBWs entering the Level B harassment zone.

Additionally, the required mitigation measures include the use of a bubble curtain for all permanent piles in waters deeper than 3 m in all months. During impact driving, the POA must implement soft starts, which ideally allows animals to leave a disturbed area before the full-power driving commences. Although NMFS does not anticipate CIBWs will abandon entering Knik Arm in the presence of pile driving, PSOs will be integral to identifying if CIBWs are potentially altering pathways they would otherwise take in the absence of pile driving. Finally, take by mortality, serious injury, or Level A harassment of CIBWs is not anticipated or exempted.

7.3.3.1 **Auditory Masking**

Natural and artificial sounds can disrupt behavior by masking, or interfering with, a marine mammal's ability to hear other sounds. Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher levels. Chronic exposure to excessive, though not high-intensity, sound could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions. Masking can interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance or fitness in survival and reproduction. If the coincident (masking) sound were anthropogenic, it could be potentially harassing if it disrupted hearing-related behavior. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs only during the sound exposure. Because masking (without resulting in threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect, but may result in a behavioral effect.

Masking occurs at the frequency band the animals utilize, so the frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Lower frequency man-made sounds are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey sound. Anthropogenic sounds may also affect communication signals when both occur in the same sound band and thus reduce the communication space of animals (Clark et al. 2009; Eickmeier and Vallarta 2023), and cause increased stress levels (Foote et al. 2004; Holt et al. 2009).

Masking has the potential to affect species at the population or community levels as well as at individual levels. Masking affects both senders and receivers of the signals and can potentially have long-term chronic effects on marine mammal species and populations. Research suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than a three-fold increase in terms of SPL) in the world's ocean from pre-industrial periods, and that most of these increases are from distant shipping (Hildebrand 2009). All anthropogenic sound sources, such as those from vessel traffic, pile driving, and dredging activities, contribute to the elevated ambient sound levels, thus intensifying masking.

Noise from pile driving activities may mask acoustic signals important to beluga whales, humpback whales, and Steller sea lions. However, pile driving activities will be intermittent, occur during daylight hours, and affect a limited area. Masking only exists for the duration of time that the masking sound is emitted (and interfering with biologically important sounds); extended periods of time where masking could occur are not expected.

Masking is likely less of a concern for Steller sea lions, which vocalize both in air and water and do not echolocate or communicate with complex underwater "songs." Any masking event that could harass sea lions would occur concurrently within the zones of behavioral harassment already estimated for pile driving activities, which have already been taken into account in the Exposure Analysis.

7.3.4 **Response Analysis Summary**

These reactions and behavioral changes are expected to be temporary and subside quickly when the exposure ceases. The primary mechanism by which these behavioral changes may affect the fitness of individual animals is through the animals' energy budget, time budget, or both (the two are related because foraging requires time). Some animals may leave the area during pile driving activities if they were disturbed and access high-quality habitat located elsewhere throughout Cook Inlet. The individual and cumulative energy costs of the physical and behavioral responses we have discussed are not likely to reduce the energy budgets of beluga whales, humpback whales, or Steller sea lions, and their probable exposure to noise sources are not likely to reduce their fitness.

8 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action, such as other phases of the PAMP, are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate change within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the Status of the Species and the Environmental Baseline sections.

We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline section and those summarized below. Reasonably foreseeable future state, local, or private actions include vessel traffic and shipping, state fisheries, pollution, and tourism, and are discussed in the following sections.

8.1 **Vessel Traffic and Shipping**

Vessel traffic, including shipping, is expected to continue in Cook Inlet. It is unknown whether overall vessel traffic or shipping will increase in the future, as this depends largely on population growth, economics, tourism, and other factors, but it is unlikely to decrease significantly. As a result, there will be continued risk to marine mammals of ship strikes, exposure to vessel noise and presence, and small spills.

