APPENDIX H—ESA BIOLOGICAL ASSESSMENT—NMFS

National Marine Fisheries Service

Biological Assessment – Section 7

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TABLE OF CONTENTS

List of Tables

List of Figures

ACRONYMS AND ABBREVIATIONS

%	percent
μPa	microPascal
4MP	Marine Mammal Monitoring and Mitigation Plan
ac	acre(s)
ADEC	Alaska Department of Environmental Conservation
AHT	anchor-handling tug
AMSL	Above Mean Sea Level
ASA	Applied Science Associates
ATBA	Aleutian Islands Areas to be Avoided
BA	Biological Assessment
BMP	Best Management Practice(s)
BOEM	Bureau of Ocean and Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
cm	centimeter(s)
CWA	Clean Water Act
DA	Department of the Army
DEIS	Draft Environmental Impact Statement
DP	dynamic positioning
dB	decibel
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FR	Final Rule
ft	foot/feet
ft^3	cubic feet
gal	U.S. gallon
GOA	Gulf of Alaska
GT	gross tons
ha	hectare(s)
HDD	horizontal direct drilling
hr	hour
Hz	hertz
IHA	Incidental Harassment Authorization
IMO	International Maritime Organization
in	inch(s)
ITOPF	International Tank Owners Pollution Federation
kHz	kilohertz

km	kilometer(s)
km^2	square kilometer(s)
kt	knot(s)
L	liter
LOC	Letter of Concurrence
m	meter(s)
m^3	cubic meters
mg/L	milligrams per liter
mi	statute mile(s)
mi^2	square statute mile(s)
MHW	mean high water
MHWM	mean high water mark
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NRC	National Research Council
OHWM	ordinary high water mark
Owl Ridge	Owl Ridge Natural Resource Consultants, Inc.
PCE	primary constituent elements
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLP	Pebble Limited Partnership
PSO	Protected Species Observer(s)
PTS	permanent threshold shift
re	referenced at
RHA	Rivers and Harbors Act
rms	root mean square
ROV	remote operated vehicle
SEBS	Southeast Bering Sea
SPCC	spill prevention control and countermeasure
SPL	sound pressure level
TES	threatened and endangered species
TSS	total suspended solids
TTS	temporary threshold shift
ULSD	ultra-low sulfur diesel
U.S.	United States
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USDOT	U.S. Department of Transportation
VRP	Vessel Response Plan

1. INTRODUCTION

In December 2017, the Pebble Limited Partnership (PLP) submitted an application for a Department of the Army (DA) permit to discharge fill material into waters of the United States (U.S.) and for the construction of structures and work in navigable waters of the U.S. for the purpose of developing a copper-gold-molybdenum porphyry deposit (Pebble deposit). PLP proposes to develop the Pebble deposit as an open pit mine, with associated infrastructure (Project). The proposed Project is in Southwest Alaska near Iliamna Lake, primarily within the Lake and Peninsula Borough with a portion of the supporting infrastructure in the Kenai Peninsula Borough (Figure 1). PLP's application includes four primary components: a mine site, a port north of Diamond Point with a dredged access channel, a transportation corridor including an access road and concentrate and return water pipelines on the north side of Iliamna Lake, and a natural gas pipeline and fiber optic cable that cross Cook Inlet to Ursus Cove, cross the Ursus Peninsula, and then follow the road corridor to the mine site (Figure 1).

PLP's proposed activities that require DA authorization under Section 404 of the Clean Water Act (CWA) include the temporary and permanent discharge of dredged or fill material into waters of the U.S. necessary to construct:

- A mine site at the Pebble deposit.
- A port site and dredged access channel north of Diamond Point (Diamond Point port).
- A road connecting the mine site and Diamond Point port along the north side of Iliamna Lake.
- Material sites adjacent to the road.
- A natural gas pipeline and fiber optic cable between Kenai Peninsula and the mine site.
- Concentrate and return water pipelines between the mine site and Diamond Point port.

Structures and work that require DA authorization under Section 10 of the Rivers and Harbors Act (RHA) include:

- o Structures and work in tidal waters below the mean-high water (MHW) of Cook Inlet:
    - o Constructing the Diamond Point port causeway/marine jetty, and access road (Iliamna Bay).
    - o Dredging the shallow port site approach out to depth adequate for year-round barge access.
    - o Installing one spread anchor mooring system at an offshore lightering station in Iniskin Bay.
    - o Installing a natural gas pipeline and fiber optic cable across Cook Inlet.

Additional required federal authorizations for the Project include

- Bureau of Safety and Environmental Enforcement (BSEE) authorization for the pipeline right-of-way in Federal waters.

- U.S. Coast Guard (USCG) authorization for bridges across the Newhalen River and Iliamna River under Title 33 Navigation and Navigable Waters, Subchapter J, Bridges (33 Code of Federal Regulations [CFR] Parts 114 through 118) (Figure 1).

The purpose of this biological assessment (BA) is to evaluate the potential effects to threatened and endangered species (TES) and critical habitat that would be caused by the proposed activities and structures requiring federal authorization (the 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. Along with the DA, both BSEE and USCG intend to use this BA to meet each agency's consultation requirements under the Endangered Species Act of 1973 (ESA).

This BA focuses on the marine components of the Project because no TES or critical habitat have been documented in the terrestrial portions of the Project. Terrestrial components of the Project, which include the mine site, terrestrial portion of the transportation and natural gas pipeline corridors, and compressor station on the Kenai Peninsula, are not discussed below because TES do not have ranges that include these terrestrial areas. In particular, neither TES nor critical habitat occur around the proposed Newhalen or Iliamna river crossings for the transportation and natural gas pipeline corridors.

Project construction and operation of the mine would require barging of fuel and other supplies into the proposed Diamond Point port. Project operations also include the transport of copper-gold-molybdenum concentrate (concentrate) from the port to refineries located in Asia. Concentrate would be transported from the port using barges to the planned offshore lightering station and then transferred onto bulk carriers (lightered) for transport to global processing facilities. No airstrip would be constructed at the port site. Instead, the existing airstrip near Pedro Bay may be used during initial construction activities.

Construction would last for approximately four years during which the facilities would be built. The operations period includes an approximate 20-year period production phase, followed by reclamation and closure, and post-closure management activities that extend for many years thereafter (Table 1).

PLP's proposed activities, including construction, operation, and reclamation activities, could encounter species listed under the ESA. Nine species (humpback whales, fin whales, North Pacific right whales, sperm whales, sei whales, blue whales, gray whales, beluga whales, and Steller sea lions) under ESA jurisdiction of the National Marine Fisheries Service (NMFS) are evaluated in this BA on the potential and magnitude of effect of activities to each of the listed species. This BA also provides substantial detail on the listed species abundance, distribution, feeding, reproduction, natural mortality, threats, acoustical ecology, designated critical habitat, and use of the Action Area, all of which are necessary to conduct the detailed effects analysis. Additional species under ESA jurisdiction of the U.S. Fish and Wildlife Service (USFWS) are addressed in a separate BA.

Table 1. Summary of Project phases.

Phase	Activity	Absolute Year (Y)	Construction Year (CY)	Operations Year (OY)	Closure Year (CLY)
Construction (4 years)	Construction	Y1 – Y4	CY1 – CY4	-	-
	Commissioning	Y4	CY4 (occurs in parallel with final construction)	-	-
	Pre-production mining/dewatering	Y3 – Y4	CY3 – CY4 (occurs in parallel with construction)	-	-
Operations (20 years)	Operations	Y5 – Y24	-	OY1 – OY20	
Reclamation and Closure (20 years)	Closure	Y25 – Y45	-	-	CLY1 – CLY20
Post-closure (perpetuity)	Water treatment and monitoring	Y46 – perpetuity	-	-	CLY21 – perpetuity

2. PROJECT DESCRIPTION AND ACTION AREA

Detailed descriptions of PLP's proposed Project, including components and activities, are described in *The Pebble Project: Project Description* (PLP 2020)[1] and in the *Pebble Project Preliminary Final Environmental Impact Statement* (PFEIS), section 2.2.7, Alternative 3–North Road Only (USACE 2020). Project components and activities that intersect listed species ranges or critical habitat are identified in Table 2 and described in sections 2.1 through 2.3. The Project's Action Area is described in Section 2.4.

Table 2. Project components and activities by listed species range or critical habitat.