8.2 **Fisheries (State of Alaska managed)**

The Alaska Department of Fish and Game (ADFG) manages fish stocks and monitors and regulates fishing under the state jurisdiction in Cook Inlet to maintain sustainable stocks. Fishing, a major industry in Alaska, is expected to continue in the area. As a result, there will be continued risk to marine mammals of prey competition, ship strikes, harassment, and entanglement in fishing gear. For Cook Inlet beluga whales, there is also a risk of continued displacement from former summer foraging habitat due to human activity associated with salmon harvest (Ovitz 2019). It remains unknown whether and to what extent marine mammal prey may become less available due to commercial, subsistence, personal use, and sport fishing, especially near the mouths of streams up which salmon and eulachon migrate to spawning areas. In addition, we do not know the full extent of the effects of fishing vessel traffic on availability of prey to belugas. The Cook Inlet Beluga Whale Recovery Plan considers reduction in availability of prey due to activities such as fishing to be a moderate threat to the population (NMFS 2016b).

8.3 **Pollution**

As the population in urban areas around Cook Inlet continues to grow, an increase in pollutants entering Cook Inlet is likely to occur. Hazardous materials are released into Cook Inlet from vessels, aircraft, and municipal runoff. Oil spills could occur from vessels traveling within the action area. In addition, oil spilled from outside the action area could migrate into the action area. There are many nonpoint sources of pollution within the action area. Pollutants can pass from streets, construction and industrial areas, and airports into Cook Inlet. The Environmental Protection Agency and the Alaska Department of Environmental Conservation will continue to regulate the amount of pollutants that enter Cook Inlet from point and nonpoint sources through NPDES/APDES permits. As a result, permittees will be required to renew their permits, verify they meet permit standards, and potentially upgrade facilities.

8.4 **Tourism**

Currently there are no commercial whale-watching companies in upper Cook Inlet. The extremely hazardous environmental and boating conditions, lack of harbors, and single boat launching facility in the Anchorage area (that cannot be used at low tides) make it unlikely that commercial whale-watching will occur in the area. However, some aircraft have circled groups of Cook Inlet beluga whales, disrupting their breathing patterns and possibly their feeding activities. In response, NMFS has undertaken outreach efforts to educate local pilots of the potential consequences of such actions, providing guidelines and encouraging pilots to “stay high and fly by.”

Watercraft (primarily sport fishing watercraft) have been observed to harass belugas in the Twentymile River. NMFS is cooperating with partners to assess the degree to which such boating activities may be a cause for concern due to the associated reduced access to concentrations of prey.

9 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step of NMFS's assessment of the risk posed to listed species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of the survival or recovery of the species in the wild by reducing its numbers, reproduction, or distribution, or (2) result in the adverse modification or destruction of critical habitat as measured through direct or indirect alterations that appreciably diminish the value of designated critical habitat as a whole for the conservation of the species. These assessments are made in full consideration of the status of the species (Section 4).

The Integration and Synthesis section evaluates the listed species and critical habitat likely to be adversely affected by the proposed action, which here include the listed species of the Cook Inlet beluga whale, Mexico and Western North Pacific DPS humpback whales, and Western DPS Steller sea lion. As we discussed in the *Approach to the Assessment* section of this opinion, we begin our risk analyses by asking whether the probable physical, physiological, behavioral, or social responses of endangered or threatened species are likely to reduce the fitness of endangered or threatened individuals or the growth, annual survival or reproductive success, or lifetime reproductive success of those individuals.

As part of our risk analyses, we identified and addressed all potential stressors and considered all consequences of exposing listed species to all the stressors associated with the proposed action, individually and cumulatively, given that the individuals in the action area for this consultation are also exposed to other stressors in the action area and elsewhere in their geographic range.

9.1 Cook Inlet Beluga Whale Risk Analysis

Based on the results of the exposure analysis, we expect 618 Cook Inlet beluga whale takes by harassment from pile driving over 6 years. Beluga whales can be found in Knik Arm year-round, but are more frequently observed in the area during the summer and fall. The most recent population estimate as of 2023 is 331 animals (Goetz et al. 2023). The trend in the updated time-series, including the 2021 and 2022 survey data, suggests the population is stable and may be slightly increasing (Goetz et al. 2023). From 2008 to 2018 the population showed a declining trend of 2.3 percent per year (Shelden and Wade 2019).