Project Components and Activities	Overlaps Listed Species Range or Critical Habitat
Construction Phase	
Mine site	No
Mine access road from the mine site to Iliamna Bay, including collocated natural gas pipeline, fiber optic cable, concentrate pipeline, and return water pipeline.	No
Mine access road along Iliamna Bay, including collocated natural gas pipeline, fiber optic cable, concentrate pipeline, and return water pipeline	Yes
Newhalen River bridge	No
Iliamna River bridge	No
Dredging of shallow approach to Diamond Point port	Yes
Diamond Point port	Yes
Lightering station	Yes
Natural gas pipeline and fiber optic cable (subsea)	Yes
Transport (overland)	No
Transport (maritime)	Yes
Use of existing airstrip at Pedro Bay	No
Operations Phase	
Mine	No
Transport (overland)	No
Transport (maritime)	Yes
Diamond Point port	Yes
Maintenance dredging of shallow approach to Diamond Point port	Yes
Pipeline maintenance and repair	Yes
Lightering operations	Yes

[1] www.pebbleprojecteis/documents

Project Components and Activities	Overlaps Listed Species Range or Critical Habitat
Reclamation and Closure Phase	
Mine site	No
Transport (overland)	No
Transport (maritime)	Yes
Diamond Point port	Yes
Maintenance dredging of shallow approach to Diamond Point port	Yes
Pipeline maintenance and repair (or pipeline decommissioning)	Yes

2.1. Construction Phase

Construction components and activities that overlap with listed species ranges or critical habitat include dredging of the navigational channel to Diamond Point port, construction of the Diamond Point port, construction of the port access road (including collocated natural gas pipeline, fiber optic cable, and concentrate and return water pipelines) along the western shore of Iliamna Bay to the Diamond Point port, installation of a lightering station, construction of the subsea portion of the natural gas pipeline and fiber optic cable, and maritime transport.

2.1.1. Diamond Point Port

The Diamond Point port would be located near the mouth of Iliamna Bay on the western shore of Cook Inlet approximately 165 mi (266 km) southwest of Anchorage and approximately 75 mi (121 km) west of Homer. The port (21.7 acres [ac], 8.8 hectare [ha]) would be operated year-round (Figure 2, Figure 3) and would include shore-based and maritime facilities for the shipment of concentrate, freight, and fuel for the project. One offshore lightering station near the entrance to Iniskin Bay would be used to lighter the concentrate to moored Handysize bulk carriers.

The shore-based facilities (15.5 ac [6.3 ha]) include the port site with separate facilities for the receipt and storage of containerized freight, and an elevated conveyor for the loading of concentrate. Other facilities at the port site would include fuel storage and transfer facilities, natural gas power generation and distribution facilities, a concentrate dewatering plant, a communication tower, maintenance facilities, break bulk storage for large equipment or other non-containerized supplies (e.g., large truck tires), a container storage area, a specialized storage facility for hazardous materials as required to maintain compliance with all applicable regulations, employee accommodations, parking, offices, and a domestic wastewater treatment plant for the employee accommodations. The wastewater would be treated and discharged to a subsurface leach field. An offtake from the natural gas pipeline (discussed below) would distribute natural gas to the port power generation facility. Dredge spoils will be stored in two bermed facilities located in uplands adjacent to the mine access road (Figure 2). Runoff water from the dredge spoils will pass through settling ponds and then into a drainage ditch paralleling the access road before flowing into Iliamna Bay. The shore-based complex would be constructed on an engineered fill pad at an elevation of 40 feet (ft) (12.2 meters [m]) to address tidal surge from major storms and potential tsunamis. The communications tower on the onshore pad would be approximately 100 to 150 ft (30.5 m to 45.7 m) tall and constructed in a monopole tower arrangement. The tower would not be guyed to minimize potential collision risk to avian species. In accordance with

FAA and USFWS guidelines, the tower would be marked with high visibility paint bands and may include flashing red lights at the top if required. Navigational aids for the port approach will include shore-based range structures on the jetty and road and electronically transmitted (virtual) aids to navigation.

The marine component (6.2 ac [2.5 ha]) includes a caisson-supported access causeway, marine jetty, and concentrate bulk transfer barge loader. The shallow approach at the port site would require dredging to create a navigation channel and a turning/mooring basin (71.4 ac [28.9 ha]) to ensure year-round access by supply barges. The concentrate loader will include a series of three caissons placed within the dredged basin to provide mooring and loading for the concentrate lighter barges. A gantry will support an enclosed conveyor from the jetty to a barge loader mounted on the caissons.

The natural gas pipeline and fiber optic cable join the transportation corridor at the Diamond Point port shore-based facilities, where offtakes would provide natural gas for power generation and data connectivity. From there the natural gas pipeline and fiber optic cable along with a concentrate slurry pipeline and a return water pipeline follow the access road to the mine site.

Design and operation of the Diamond Point port would comply with all applicable federal and State of Alaska regulations. Key regulatory requirements include:

- Vessel inspections, mariner training, safety equipment, and other shipping requirements in Title 46 CFR.
- Requirements for facilities and vessels that engage in oil (e.g., diesel fuel) and hazardous material transfers and spill response measures in Title 33 CFR parts 154-158.
- Provisions for handling of dangerous cargo at ports in Title 33 CFR part 126, including the general provisions specific to ammonium nitrate in part 126.28.
- Hazardous materials transport requirements including packing and container requirements, emergency response, training, and security plans in Title 49 CFR parts 171-180.
- Hazardous waste disposal and transport requirements including waste tracking, emergency response and personnel training requirements in Title 40 CFR parts 260-265.
- Pipeline safety requirements in Title 49 CFR parts 186-189.
- Spill prevention control measures including requirements for the preparation of Spill Prevention Control and Countermeasure (SPCC) Plans detailing tank inspections, personnel training, and oil spill response requirements in Title 40 CFR part 112.
- Spill prevention and response requirements for fuel storage facilities in Title 18 of the Alaska Administrative Code (AAC) 75 that require preparation of Oil Discharge Prevention Contingency Plans (ODPC) for the port bulk fuel storage tanks and certain tank and non-tank vessels.
- Wastewater disposal regulations Title 18 AAC 72 would require wastewater discharges at the port to obtain an Alaska Pollutant Discharge Elimination System (APDES) permit, in accordance with the water quality standards in Title 18 AAC 70, and wastewater operator training requirements in Title 18 AAC 74.

Consistent with the above and other applicable regulatory requirements which may include international standards and regulations, the Project would implement systems for proper screening, acceptance, storage, and transport of dangerous cargo that require:

- Validating dangerous goods manifests for hazardous materials whether in transit, loading or unloading to and from ships, including proper shipping name, hazard class, United Nations number, and packing group.
- Training port staff in relevant aspects of dangerous goods management, including screening, acceptance, and handling/transfer/storage/emergency response of dangerous goods at the port.
- Establishing segregated and access-controlled storage areas for dangerous goods with emergency response procedures and equipment to ensure collection and/or containment of accidental releases.

A list of permit authorizations that would be required by the Pebble Project are included in Appendix E of the PFEIS, Table E-1 (USACE 2020).

2.1.1.1. Navigation Channel and Basin

The shallow approach to the Diamond Point port site would require dredging for construction of a navigation channel and turning basin (71.4 ac [28.9 ha]). The channel will be approximately 2.9 mi (4.7 km) long and 300 ft (91.4) wide (3 times the maximum expected barge width), while the basin will incorporate an area of approximately 1,100 by 800 ft (335.3 m by 243.8 m) (Figure 2). The channel and basin would be dredged to -18 ft (-5.5 m) mean lower low water (MLLW) to ensure year-round access under all tidal conditions by supply barges and other vessels requiring 15 ft (4.6 m) of draft (Figure 4). The target depth also provides for accumulated sedimentation between forecast maintenance dredging (estimated at 20 inches over 5 years) and over depth excavation.

A 1994 USACE dredging study was completed for the evaluation of a dredged access channel and port facility at Williamsport. PLP completed a bathymetric survey of the Iliamna Bay area in 2008. The information from the USACE report and the bathymetric survey data were used to inform the dredge planning and design. Based on available geophysical data, bedrock in the vicinity of the dredged channel and basin occurs at depths greater than 100 ft (30.5 m), well below the proposed dredge depth. Sediments are expected to be composed of greater than 70 percent fines, with the remainder consisting of sand and gravel. Dredge slopes of 4H:1V are proposed to address sediment stability and the potential for seismic induced slumping.

Dredging would be done using a barge mounted cutterhead suction dredge. The total dredge volume would be 1,100,000 yd^3 (841,010 m^3). The dredged material would be pumped directly to shore from the dredge barge or placed on barges and transported to shore for storage in the bermed facilities on uplands. Consolidation and runoff water from the dredge material stockpiles would be channeled into a sediment pond and suspended sediments would be allowed to settle before discharge to Iliamna Bay via a drainage ditch paralleling the access road. Boulders encountered during dredging would be removed using a grab bucket or a cable net placed by divers and transported to shore for placement in the stockpiles or used in construction. Dredging operations are expected to commence in May of the second year of construction (CY2) and would last approximately 4 to 6 months.

Dredged channels are prone to sedimentation and the Diamond Point port navigation channel and basin would require maintenance dredging to ensure uninterrupted year-round access by supply barges and other vessels. Maintenance dredging (estimated at 20 in [50.8 cm]) is estimated to be required every 5 years and is expected to total 700,000 yd^3 (535,188 m^3) over twenty years (four times). Maintenance dredging would be completed using the same techniques and sediment storage locations used for construction of the channel. Maintenance dredging operations would be conducted during the early summer and are expected to last 3 to 4 weeks.

2.1.1.2. Diamond Point Port Marine Components

The marine components include a causeway extending out to a marine jetty located in the 18-foot deep dredged basin. The access causeway, marine jetty, and concentrate bulk loader design include the use of caissons for support (Figure 2). Caissons are pre-cast concrete open-top rectangular prisms with a flat bottom (60 ft x 60 ft and 120 ft x 60 ft [18.3 m x 18.3 m and 36.6 m x 18.3 m]) that would be lowered onto the seabed and then filled with quarried material to act as supports for the causeway and jetty. The use of caissons allows for the unimpeded flow of water through and around the structures. The jetty will be constructed along the northern and western limits of the basin and consist of 120 x 60-foot concrete caissons 58 ft (17.7 m) high that would be separated by 60 ft (18.3 m). The marine jetty caissons will be covered with a concrete deck. Fuel and freight barges will be moored to the jetty for loading and unloading.

In addition to the jetty, a series of three caissons (60 ft x 60 ft [18.3 m x 18.3 m]) will be placed within the dredged basin to provide mooring and loading for the concentrate lighter barges. A gantry will support an enclosed conveyor from the jetty to a barge loader mounted on the caissons. A floating dock, on the jetty but separate from the cargo handling berths, will be provided for ice-breaking tug moorage. The causeway will also be constructed with concrete caissons (60 ft x 60 ft [18.3 m x 18.3 m]) to support a concrete deck.

The causeway, marine jetty, and bulk loader cover an area of 6.2 ac (2.5 ha) (Figure 3). This includes approximately 3.4 ac (1.4 ha) of permanent fill below the MHW from installation of the caissons, and 2.8 ac (1.1 ha) of over-water structures. The footprint for the jetty structures would be dredged to -18 ft (-5.5 m) MLLW coincident with the dredging of the navigation channel and basin, bringing the total dredged area for construction to 78.8 ac (31.9 ha).

Caisson installation requires excavating the footprint up to 5 ft (1.5 m) below the dredged basin and leveling the seabed before caisson placement. Once the footprint is prepared, caissons would be floated into place with a tugboat at high tide and then seated on the prepared seabed on the falling tide or slowly lowered by pumping water into the caisson. Cranes may be used to place caissons in shallower water. Once set in place, the caissons would be filled with coarse material from the dredging and additional quarried material of a size that would achieve proper compaction when filled to avoid settlement over time. The additional fill material would be sourced from onshore material sites. Fill would be transported from shore to the caissons using a barge. Initially, only enough fill would be placed into the caisson to achieve proper seating, avoiding displacement and overflow of any water within the caisson. Fill materials would be stored temporarily on a barge moored adjacent to the construction area. Any water accumulated within the caisson would be pumped out to avoid saturation in the top fill layers and, if necessary, run through tanks on a barge for sediment settlement before discharge into the marine environment.

Pre-cast bridge beams (T-sections) would be placed on the caissons to create the main service deck and the access trestle. These pre-cast beams would then be tied together with rebar and topped with a cast-in-place concrete deck for the final surface. The caissons at the jetty area would be placed on the dredged seabed at depths of approximately -23 ft (-7 m) MLLW and extend to an elevation of +35 ft (+10.5 m) MLLW, or 58 ft (17.7 m) in total height. Caissons would be progressively shorter closer to shore. The concentrate conveyor on the marine facility would have a maximum height of 68 ft (20.7 m) MLLW (Figure 3). For the shore transition, concrete pedestals would be constructed from shore to support the final bridge beams leading to the causeway. At the dock area, the caissons would be used to mount the fendering system and barge ramp equipment for the marine operations. Dredged areas between the caissons would be allowed to fill naturally over time.

Construction of the dock and causeway would take place following completion of the dredging and would occur in the summer/fall of Y2 of construction. The conveyor and fuel unloading pipeline would be constructed on the causeway and dock deck.

2.1.2. Lightering Station

One offshore lightering station at the entrance to Iniskin Bay would be used to lighter the concentrate to moored bulk carriers (Figure 2). The lightering location in Iniskin Bay is protected from wave action, reducing the heave of anchored vessels.

Installation of the lightering station would require the placement of anchors for mooring bulk carriers. The proposed mooring structure, which requires DA authorization, includes a 2,300 ft x 1,700 ft (700 m x 520 m) spread anchor mooring system in approximately 50 ft to 70 ft (15.2 m to 21.4 m) MLLW of water, consisting of 10 anchors and 6 mooring buoys (Figure 4). To prevent excessive drag and swinging of the anchor chains an arrangement similar to that shown in Figure 6 would be utilized. A positioning (sinker mass) anchor would be set on the seafloor with only enough slack in the chain to allow the buoy to move closer to the main anchor and minimize sagging of the main anchor chain (PLP 2018).

Each 10-ft (3.0 m) diameter mooring buoy would be tethered by lengths of 2-in (5.1 cm) diameter chain attached to three gravity anchors; first to a station keeping mass anchor, typically a 3.3 ft x 3.3 ft x 3.3 ft (1 m x 1 m x 1 m) concrete block, and secondly to two large mass anchors connected by chain equalizers (Figure 6). The anchor chain length would be approximately 500 ft (152 m). The typical sinker mass would be cast with steel punchings, or other heavy scrap to increase the density. The typical large mass anchor is a rock and concrete filled 40 ft x 8 ft x 8 ft (12.2 m x 2.4 m x 2.4 m) shipping container that is lowered to the seafloor. The 40-ft (12.1 m) shipping container is a sacrificial form that is used to cast the solid concrete/graded rock block that serves as the anchor weight. The anchor chain would be deeply imbedded into the cast concrete and not attached to the container itself. If the final design criteria call for additional mass, additional dense material would be cast into the block in a similar fashion to the mass sinker. Placement of the anchors would result in less than 0.1 ac (<0.1 ha) of fill at the lightering station (PLP 2018).

Construction of each anchor would require approximately 1 day of work at the site. It would take 10 to 12 days to establish all 10 anchors at the lightering station. The work would be performed from a barge with support tugs and a supply vessel. Placement of the mass anchors onto the seafloor is not expected to require modification of the bottom surface; re-suspension of sediments would therefore be minimal.

2.1.3. Access Road to Diamond Point Port (Iliamna Bay)

A double-lane road would connect the mine site to the Diamond Point port in Iliamna Bay (Figure 1). Since Iliamna Bay is bordered by mountains that rise very steeply from tidewater, the road route would be constructed at the toe of the mountain slope within the intertidal zone (Figure 2). This design approach is dictated by the steepness of the mountain slopes and the requirement to avoid avalanches and rockslides. Mass rock excavation is required, as is placement of rock select fill and armor rock protection in the intertidal zone (Figure 7). Select rock fill would consist of durable, coarse, free draining material to minimize sedimentation. Roughly 1.7 miles (mi) (2.7 kilometers [km]) of the road in Iliamna Bay would include construction in the intertidal zone. Placement of fill activities would affect 26.3 ac (10.6 ha) of intertidal zone, with 19.1 ac (7.7 ha) of permanent impacts from the placement of fill, and 7.2 ac (2.9 ha) of temporary impacts. Temporary impacts include areas abutting fill placement sites that may be affected by construction activities (e.g. ground scarring from equipment operation, dust/sediment deposition) but are expected to recover once the construction activity ceases.

Average high tide in Iliamna Bay is approximately +12 ft (3.7 m). For this reason, road embankments in the intertidal zone would be constructed to a minimum elevation of 25 ft (7.6 m) above mean sea level (AMSL). The west side of the embankment generally would be at or above the MHW mark and the east side would be in the tidal zone. Drainage and equalization culverts would be installed throughout this road segment.

The concentrate pipeline, return water pipeline, natural gas pipeline, and fiber optic cable installed between the port site and the mine site would be incorporated in a single trench at the road shoulder on the inland side of the road. The concentrate pipeline (6.25-inch-diameter) would transport a mixture of 55 percent concentrate and 45 percent water by mass from the mine site to the port. At the Diamond Point port, the concentrate slurry would be dewatered, and the water returned to the mine site via an 8-inch diameter return water pipeline.

Construction would start with the placement of select, free draining, coarse rock fill directly on the sandy material in the intertidal zone to an elevation above the high tide line. This fill work can mostly be completed when water levels are below the minimum elevation of the surface on which rock is being placed. Armor rock would be placed as the final embankment elevation of 25 ft (7.6 m) AMSL is achieved. Installation of the pipelines would be completed after the road embankment height attains pipeline ditch elevation. Equalization culverts would be installed during embankment construction to maintain cross drainage in the few locations where the full embankment footprint is within the intertidal zone and in natural drainages. Blasting at the bedrock cuts along the road alignment would all be above the high tide line and would be done to coincide with the low tide cycle when the bay is partially dry.