Exposure to project-related vessel noise and risk of vessel strike may occur, but adverse effects from vessel disturbance and noise are likely to be insignificant due to the small marginal increase in such activities relative to the environmental baseline, the transitory nature of project-related vessel traffic, and the likely habituation of whales that frequent this heavily trafficked area. Adverse effects from vessel strikes are considered extremely unlikely because of the few additional construction vessels introduced by the action, slow speeds at which these vessels will operate, and the 91 m shutdown zone that will be implemented by transiting project vessels.

Disturbance to seafloor, habitat, and prey resources are not expected to adversely affect belugas because these disturbances are temporary. Based on the localized nature of small unauthorized spills, the relatively rapid weathering and dispersion expected, and the safeguards in place to avoid and minimize spills, we conclude that the probability of the proposed action causing a small spill and exposing beluga whales is extremely small. If exposure were to occur, NMFS does not expect detectable responses from beluga whales due to the ephemeral nature of small, refined spills. Increases in turbidity will be temporary, localized, and difficult to detect in the waters of Cook Inlet, which have a very high concentration of suspended solids because of glacial runoff and extreme tidal exchange. Impacts on zooplankton, fish, and marine mammals from seafloor disturbance and turbidity are expected to be brief, intermittent, and minor, if impacts occur at all. And any effects to beluga whales from seafloor disturbance and increased turbidity levels would be immeasurably small. We also conclude that the expected impacts on prey, as well as the impacts from trash and debris resulting from the CTR project, is very minor, and thus effects to beluga whales will be immeasurably small.

Pile driving noise at the POA could restrict beluga access to important foraging areas north of the project site, or inhibit whales from swimming south past the project site and leaving Knik Arm, but this is not expected. Belugas continued to travel past the POA into upper Knik Arm and to leave Knik Arm despite pile driving during previous projects at the port using piles of a similar size. CIBWs are not expected to abandon entering or exiting Knik Arm as this is not evident based on monitoring data (61N Environmental, 2021, 2022a, 2022b; Easley-Appleyard and Leonard, 2022). During yearly dredging operations, belugas have also been observed traveling past the POA. With the proposed mitigation measures, we expect that belugas will continue to travel past the POA to and from feeding areas during the POA project. Limited changes in behavior, such as increased traveling and swimming speed, changes in diving and surfacing behaviors, alterations to communication signals, as well as changes in group composition have been recorded during previous POA pile driving activities and could occur due to exposure to stressors from the CTR project (Kendall and Cornick 2015). However, the project area represents a very small portion of the available foraging area so no loss of foraging capabilities or the abandonment of critical habitat is anticipated.

The implementation of mitigation measures (including shutdown zones) to reduce exposure to high levels of sound decrease the likelihood of a behavioral response that may affect vital functions, or cause TTS or PTS of beluga whales. If a beluga whale is observed approaching or entering the Level B harassment zone, in-water pile installation and removal will be halted or delayed, and will not commence or resume until either the whale has voluntarily left and been visually confirmed beyond the shutdown zone and on a path away from such zone or 30 minutes have passed without subsequent detections. This will decrease the likelihood of exposing belugas to noise at received levels that could cause Level B harassment, disturbance, or stress. Additionally, the mitigation measures (*i.e.*, soft starts, pre-clearance monitoring, shutdown zones, bubble curtains) reduce the likelihood of restricting belugas from passing by the POA, as pile driving will not occur if belugas are observed traveling into or out of Knik Arm, or appear likely to do so. Exposures to Level B thresholds are expected to be short in duration. The implementation of mitigation measures is also meant to prevent any Level A harassment (and no Level A take of Cook Inlet beluga whales is anticipated from this project nor proposed for authorization by the NMFS Permits Division).