The access road would be constructed using typical construction equipment (e.g., dump trucks, dozers, graders, and excavators). This section of the access road would be constructed in June Y1 through September Y1.

2.1.4. Natural Gas Pipeline (Subsea)

The primary energy source for the Project would be natural gas supplied via a 163-mi (262-km) long, 12-in (30.5 cm) diameter pipeline originating near Anchor Point on the Kenai Peninsula (Figure 8). From Anchor Point the natural gas pipeline would traverse Cook Inlet in a general southwest direction and come ashore at Ursus Cove (74.3 mi [119.7 km]). From Ursus Cove, the pipeline would be routed north, running overland to Cottonwood Bay. At Cottonwood Bay the natural gas pipeline route would cross the head of the bay and come ashore at the Diamond Point port (3.6 mi [5.8 km]). From there the pipeline would be buried in a trench that follows the road alignment (Figure 8).

The pipeline would be buried over the entire Cook Inlet traverse. The pipeline burial depth and thickness of cover would vary depending on conditions. Typical trench sections are shown in Figure 9 and Figure 10. Pipeline installation trenching requirements, the associated footprints, ground conditions, and suitable trenching techniques are shown in Table 3. Trenching techniques may include using an extended reach backhoe or clamshell dredge in shallow waters near the shore transition and either a mechanical or jet trencher in deeper waters. Trenching and pipeline laying might also involve a pipeline trenching plough if it is determined during detailed design that a plough might be suitable for use in lower Cook Inlet (based on substrate conditions). However, at this time, due to the unknown suitability of ploughs, they are not assumed to be a primary option and have not been included in Table 3. If ploughing can be used, the shore approaches would still need to be excavated using other means, such as conventional long-reach backhoe excavators or a clamshell dredge. All equipment would work from barges up to 240 ft long by 60 ft wide (73.2 m x 18.3 m). The plough option would require a marine support vessel capable of supporting a large crane or A-frame necessary to deploy and recover the plough and the power to pull the plough through the lower Cook Inlet seafloor sediments.

Material would be excavated, placed to the side of the trench and, following installation of the pipe, returned to the trench with construction equipment and through the natural tidal process (Figure 9, Figure 10). To provide for on-bottom stability and pipe protection the entire alignment is required to be backfilled after pipe installation. Material not naturally backfilled by tidal processes would be replaced using an extended reach backhoe or clamshell dredge.

The Anchor Point shore transition would use shore-based horizontal directional drilling (HDD) out to approximately 12 ft (3.7 m) of water depth, estimated to be approximately 200 ft (61 m) horizontal distance beyond MLLW. The drill rig and other equipment necessary for the HDD installation would be located onshore, approximately 1,600 ft (488 m) inland from and 200 ft (61 m) above MLLW (Figure 11). Due to the onshore location of the HDD equipment and the prevalence of sand, generally a very poor conductor of vibrations, the HDD activities would not generate underwater noise levels that exceed harassment levels. A jack-up rig might be deployed to complete the marine exit portion of the HDD if required as a result of final design and state permitting. For the Cottonwood Bay crossing, the pipeline would be installed in a trench using a barge-mounted excavator in inundated areas, or low ground pressure equipment and mats in tidal areas. The pipeline would come ashore at Diamond Point port, where natural gas would be supplied to the port site power station and for facility heating.

PLP estimated that approximately 569 ac (230.3 ha) of marine substrate would be temporarily disturbed from trenching activities between Anchor Point and Ursus Cove. Additionally, 69.1 ac (28 ha) of marine substrate would be disturbed within the intertidal zone in the head of Cottonwood Bay. This does not include potential seabed disturbance from anchor placement which is discussed below.

Table 3. Pipeline trenching requirements and methodologies.

Range from Origin mi (km)[1]		Avg. Water Depth ft (m)	Min. Cover Depth in. (m)	Total Impact Width ft (m)	General Soil Type (Sand)	Relative Density (%)	Extended Reach Backhoe	Clamshell Dredge	Mechanical Trencher	Jet Trencher
Shore Transition (Anchor Point)	0.6 (1.0)	22.6 (6.9)	39.4 (1.0)	90.6 (27.6)	Medium to Coarse	50		✓[2]	✓	✓
0.6 (1.0)	3.7 (6.0)	63.3 (19.3)	19.7 (0.5)	68.2 (20.8)	Dense	50		✓	✓	✓
3.7 (6.0)	9.0 (14.5)	108.3 (33.0)	19.7 (0.5)	68.2 (20.8)	Dense	55		✓	✓	✓
9.0 (14.5)	13.7 (22.0)	137.1 (41.8)	19.7 (0.5)	68.2 (20.8)	Dense	55		Water depth may limit the use of clamshell dredgers	✓	✓
13.7 (22.0)	17.1 (27.5)	196.9 (60.0)	19.7 (0.5)	68.2 (20.8)	Dense	50			✓	✓
17.1 (27.5)	22.0 (35.5)	247.7 (75.5)	19.7 (0.5)	68.2 (20.8)	Dense	50			✓	✓
22.0 (35.5)	28.9 (46.5)	249.7 (76.1)	7.9 (0.2)	56.7 (17.3)	Medium	45			✓	✓
28.9 (46.5)	33.5 (54.0)	182.1 ft (55.5)	7.9 (0.2)	56.7 (17.3)	Dense	45			✓	✓
33.5 (54.0)	65.6 (105.6)	109.3 (33.3)	7.9 (0.2)	56.7 (17.3)	Medium	~45		✓	✓	✓
65.6 (105.6)	69.9 (112.6)	45.6 (13.9)	19.7 (0.5)	68.1 (20.8)	Loose	~30		✓	✓	✓
69.9 (112.6)	72.1 (116.1)	29.5 (9.0)	39.4 (1.0)	90.6 (27.6)	Loose	~30		✓	✓	✓
72.1 (116.1)	73.6 (118.5)	21.7 (6.6)	39.4 (1.0)	90.6 (27.6)	Clay	N/A[3]		✓	✓	✓
73.6 (118.5)	74.1 (119.3)	18.4 (5.6)	39.4 (1.0)	90.6 (27.6)	Loose	~30		✓	✓	✓
74.1 (119.3)	74.3 (119.7)	9.8 (3.0)	47.2 (1.2)	101.7 (31.0)	Dense	~65		✓	✓	✓
79.9 (128.7)	83.0 (133.5)	Tidal 0-15 (0-4.5)	59.1 (1.5)	175.0 (53.5)	N/A	N/A	✓			

[1] Trench Burial Mode Limits shown in Figure 12
[2] ✓= Trenching methodology suitable for use
[3] N/A = Not Available

The pipe would be laid using a conventional pipe-lay barge, a non-motorized barge that is moved by picking up and resetting the 8 to 12 anchors used to hold it in place while pipe is welded together and laid over the back of the barge. Anchor-handling tugs (AHTs) using bow-thrusters would be used to reposition the anchors that keep the barge properly positioned and moving along. Anchors would be 5 to 15 tons (4.5 to 13.6 tonnes), depending on vessel size, and typically would be relocated 2,500 ft to 3,000 ft (762 m to 914 m) with each move. Anchor relocations would occur multiple times per day (estimated average of 4 to 8 per day), including the need to account for changes in tides and currents (e.g., short distance relocations at slack tide to allow the vessel to prepare for the change in current direction). Anchor placement may extend approximately 650 ft to 4,101 ft (198 m to 1,250 m) on either side of the pipeline centerline depending on depth. Sediment disturbance may occur as a result of anchor placement, chain anchor drag, and chain sweep; thus, PLP has estimated a 48,933 ac (19,802 ha) anchor placement corridor (Figure 12). However, not all areas inside this corridor would be disturbed by anchor chain drag or chain sweep. In comparison, the Alaska LNG Project Draft Environmental Impact Statement estimated 5,039 ac (2,039 ha) of potential anchor chain drag and anchor sweep from proposed construction of a 27.3-mile (43.9 km) long pipeline in upper Cook Inlet (FERC 2019). Cook Inlet subsea pipeline construction would occur in the months of June through August of a single year and would take approximately 30 to 40 days to install the pipe, plus an additional 30 to 60 days of pre- and post-pipe laying activities. Equipment and vessels required may include:

- One anchored pipe-laying barge with an 8- to 12-point mooring system.
- Two anchor and barge handling vessels.
- Two tug and barge combinations for pipe haul from shore to the lay barge.
- One survey vessel for pre- and post-lay survey work and touch down monitoring with a remotely operated vehicle (ROV).
- One rock dump and construction support vessel (diving and ROV) for span crossing mitigation as required.
- One cutterhead suction dredge and/or clamshell dredge for marine trenching, as needed.
- One crew boat and supply vessel for moving personnel and equipment.
- One ploughing vessel if ploughing is used.