As mentioned in the Environmental Baseline section, Cook Inlet beluga whales may be impacted by a number of anthropogenic activities present in Cook Inlet. The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors that marine mammals must contend with. Coastal development and boat traffic, especially near Anchorage, has the potential to disrupt beluga whale behavior, and may alter movements among important summer habitat through acoustic disruption. Seismic exploration in upper Cook Inlet has exposed Cook Inlet beluga whales to sound above the Level A injury and Level B harassment thresholds. Aircraft circling overhead have been observed to cause behavioral changes in groups of Cook Inlet beluga whales, disrupting breathing patterns and possibly feeding activities. Pollution and contaminants were listed as a low relative concern for impeding the recovery of Cook Inlet beluga whales (NMFS 2016b). Currently, there is not a subsistence harvest and direct human-caused mortality due to fisheries bycatch, vessel strikes, or other sources has not been definitively determined (Muto et al. 2022). Belugas have been documented with scars due to vessel strikes and entanglements in ropes and lines, indicating these sources are a potential cause of injury or mortality (McGuire et al. 2020). Anthropogenic noise remains a potential threat of high concern regarding the recovery of Cook Inlet belugas (NMFS 2016b). These risk factors are in addition to those operating on a larger scale such as predation, prey availability, disease, and climate change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats. All of these activities are expected to continue to occur into the foreseeable future.

Based on the best information currently available, we do not expect that the proposed action will result in serious injury or mortality of any belugas, and none is proposed for authorization by the NMFS Permits Division. Further, we do not expect the effects of the action to alter the physiology, behavioral ecology, or social dynamics of individual whales in ways or to a degree that would reduce their fitness, nor do we expect the proposed action to be linked to a reduction in the Cook Inlet beluga whale reproduction, numbers, or distribution. Based on this, NMFS concludes that the proposed action is not expected to appreciably reduce the likelihood of survival or recovery of Cook Inlet beluga whales.

9.2 Mexico and Western North Pacific DPS Humpback Whales

Based on the results of the exposure analysis, we expect 24 humpback whales may be exposed to noise from pile driving; 11 percent are expected to be from the Mexico DPS and less than one percent are expected to be from the WNP DPS, equating to one Level B harassment and two Level A harassment exposures for listed humpbacks (Table 22).

Upper Cook Inlet is not regularly used by humpback whales, which is the strongest evidence supporting the conclusion that the proposed action will likely have minimal impact on humpback whale populations or individuals.

Exposure to project-related vessel noise and risk of vessel strike may occur, but effects from vessel disturbance and noise are likely to be insignificant due to the small marginal increase in such activities relative to the environmental baseline, the transitory nature of project-related vessel traffic, and the likely habituation of marine mammals that frequent this heavily trafficked area. Adverse effects from vessel strikes are considered extremely unlikely because of the few additional construction vessels introduced by the action, slow speeds at which these vessels will operate, rarity of humpbacks in the area, existing regulations regarding approaching humpback whales, and the 91 m shutdown zone that will be implemented.

Disturbance to seafloor, habitat, and prey resources, as well as any trash or pollution from the action, are not expected to adversely affect humpback whales because these disturbances are anticipated to be minimal and/or temporary, and the action area is not important habitat to humpback whales for foraging, migrating, breeding, or other essential life functions. Mitigation measures and adherence to Clean Water Act regulations are expected to minimize the risk of exposure of humpback whales to the potential introduction of pollutants into the action area.

It is difficult to estimate the behavioral responses, if any, that humpback whales in the action area may exhibit to underwater sounds generated by project activities. Though the sounds produced during project activities may not greatly exceed levels that humpbacks already experience in Cook Inlet, some of the sources proposed for use in this project are not among sounds to which they are commonly exposed. The most likely responses from humpback whales to noise from pile driving activities include brief startle reactions or short-term behavioral modification. These reactions are expected to subside quickly when the exposure to pile driving noise ceases. The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animals' energy and time budget. Large whales such as humpbacks have an ability to survive for months on stored energy during migration and while in their wintering areas, and their feeding patterns allow them to acquire energy at high rates. The individual and cumulative energy costs of the behavioral responses we have discussed are not likely to measurably increase energetic costs of humpback whales, and their probable exposure to project-related noise is not likely to reduce their fitness.

As mentioned in the Environmental Baseline section, Mexico and WNP DPS humpback whales may be impacted by a number of anthropogenic activities present in Cook Inlet. The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors that marine mammals must contend with, including: coastal and marine development, oil and gas development, ship strikes, noise pollution, water pollution, prey reduction, fisheries, tourism, and research. These risk factors are in addition to those operating on a larger scale such as predation, disease, and climate change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats. All of these activities are expected to continue to occur into the foreseeable future.