The pipeline would include a cathodic protection system with 195.4-pound (88.6 kilogram) aluminum-zinc anodes placed every 240 ft (73 m), or every sixth joint, along the pipeline. Anode half shells would be clamped centrally on the pipe with overlapping fixing lugs fillet welded together at each anode location. Neoprene liners, felt pads, or similar may be placed between the anode and pipe external anti-corrosion coating to prevent damage to the coating. The anode electrical connection to the pipe would be completed by removing an area of external anti-corrosion coating from the pipeline (one per anode half shell bonding cable), pin brazing the electrical bonding cables, and then repairing the pipe coating using a liquid epoxy repair kit or equivalent. The exposed pipeline surface would be wire brushed prior to making the cable connection. Any noise generated by the anode attachment operation would be masked by that of the overall pipelay operation.

During the pipeline laying operation, a suite of equipment would be deployed that generate continuous underwater noise exceeding 120 decibel (dB) threshold level for disturbance (Level B) of marine mammals

(Table 4). Because individual equipment operation varies in time and location, and occurs simultaneously with other equipment, the operation should be considered in the context of a single "layout" with impact calculations based on the loudest noise source. This is the approach that was taken by NMFS (2018a) in their assessment of Harvest Alaska's 2018 Cook Inlet Pipeline Cross Inlet Extension Project (CIPL), a pipeline project very similar to this proposed Project. This approach and the resultant calculated area of impact relative to determination of the Action Area is discussed further in Section 2.4.4.

Table 4. Representative underwater noise levels from proposed marine construction activity.

Equipment/Activity	Sound Energy at Source (dB re 1 µPa rms @ 1 m)	Distance to Level B 120 dB Disturbance Threshold (based on spherical spreading)	Source
Cutter suction dredge	175.0	1,844 ft (562 m)	Reine et al. (2012b, 2014a)
Cutter suction dredge	178.0	2,605 ft (794 m)	Greene (1987)
Cutter suction dredge	167.0	735 ft (224 m)	Greene (1987)
Trailing hopper suction dredge	171.0	1,165 ft (355 m)	Reine et al. (2014b)
Trailing hopper suction dredge	161.3	381 ft (116 m)	Reine et al. (2014b)
Trailing hopper suction dredge	161.2	377 ft (115 m)	Reine et al. (2014b)
Clamshell/bucket dredge (bottom strike)	179.4	66 ft (20 m)[1]	Dickerson et al. (2001), Reine et al. (2012a, 2014a)
Clamshell/bucket dredging (scoop)	146.0	66 ft (20 m)	Dickerson et al. (2001), Reine et al. (2012a, 2014a)
Winching in/out[1]	149.0	350 ft (107 m)	Dickerson et al. (2001)
Barge loading	166.2	669 ft (204 m)	Reine et al. (2012a)
Emptying barge at placement site	158.7	282 ft (86 m)	Dickerson et al. (2001)
Tugboat anchor handling	170.0	1.7 mi (2.7 km)[2]	NMFS (2018a)

[1] Bottom strike considered an impulsive noise source. Distance calculated to the 160-dB threshold.
[2] Distance used by NMFS in impact assessment for CIPL (based on Warner et al. 2014).

2.1.5. Fiber Optic Cable (Subsea)

A fiber optic cable would be installed in conjunction with the natural gas pipeline. The fiber optic cable would be installed adjacent to or bundled with the natural gas pipeline during the same construction event. Alternatively, it is possible that the fiber optic cable would be laid separately and adjacent to the pipeline (although it would occur within the same work period as the pipeline lay). The proposed method for a separate cable lay would be to use a tug or vessel of similar size to the pipeline construction vessels. A separate HDD would not be conducted to transition the cable to shore, but rather the cable would be bundled with the pipeline to utilize the HDD tunnel for both pipe and cable (Figure 8).

2.1.6. Maritime Transport

During the 4-year construction period, about 100 barge loads (25 per year) of construction equipment, materials, and supplies would be delivered to the Diamond Point port from west coast ports. Initially deliveries would occur only during the summer open water seasons. However, during the later years of construction barge deliveries would occur year-round.

In general, marine transport during construction would traverse established maritime routes on the Pacific Ocean from west coast ports and cross lower Cook Inlet. During unfavorable sea conditions, however, barges may opt for a more coastal route through Southeast Alaska and Gulf of Alaska (GOA) waters. Within lower Cook Inlet, vessel traffic between Diamond Point port and Nikiski port is also possible, depending on the origin of vessels available at the time and preferences of third-party freight companies.

PLP would contract with established third-party freight companies that operate tugs and barges between Alaska and the West Coast for the transport of all materials and supplies to the Diamond Point port. PLP would not own or operate the vessels transporting the materials and supplies.

2.2. Operational Phase

Operational activities that intersect with listed species ranges or critical habitat include maritime operations associated with the transport of Project supplies and concentrate, and natural gas pipeline maintenance.

2.2.1. Diamond Point Port Maintenance Dredging

Dredged channels are prone to sedimentation and the Diamond Point port navigation channel and basin (71.4 ac [28.9 ha]) would require maintenance dredging to ensure uninterrupted year-round access by supply barges and other vessels with a 15-ft (4.6 m) draft. The frequency of required maintenance dredging is estimated to be every 5 years. Maintenance dredging would be completed using the same techniques and sediment storage locations described in Section 2.1.1.1. Maintenance dredging operations would be conducted during the summer and would last 3 to 4 weeks.

2.2.2. Lightering Operations and Maritime Transport

After construction is complete, PLP maritime transport needs would result in an increase in the number of vessels that transit in lower Cook Inlet and established maritime vessel routes between Cook Inlet and either West Coast ports or East Asia (Figure 13).

Maritime transport during the operational phase of the Project would consist of barging mine supplies to Diamond Point port, including reagents, fuel, consumables, and general cargo and barge transport of concentrate to the lightering station where the concentrate would be transferred to bulk carrier ships for transport to out-of-state smelters. A summary of expected vessel traffic is shown in Table 5. Marine transport of supplies and concentrate extends to outside of Cook Inlet waters. Supply barging and concentrate lightering and shipping operations are discussed below.

Table 5. Operations phase (20 years) vessel traffic.

Transit Route	Purpose	Cargo	Vessel Type	Vessel Speeds	Round Trips/Year
Diamond Point port – West Coast ports	Cargo supply	Mine consumables	Marine linehaul barge. Typically, 11,500-ton (10,433 tonne) DWT barge. Hawser-towed by a 4,200-horsepower oceanic tugboat	<10 kt (18.5 km/hr)	29
Diamond Point port – West Coast ports (Alternatively Nikiski)	Fuel supply	Fuel	Double-hulled fuel barges. Max. capacity 4 million gal (15 million liters)	<10 kt (18.5 km/hr)	4
Diamond Point port – East Asia	Concentrate transport	Copper/gold concentrate	Bulk carrier – Handysize[1]	13-15 kt (14.9-17.3 mph) in open water (24-28 km/hr)	27
Diamond Point port – lightering station	Lightering of concentrate	Copper/gold concentrate	Barges with tug	<10 kt (18.5 km/hr)	162[2]

[1] Handysize is a naval architecture term for smaller bulk carriers or oil tanker with deadweight tonnage (DWT) up to 40,000 tons [36,287 tonnes], although there is no official definition in terms of exact tonnages.
[2] Assumes 6 round trips by barge and tug combinations to load 1 bulk carrier (27 bulk carriers x 6 round trips barge and tug = 162 round trips) based on average concentrate annual production.

2.2.2.1. Supply Barging

Cargo barging to and from Diamond Point port would occur year-round, subject to sea ice conditions (Dickins 2018). All consumables, including reagents and fuel for the operation, would be barged directly to the Diamond Point port using marine line haul barges. No lightering of fuel or supplies would occur.

During the 20 years of operations approximately 33 barge trips would call annually at the port, including 29 cargo and four fuel barge trips. The barges shipping consumables used during mine operations (and construction) would come principally from West Coast ports (Figure 13). The four annual fuel barges would most likely also come from West Coast ports, although it is possible that some of the fuel could be sourced from the refinery in Nikiski. Incidental barge traffic that originates from or departs to other Alaska ports is unlikely, but possible in the event that a regularly scheduled cargo barge traveling between those ports and the West Coast is used to expedite delivery of urgently needed equipment or supplies. Each barge would have a deadweight capacity of approximately 11,500 tons (10,433 tonnes) and a net cargo capacity of 9,480 tons (8,600 tonnes) and would be hawser-towed by a 4,200-horsepower oceanic tugboat. Cargo would include mine supplies and chemical reagents for the mining process. Processing chemical reagents and their method of shipment are shown in Table 5. Approximately 250,000 tons (226,796 tonnes) of grinding media (steel balls), reagents and other supplies would be shipped annually. Cargo would be consolidated in reusable 20 ft (6.1 m) intermodal freight containers (also known as ocean containers or Conex boxes) or tanks (e.g., Isotanks) suitable to withstand shipment, storage, and handling.

Diesel fuel would be shipped directly to the port using double-hulled fuel barges (with approach/departure assistance from two port-based tugs) as required. The maximum shipment parcel would be approximately 4 million gallons (gal) (15 million liters [L]), with a total annual shipment of approximately 16 million gal (61 million liters) (4 trips) (Table 6). Diesel would be stored onshore at the port site in four 1.25-million-gal (4.7-million-liter) tanks. Diesel would be used both to power the mine mobile fleet and to produce explosives when combined with ammonium nitrate. Ammonium nitrate would be shipped as solid prill (approximately 25,000 tons [22,680 tonnes] annually).

The transport of supplies would comply with all applicable federal and State of Alaska regulations, including hazardous materials transport requirements for packing and container requirements, emergency response, training, and security plans set forth in Title 49 CFR parts 171-180. A more detailed discussion of regulatory requirements applicable to the port and vessel operations is provided in Section 2.1.1. All cargo would be temporarily stored within shipping containers (except for break bulk cargo such as tires and other items too large for containers) at the port's general cargo area located approximately 500 ft (150 m) onshore from the bay.

PLP would contract with established third-party freight companies that operate tugs and barges between Alaska and the West Coast for the transport of supplies. PLP would also contract with established fuel vendors that provide fuel transportation services to remote Alaska locations for the delivery of fuel. PLP would contract for the delivery of fuel and supplies to the Diamond Point port facility and would not own or operate the vessels transporting the fuel, materials, and supplies.

2.2.2.2. Concentrate Lightering and Shipping

Dewatered copper concentrate would be stored in bulk in an enclosed storage building near the concentrate pipeline terminus and dewatering plant (Figure 3). For barge loading, a conveyor would transfer concentrate from inside the storage building to the barge loading area. The conveyors would be fully enclosed with a tubular structure to contain dust and shed snow. At the barge concentrate bulk loader dock, the barge loader would use an enclosed conveyor boom and telescoping spout to distribute concentrate onto the barge (Figure 3). The barge loader also would have mechanical dust collection and each barge would have a cover system to prevent fugitive dust and protect the concentrate from precipitation.

The barge loader would load barges that have a nominal capacity of 6,000 tons (5,443 tonnes). The loader would be designed to enable full loading of a barge from a single mooring location. Two lightering barges would be stationed at the port.

Once loaded, the barges would be transported to and secured against Handysize (up to 40,000 tons [36,287 tonnes]) vessels at the lightering station in Iniskin Bay (Figure 2). During lightering operations, the barge's internal system would retrieve and convey concentrate to the bulk carrier via a self-discharging boom conveyor. The boom would be fully enclosed and equipped with a telescoping spout. It also would have mechanical dust collection to prevent spillage and fugitive dust. The Alaska Department of Environmental Conservation (ADEC) air quality standards (Title 18 AAC 50) include requirements to take reasonable precautions and prevent fugitive dust to prevent unhealthy air and protect human health (ADEC 2020). The estimated transfer rate is approximately 2,000 tons (1,814 tonnes) of concentrate per hour. The barge location would be adjusted along the ship during the loading process.

Table 6. Petroleum products and chemical reagents.[1]

Material/Reagent Name	Use	Approximate Annual Consumption	Shipping State	Typical Shipping Container[2]	Transportation Method (Containerized or Bulk)	Mine Site Storage
Diesel fuel	Vehicle fuel and blasting	16 million gal (60.5 million liters)	Liquid	Barged in bulk and transferred to port bulk storage. Road transport in 6,350-gal (24,037-L) ISO tank-containers.	Bulk/Containerized	Bulk tanks
Lubricants	Vehicle and equipment lubrication	1,000 tons (907 tonnes)	Liquid	Drums and totes	Containerized	Containers until used.
Sodium nitrate	Blasting	800 tons (726 tonnes)	Solid (prills)	1- or 1.5-ton supersacks	Containerized	Containers until used.
Aluminum	Blasting	240 tons (218 tonnes)	Solid	1 m^3 (35 ft^3) lined dry totes	Containerized	Containers until used.
Mineral oil	Blasting	160 tons (145 tonnes)	Liquid	1 m^3 (35 ft^3) tote tanks	Containerized	Containers until used.
Paraffin wax	Blasting	160 tons (145 tonnes)	Solid	1 m^3 (35 ft^3) tote tanks	Containerized	Containers until used.
Packaged explosives and detonators	Blasting	1,500 tons (1361 tonnes)	Solid	Specialized packaging as required	Containerized	Containers until used.
Ammonium nitrate prill	Blasting	25,000 tons (22,680 tons)	Solid (prills)	Plastic lined bulk container	Containerized	Bulk silos
Calcium oxide	pH modifier to depress pyrite in copper- molybdenum flotation.	135,000 tons (122,470 tonnes)	Solid (pebbles)	Bulk dry chemical tank	Containerized	Bulk silos
Sodium ethyl xanthate	Copper collector used in rougher flotation circuit.	8,000 tons (7,257 tonnes)	Solid (pellets)	1 or 1.5-ton supersacks	Containerized	Containers until used.

Material/Reagent Name	Use	Approximate Annual Consumption	Shipping State	Typical Shipping Container[2]	Transportation Method (Containerized or Bulk)	Mine Site Storage
Sodium hydrogen sulfide (NaHS)	Copper depressant used in the copper - molybdenum separation processes. Reducing agent used for precipitation of metal sulfides.	4,300 tons (3,900 tonnes)	Solid (pellets)	1 or 1.5-ton supersacks	Containerized	Containers until used.
Carboxymethyl cellulose	Used to depress gangue material in flotation.	1,000 tons (907 tonnes)	Solid (pellets)	1 or 1.5-ton supersacks	Containerized	Containers until used.
Methyl isobutyl carbinol	Frother to maintain air bubbles in the flotation circuits.	4,000 tons (3,628 tonnes)	Liquid	Steel 20-ft ISO tanks.	Containerized	Containers until used.
Sodium silicate depressant	Used to depress gangue material in flotation.	3,000 tons (2,722 tonnes)	Solid (pellets)	1 or 1.5-ton supersacks	Containerized	Containers until used.
Anionic polyacrylamide	Thickener aid.	1000 tons (907 tonnes)	Solid (pellets)	1 or 1.5-ton supersacks	Containerized	Containers until used.
Polyacrilic acid $(C_3H_4O_2)n$	Anti-scalant for process water.	385 tons (350 tonnes)	Solid (powder)	1 or 1.5-ton supersacks	Containerized	Containers until used.
Hydrochloric acid (HCl 35%)	pH modifier used in water treatment.	17,500 tons (15,876 tonnes)	Liquid	Plastic or rubber-lined 20-ft ISO tanks.	Containerized	Bulk storage tanks
Ferric chloride ($FeCl_3$)	Metals co-precipitation in water treatment.	15,000 tons (13,608 tonnes)	Solid (powder)	Plastic or rubber-lined airtight dry chemical tanks.	Containerized	Bulk silos
Ferrous chloride ($FeCl_2$ 30%)	Provides iron for co-precipitation of metals and metalloids in water treatment.	125 tons (113 tonnes)	Liquid	1 m^3 (35 ft^3) tote tanks	Containerized	Containers until used.
Potassium permanganate ($KMnO_4$)	Oxidation of metals in water treatment.	100 tons (91 tonnes)	Solid (pellets)	1 or 1.5-ton supersacks	Containerized	Containers until used.

Material/Reagent Name	Use	Approximate Annual Consumption	Shipping State	Typical Shipping Container[2]	Transportation Method (Containerized or Bulk)	Mine Site Storage
Polymer (typically, a proprietary material selected through laboratory testing based on site-specific water quality).	Coagulation and settling of precipitated solids in water treatment.	100 tons (91 tonnes)	Solid (powder)	1 or 1.5-ton supersacks	Containerized	Containers until used.
Antiscalant (typically, a proprietary mixture of organic acids and other chemicals based on membrane manufacturer recommendations and laboratory testing).	Disperse scale forming precipitates in reverse osmosis systems.	50 tons (45 tonnes)	Liquid	1 m^3 (35 ft^3) tote tanks	Containerized	Containers until used.
Membrane clean-in-place acid solution (typically, a proprietary mixture of citric acid and chelating agents).	Acid cleaning solution for ultrafiltration and RO membranes.	10 tons (9 tonnes)	Liquid	1 m^3 (35 ft^3) tote tanks	Containerized	Containers until used.
Membrane clean-in-place alkaline solution (typically, a proprietary mixture of 50% sodium hydroxide, detergents, and additives).	Alkaline cleaning solution for ultrafiltration and RO membranes.	0.5 tons (0.4 tonnes)	Liquid	1 m^3 (35 ft^3) tote tanks	Containerized	Containers until used.
Soda Ash (Na_2CO_3)	Add alkalinity to treated water as needed prior to discharge.	450 tons (408 tonnes)	Solid (powder)	1 or 1.5-ton supersacks	Containerized	Containers until used.