The implementation of mitigation measures (including shutdown zones) to reduce exposure to high levels of sound decrease the likelihood of a behavioral response that may affect vital functions, or cause TTS or PTS of humpback whales. Based on the best information currently available, the proposed action is not expected to appreciably reduce the reproduction, numbers, or distribution of humpback whales and therefore is not expected to appreciably reduce the likelihood of survival and recovery of Mexico or WNP DPS humpback whales.

9.3 Western DPS Steller Sea Lion Risk Analysis

Based on the results of the exposure analysis, we expect 54 Western DPS Steller sea lions (approx. nine per year) may be exposed to noise from pile driving (29 Level A and 25 Level B harassment exposures; see Table 22). Upper Cook Inlet is not highly utilized by Steller sea lions, which is the strongest evidence supporting the conclusion that the proposed action will likely have minimal impact on the Western DPS Steller sea lion population.

Exposure to vessel noise and presence, marine debris, seafloor disturbance and turbidity, and small oil spills may occur, but such exposure would have a very small impact, and we conclude that these stressors are unlikely to result in take of Steller sea lions. The increase in ship traffic due to the proposed action is unlikely to result in a vessel strike. Project vessels will be traveling at slow speeds, the increase in project-specific vessel traffic will be small, and vessel strike is not considered a significant concern for Steller sea lions (only four reports of potential vessel strikes involving Steller sea lions have been reported in Alaska).

Exposure to non-biodegradable marine debris, specifically to debris that can cause entanglement, remains an unquantifiable risk, but associated effects from this project would be minimal. Any increases in turbidity or seafloor disturbance would be temporary, localized, and minimal. Based on the localized nature of small oil spills, the relatively rapid weathering and dispersion expected, and the safeguards in place to avoid and minimize oil spills, we conclude that the probability of the proposed action causing a small oil spill and exposing Western DPS Steller sea lions is extremely small. If exposure were to occur, NMFS does not expect detectable responses due to the ephemeral nature of small, refined spills. Mitigation measures and adherence to Clean Water Act regulations are also expected to minimize the risk of exposure of Steller sea lions to the potential introduction of pollutants into the action area.

It is difficult to estimate the behavioral responses, if any, that Western DPS Steller sea lions in the action area may exhibit to underwater sounds generated by project activities. Though the sounds produced during project activities may not greatly exceed levels that Steller sea lions already experience in Cook Inlet, some of the sources proposed for use in this project are not among sounds to which they are commonly exposed. In response to project-related sounds, some Steller sea lions may move out of the area or change from one behavioral state to another, while other Steller sea lions may exhibit no apparent behavioral changes at all. Potential reactions are expected to subside quickly when the exposure to pile driving noise ceases.

The primary mechanism by which the behavioral changes may affect the fitness of individual animals is through the animal’s energy budget, time budget, or both. Most adult Steller sea lions occupy rookeries during the pupping and breeding season, which extends from late May to early July (NMFS 2008b). The closest major rookery or haulout is over 200 km away from the project site. The individual and cumulative energy costs of the behavioral responses we have discussed are not likely to measurably reduce the energy reserves of Steller sea lions in the action area.

The probable responses (i.e., tolerance, avoidance, short-term masking, and short-term vigilance behavior) to close approaches by vessel operations and their probable exposure to noise from pile driving are not likely to reduce the current or expected future reproductive success or reduce the rates at which Steller sea lions grow, mature, or become reproductively active. Therefore, these exposures are not likely to reduce the abundance, reproduction rates, or survival and growth rates of the population those individuals represent.

Noise from pile driving is likely to cause some individual Steller sea lions to experience changes in their behavioral states that may have adverse consequences (Frid and Dill 2002). However, these responses are not likely to alter the physiology, behavioral ecology, or social dynamics of individual Steller sea lions in ways or to a degree that would reduce their fitness.

As mentioned in the Environmental Baseline section, Western DPS Steller sea lions may be impacted by a number of anthropogenic activities present in Cook Inlet. The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors that marine mammals must contend with, including: coastal and marine development, oil and gas development, ship strikes, noise pollution, water pollution, prey reduction, fisheries, tourism, and research. These risk factors are in addition to those operating on a larger scale such as predation, disease, and climate change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats. All of these activities are expected to continue to occur into the foreseeable future.

The implementation of mitigation measures (including shutdown zones) to reduce exposure to high levels of sound decrease the likelihood of a behavioral response that may affect vital functions, or cause TTS or PTS of Steller sea lions. Based on the best information currently available, the proposed action is not expected to appreciably reduce the reproduction, numbers, or distribution of Steller sea lions and therefore is not expected to appreciably reduce the likelihood of survival or recovery of Western DPS Steller sea lions.

9.4 **Project Risk Assessment**

As we discussed in the Approach to the Assessment section of this opinion, an action that is not likely to reduce the fitness of individuals would not be likely to reduce the viability of the populations those individuals represent (that is, we would not expect reductions in the reproduction, numbers, or distribution of such populations). For this project, we do not expect that the project effects, including the sound created by pile driving, will reduce the fitness of any individual marine mammals. An action that is not likely to reduce the viability of those populations is not likely to increase the extinction probability of the species those populations comprise; in this case, the Cook Inlet beluga whale, Mexico and WNP DPS humpback whale, and Western DPS Steller sea lion. As a result, the proposed action is not likely to appreciably reduce the likelihood of the Cook Inlet beluga whale, Mexico or WNP DPS humpback whale, or Western DPS Steller sea lion surviving or recovering in the wild.

10 CONCLUSION

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of Cook Inlet beluga whales, Mexico or Western North Pacific DPS humpback whales, or Western DPS Steller sea lions. NMFS concurs that the proposed action is not likely to adversely affect critical habitat designated for Cook Inlet beluga whales.

11 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. 1532(19)). "Incidental take" is defined as take that results from, but is not the purpose of, the carrying out of an otherwise lawful activity conducted by the action agency or applicant (50 CFR 402.02). Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). 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] (16 U.S.C. 1362(18)(A)(i) and (ii)). For this consultation, it is expected that take of Cook Inlet beluga whales, Mexico or WNP DPS humpback whales, or Western DPS Steller sea lions will be by harassment.

The ESA does not prohibit the take of threatened species unless special regulations have been promulgated, pursuant to ESA section 4(d), to promote the conservation of the species. Federal regulations promulgated pursuant to section 4(d) of the ESA extend the section 9 prohibitions to the take of Mexico DPS humpback whales (81 FR 62260; September 8, 2016) (50 CFR 223.213).

Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

Section 7(b)(4)(C) of the ESA provides that if an endangered or threatened marine mammal is involved, the taking must first be authorized by section 101(a)(5) of the MMPA. Accordingly, **the terms of this incidental take statement (ITS) and the exemption from section 9 of the ESA become effective only upon the issuance of MMPA authorization to take the marine mammals identified here**. Absent such authorization, this incidental take statement is inoperative.

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. NMFS Permits Division and USACE have a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, the POA must monitor and report on the progress of the action and its impact on the species as specified in the ITS (50 CFR 402.14(i)(4)). If NMFS Permits Division and USACE (1) fail to require the permit holder to adhere to the terms and conditions of the ITS through enforceable terms that are added to the authorization, and/or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

11.1 **Amount or Extent of Take**

Section 7 regulations require NMFS to estimate the number of individuals that may be taken by the proposed actions or utilize a surrogate (e.g., other species, habitat, or ecological conditions) if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR 402.14(i)(1); see also 80 FR 26832; May 11, 2015).

NMFS AKR is reasonably certain the proposed activities for the CTR project at the POA are likely to result in the incidental take of ESA-listed species by Level A and Level B harassment associated with noise from pile driving. The taking by serious injury or death is prohibited and will result in the modification, suspension, or revocation of the ITS. Table 23 lists the amount and timing of exempted take for this action. The method for estimating the number of listed species exposed to sound levels expected to result in Level A and Level B harassment is described in Section 6.2.

NMFS AKR expects that 618 instances of Level B harassment of Cook Inlet beluga whales may occur. NMFS AKR expects that 24 instances of harassment of humpback whales may occur, of which 11 percent of these would be from the listed Mexico DPS, and <1 percent from the listed WNP DPS. We expect two Level A takes and one Level B take for Mexico or WNP DPS humpback whale, and we will consider the ESA take limit to be exceeded if the MMPA-authorized limit of 17 Level A or 7 Level B takes of humpback whales is exceeded, as it is often impracticable to distinguish between humpback whale DPSs in the field. NMFS AKR expects that 29 instances of Level A harassment and 25 instances of Level B harassment of Western DPS Steller sea lions may occur.