[1] Cyanide is not be used in the mining and milling process.
[2] Packaging of hazardous material would comply with hazardous materials transport requirements in Title 49 CFR part 171-180 and other applicable regulations.

The load for each vessel would range between 30,000 and 35,000 tons (27,216 and 31,751 tonnes), requiring 5 to 6 barge loads per bulk carrier vessel. Typically, the vessel would be anchored at the lightering station for 3 to 4 days (or longer if operations are interrupted by weather). An estimated 27 shipments of concentrate would occur annually based on average annual production. Lightering would occur year-round, subject to sea and ice conditions.

Ice is expected to form around Diamond Point port and other parts of the bay in most years. The ice is predominantly thin (11.8 in to 27.6 in [30 to 70 cm]) even in extremely cold years (Dickens 2018). In addition to the tugs that tow the lightering barges, two ice-breaking tugs would be stationed at the port to clear ice and assist vessels transiting to and from the port and lightering station as needed.

Compulsory pilotage boundaries for Cook Inlet are all waters inside a line extending from Cape Douglas to the western tip of Perl Island then northward to the shoreline of the Kenai Peninsula. Alaska State regulation 12 AAC 56.960(a) states that a pilot shall be on duty at the conn, piloting the vessel at all times when the vessel is in transit or maneuvering in compulsory pilotage waters. The passage of the bulk carriers from the mouth of Cook Inlet to the mooring location would require the establishment of new protocols with the Southwest Alaska Pilots Association that would be developed during detailed design and in coordination with the shipping companies that operate the bulk carriers. The shipping companies would coordinate arrangements for the transfer of pilots from shore to the bulk carriers and back with the Southwest Alaska Pilots Association. Transportation of pilots to the ships could use pilot vessels and/or helicopters departing from an appropriate location.

The concentrate bulk carrier vessels would be owned and operated by third-party shipping lines operating under contract to load and deliver the concentrate to smelters. The shipments of concentrate would be transported from Cook Inlet through Shelikof Strait and the Aleutian Islands, Unimak Pass, and the Bering Sea to destinations in East Asia (Figure 13).

2.2.3. Natural Gas Pipeline Maintenance Activities

The integrity of the natural gas pipeline would be monitored during operations for geometry deformation using intelligent pigging (in-line inspection) on a 3 to 5 year basis to inspect for and detect any changes in the pipeline geometry, pipe deformation, and to estimate any strain in the pipe wall. If a survey indicates suspected free spanning, pipe movement, damage, or loss of cover, then appropriate visual inspection tools (such as a marine support vessel and ROV or drop camera) would be deployed to visually inspect the affected area and cover conditions. Every 5 years, a smart-pig would be used to inspect the entire line length for internal corrosion/metal loss using magnetic-flux-leakage or ultrasonic testing. More frequent pig inspections would be performed if internal corrosion/metal loss is suspected or confirmed. External visual inspection would not be required for the routine inspection program.

Pipe repairs be required if the pipeline is damaged by external forces or other requirements for repair are identified. Repair plans would be made on a case by case basis considering the nature and extent of the damage, location, seasonal weather conditions, and worker safety. During the winter season, temporary repair methods could be used for initial repairs to ensure pipeline integrity and maintain gas flow. Such temporary repair methods could include the use of pipeline clamps and sleeves placed by divers operating from a surface support vessel. Permanent offshore repair work would typically be scheduled during the summer season. Permanent pipeline repair methods could include welding in a new segment of pipe, insertion of a flanged piece of pipe, the use of permanent pipeline clamps and sleeves, or a combination of these. The repair could be completed by lifting the damaged pipeline portion to the water surface using a construction support vessel or pipe lay barge with a heavy crane, or by divers operating on the seafloor from dive support vessels, depending on water depth, practicability, and safety. Dredging equipment like that utilized during construction (section 2.1.1.1) would be used to expose and then rebury the pipeline as required for the repair. Permanent repairs using the methods described above are typically completed within one week. Effects associated with the repair activity would be similar in nature and extent to those associated with the initial pipeline construction (section 2.1.4) but limited to the specific area of the repair.

2.3. Reclamation and Closure Activities

Before commencing construction, the Project's Reclamation and Closure Plan and associated financial assurance mechanisms would be approved by the Alaska Department of Natural Resources (ADNR) and the ADEC. The Reclamation and Closure Plan and financial assurance obligations would be updated on a 5-year cycle, in accordance with regulatory requirements, to address any changes in closure and post-closure requirements and cost obligations (SRK 2019).

At the end of operations, mine facilities would be closed and reclaimed according to permit conditions. Closure is planned to be completed in phases: physical reclamation is scheduled for a period of 20 years; it would be followed by long-term post-closure monitoring and water management (SRK 2019). Reclamation and closure activities that overlap with listed species ranges or critical habitat may include construction, removal, or modification of facilities at the Diamond Point port or Cook Inlet submerged portion of the natural gas pipeline and fiber optic line.

The Diamond Point port would be required to support the post-closure care and maintenance period and would not be reclaimed until it is no longer needed to support water treatment operations at the mine site. Maintenance dredging operations at the port would continue if required for the barging of reclamation and closure supplies (Section 2.2.1). The facilities would be reconfigured, and buildings, areas, or port infrastructure no longer required would be decommissioned. Paved areas would be ripped, and the pavement disposed off-site. Compacted areas would be ripped prior to placing 6 in to 12 in (15.2 cm to 30.5 cm) of growth medium and seeding the area. Port equipment (e.g., mobile equipment, containers) would be transported to the nearest large port and sold or disposed in an approved landfill. Fuel tanks no longer needed would be drained, rinsed, and dismantled; foundations demolished; and materials disposed in an approved landfill. Rinsate water would be sent to an oil/water separator for treatment prior to discharge. The concentrate and return water pipelines in the intertidal areas would be cleaned and abandoned in place or removed from the roadbed. The concentrate lightering station would be removed immediately after operations cease.

Vessel activity at the port would be substantially reduced from operations levels as concentrate shipping and associated activity would cease. Once the initial physical closure is completed, barging activity would be limited to the supply of fuel and water treatment consumables required to support long term water treatment and site monitoring activities. Barging activity would be limited to the spring through fall months and no more than 5 barges annually are anticipated once the major physical closure activities are completed (approximately 15 to 20 years after operations cease).

The final details regarding the disposition of the natural gas pipeline after it is no longer required by the Project would be determined in concert with all the involved stakeholders, including all landowners and the State of Alaska and federal government. If the pipeline is decommissioned, reclamation and closure would most likely include pigging and cleaning of the pipeline, removal of the above ground components and infrastructure, and abandonment of the buried pipe in place; however, final disposition may also include the removal of all or selected underground pipeline segments.

2.4. Action Area

An Action Area is defined by regulation as all areas that would be affected directly or indirectly by the federal Action and not merely the immediate area involved in the Action (50 CFR 402.02). The Project's Action Area (Figure 14, Figure 15) includes the proposed mine and transportation corridor, a portion of lower Cook Inlet waters, marine areas crossed by marine transport vessels, including concentrate bulk carriers, traveling from Cook Inlet through Shelikof Strait and the Aleutian Islands, and marine line haul barges from Cook Inlet to West Coast ports traveling either through the Pacific Ocean or near the coast through the GOA and southeast Alaska.

The geographic extent of the Action Area includes those areas in which Project activities would have the potential to affect threatened or endangered species and their critical habitats directly or indirectly. Some activities directly impact habitat (such as placement of fill) and others the acoustical environment (noise generated by operating vessels), or both. The potential impact zones for relevant Project activities are shown in Table 7. The details on how the impact zone for each activity was calculated are discussed in Sections 2.4.1 through 2.4.7.

Table 7. Potential impact areas for Project activities.