Table 23. Incidental take of ESA-listed species exempted.

Species	Total Amount of Take		Duration Across which Take Will Occur
	Level A	Level B	
Cook Inlet beluga whale	0	618	6 years
Humpback whale Mexico and WNP DPS	2	1	
Western DPS Steller sea lion	29	25	

11.2 Effect of the Take

In Section 9 of this opinion, NMFS AKR determined that the level of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species.

Although the biological significance of the expected behavioral responses of Cook Inlet beluga whales, Mexico DPS humpback whales, WNP DPS humpback whales, and Western DPS Steller sea lions remains unknown, this consultation has assumed that exposure to disturbances associated with the POA CTR pile driving and construction activities might disrupt one or more behavioral patterns that are essential to an individual animal's life history. However, any behavioral responses of these whales and pinnipeds to major noise sources, and any associated disruptions, are not expected to measurably affect the reproduction, survival, or recovery of these species.

11.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take." (50 CFR 402.02). Failure to comply with RPMs (and the terms and conditions that implement them) may invalidate the take exemption and result in unauthorized take.

RPMs are distinct from the mitigation measures that are included in the proposed action (described in Section 2.1.2). We presume that the mitigation measures will be implemented as described in this opinion. The failure to do so will constitute a change to the action that may require reinitiation of consultation pursuant to 50 CFR 402.16.

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPM is necessary and appropriate to minimize or to monitor the incidental take of Cook Inlet beluga whales, Mexico and WNP DPS humpback whales, and Western DPS Steller sea lions resulting from the proposed action.

The NMFS Permits Division, USACE, and POA through the aforementioned Federal entities must monitor and report all authorized and unauthorized takes, and monitor and report the effectiveness of mitigation measures incorporated as part of the proposed action—the for the incidental taking of ESA-listed marine mammals pursuant to section 101(a)(5)(A) & (D) of the MMPA. In addition, they must submit a report to NMFS AKR that evaluates the mitigation measures and reports the results of the monitoring program.

11.4 **Terms and Conditions**

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. These terms and conditions are in addition to the mitigation measures included in the proposed action, as set forth in Section 2.1.2 of this opinion. The NMFS Permits Division and USACE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14(i)(4)).

Any taking that is in compliance with these terms and conditions is not prohibited under the ESA (50 CFR 402.14(i)(6)). As such, partial compliance with these terms and conditions may invalidate this take exemption and result in unauthorized, prohibited take under the ESA. If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the action may lapse.

These terms and conditions constitute no more than a minor change to the proposed action because they are consistent with the basic design of the proposed action.

To carry out the RPM, NMFS Permits Division, USACE, or POA through the aforementioned Federal entities must:

Provide NMFS AKR with written and photographic (if available) documentation of any effects of the proposed actions on listed marine mammals and implementation of the mitigation measures specified in Section 2.1.2 of this biological opinion.

12 **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

NMFS recommends the POA:

- Coordinate with NMFS AKR on outreach materials such as signage for placement at City of Anchorage owned coastal sites, e.g., the Ship Creek Small Boat Harbor and Point Woronzof, highlighting the endangered status of Cook Inlet beluga whales, the need to properly dispose of trash that may affect marine mammals, and advising people to maintain a distance of 100 yards from all marine mammals;
- Participate as a partner in the annual Belugas Count! event; and
- Participate in the Alaska Beluga Monitoring Program.

In order to keep NMFS AKR's Protected Resources Division informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the POA should notify NMFS AKR of any conservation recommendations they implement in their final action.

13 **REINITIATION OF CONSULTATION**

As provided in 50 CFR 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately (50 CFR 402.14(i)(5)).

14 **DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW**

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

14.1 **Utility**

This document records the results of an interagency consultation. The information presented in this document is useful to NMFS Permits Division, USACE, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/pr/biological-opinions/. The format and name adhere to conventional standards for style.

14.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

14.3 Objectivity

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR § 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

15 REFERENCES

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