Activity	Impact Area
Physical Impact	
Access road to Diamond Point port in Iliamna Bay (intertidal area)	19.1 ac (7.7 ha)
Construction dredging area including, navigation channel, turning basin, and jetty footprint (subtidal area of Iliamna)	78.8 ac (31.9 ha)
Maintenance dredging area for navigation channel and turning basin (subtidal area of Iliamna).	71.4 ac (28.9 ha)
Diamond Point port marine components construction (intertidal and subtidal area of Iliamna Bay)	6.2 ac (2.5 ha)
Natural gas pipeline and fiber optic cable construction anchor placement corridor (potential extent of the anchor placement area in Cook Inlet waters between Anchor Point and Ursus Cove)	76.5 mi^2 (198.0 km^2)
Natural gas pipeline and fiber optic cable construction – Cottonwood Bay (disturbance footprint in the intertidal zone)	69.1 ac (28 ha)
Mooring placement for the lightering station (waters in Iniskin Bay)	0.07 ac (0.03 ha)

Activity	Impact Area
Acoustical Impact	
Dredging of navigation channel and basin (ensonified area at any given time)	490 ac (198 ha)
Initial dredging of navigation channel and basin (total ensonified area)	1,358 ac (550 ha)
Maintenance dredging of navigation channel and basin (total ensonified area)	1,344 ac (544 ha)
Diamond Point port marine components construction (total ensonified area)	175 ac (71 ha)
Natural gas pipeline construction anchor handling tugs (daily ensonified area)	21.1 mi^2 (54.6 km^2)
Natural gas pipeline construction anchor placement corridor (total ensonified area)	330 mi^2 (855 km^2)
Fiber optic cable installation anchor handling tugs (daily ensonified area)	21.1 mi^2 (54.6 km^2)
Fiber optic cable installation anchor placement corridor (total ensonified area)	330 mi^2 (855 km^2)
Mooring placement for the lightering station (total ensonified area)	7.1 mi^2 (18.4 km^2)
Marine vessel travel, with a 4 nm corridor width and 1.2 nm buffer	6.4 nm (7.4 mi, 11.8 km)

2.4.1. Access Road to Diamond Point Port (Iliamna Bay)

Fill placement for construction of the road within the intertidal zone of Iliamna Bay would mostly be completed when water levels are below the minimum elevation of the surface on which rock is being placed using overland construction equipment such as dozers, graders, and excavators. On-land blasting of side hills or rock mounds will be required in some areas. Blasting at the bedrock cuts would all be above the high tide line and would be done to coincide with the low tide cycle when the bay is partially dry. Construction of the road would fill approximately 19.1 ac (7.7 ha) of intertidal habitat in Iliamna Bay.

Underwater sound from on land blasting activities is not expected to result in underwater noise level above the NMFS criterion of 160 dB re 1 μPa root mean squared (rms), as sound is easily attenuated within the earth and near the sea surface. JASCO Applied Sciences and Illingworth & Rodkin, Inc. conducted a sound source verification test on behalf of SAExploration, Inc. to characterize the underwater received sound levels resulting from land-based explosives, including explosives in mud flats of Trading Bay, upper Cook Inlet. Equivalent recorded levels ranged from 107 to 111 dB and maximum levels from 115 to 120 dB, but those noise levels were not associated with the shot, as a signal was never detected during the study (ASRC 2014).

2.4.2. Dredging for Diamond Point Port Marine Components and Navigation Channel and Basin

Initial dredging for construction of the Diamond Point port marine components and the navigation channel and basin includes an area of 78.8 ac (31.9 ha) to a depth of -18 ft (-5.5 m) MLLW (Table 7). The total volume of dredge material includes 1,100,000 yd3 (841,010 m3) of sands and silty sediments with occasional rocks. Dredging would be completed with the use of a cutter suction dredge. Construction dredging activity would commence in May of the second year of construction (CY2) and would last approximately 4 to 6 months. Thereafter, summer maintenance dredging would be conducted for the navigation channel and basin (71.4 ac ([8.9 ha]) approximately every 5 years, and last 1 to 2 weeks. The dredged material would be placed on barges and transported to shore for storage in the bermed facilities on uplands east and west of the dock site.

The potential impact zone for the dredging of the Diamond Point port approach is based on the area that may experience underwater noise associated dredging activities using a cutter suction dredge. Reine et al. (2012b, 2014a) and Greene (1987) found cutter suction dredge noise levels ranged from 167 to 178 dB re 1 μPa rms @ 1 m with distances to Level B disturbance ranging from 735 ft (224 m) to 2,605 ft (794 m) (Table 4). Based on a conservative noise disturbance radius of 2,605 ft (794 m), the area of acoustical impact at any given time is 490 ac (198 ha); a total ensonified area of 1,358 ac (550 ha) during the initial dredging; and 1,344 ac (544 ha) during maintenance dredging (Table 7).

2.4.3. Diamond Point Port Marine Components Construction

Caisson installation requires leveling the footprint on the seabed prior to caisson placement. Footprint preparation would make use of an extended reach excavator mounted on a barge to minimize the extent of the disturbed area. Once the footprint is prepared, the caisson is floated into place with a tugboat at high tide and then seated into place with the falling tide or is slowly lowered by pumping water into it. Tugboat operation may include the use of thrusters. Once each caisson is set in place, it would be filled with material sourced from preparing the caisson base or from Project quarries. Fill material is expected to contain few fines and limited siltation of the water is expected.

Dickerson et al. (2001) measured emptying a barge at a fill placement site and found that underwater noise levels exceeding marine mammal thresholds (120-dB Level B threshold) extended to 443 ft (135 m) from the sound source. However, in a recent programmatic consultation between the USACE and USFWS regarding effects to northern sea otters from activities permitted by the USACE, the USFWS found that all in-water use of heavy equipment for manipulating the substrate, including fill placement, would require a monitoring zone radius extending out to 984 ft (300 m) from the sound source to avoid take (USACE Sea Otter Programmatic Consultation 2015; Consultation #2013-0016). Given that sea otters and NMFS-jurisdiction marine mammals would be monitored following the same Marine Mammal Monitoring and Mitigation Plan (4MP), the more conservative radius was selected for assessing fill placement impacts in this BA. Based on the 984-ft (300 m) impact radius, the marine portion of the ensonified area would be 175 ac (71 ha) (Table 7).

2.4.4. Natural Gas Pipeline Construction

The potential impact zone for the pipeline construction is based on the corridor width that may experience temporary anchor spread impacts plus the underwater noise associated with tugs handling anchors working along the edge of the corridor. The average width of the anchor spread (which varies by depth) supporting the lay barge is 1 mi (1.6 km). The impact width, however, is this width plus the extent of underwater noise generated by the tugboats during anchor handling that exceeds the 120-dB harassment threshold for continuous noise sources. This distance is conservatively estimated at 1.7 mi (2.7 km) based on the CIPL project conducted in Cook Inlet in 2018.

During the CIPL project, 11 mi (17.8 km) of 8-in and 10-in pipeline were laid in Cook Inlet using very similar equipment (noise sources) proposed for this Project. NMFS's (2018a) approach in issuing an Incidental Harassment Authorization (IHA) for the CIPL project was to recognize that the cavitation noise produced by tugboats during anchor handling operations would be the most dominant noise source and based the potential area ensonified by harassing noise levels on the spacing and operation of anchor handling tugboats. In their assessment, NMFS assumed a tugboat sound source of 170 dB re 1 μPa rms, based on measurements taken by Warner et al. (2014) and adjusted on the basis of vessel length, power, and speed (Wales and Heitmeyer 2002), resulting in a radius of 1.4 mi (2.2 km) using the practical spreading model. In their calculations, they added 0.3 mi (0.5 km) to account for noise propagating from either side of the tugboats resulting in an assumed 1.7-mi (2.7-km) radius to the 120-dB threshold.

To verify the validity of the 1.7-mi (2.7-km) radius for assessing acoustical impacts from pipeline operations, Castellote (2019) acoustically monitored the operations during active pipelaying. The acoustical monitoring plan was not designed to determine the sound source levels of the various equipment used in the operation, but rather to determine whether noise levels exceeding 120 dB extended greater than 1.7 mi (2.7 km) from the pipeline corridor. The results showed that the combined continuous noise sources, which included anchor handling and pipe pulling (winching), "did not exceed the level B threshold at 2.7 km isopleth distance." Castellote (2019) found the pipeline laying operation noise levels 0.6 mi (1 km) from the pipeline corridor (where acoustic moorings were placed) to average about 123 dB re 1 μPa rms. A rough back calculation using the practical spreading model suggests that average continuous underwater noise levels from pipeline operations, including anchor handling, did not exceed 1 mi (1.6 km).

Castellote (2019) also looked specifically at noise level events generated by vessels alone. Again, levels did not exceed threshold at 1.7 mi (2.7 km) from the source. The average level measured 0.6 mi (1 km) from the source was 120.7 dB re 1 μPa rms suggesting the actual distance to threshold is a little over 0.6 mi (1 km).

Results from Castellote (2019) suggest that assuming a 1.7-mi (2.7-km) radius for all noise sources generated during pipeline operations is conservative enough to account for minor differences in equipment between the CIPL project and the proposed Project. It is assumed that anchor handling tugs would move approximately 2 mi (3.2 km) along the pipeline corridor daily. Thus, the daily area potentially ensonified is a 1 mi x 2 mi (1.6 km x 3.2 km) box surrounded by a 1.7 mi (2.7 km) buffer to account for tug noise exceeding the Level B threshold, which equates to 21.1 mi^2 (54.6 km^2) (Table 7). The total area ensonified over the length of the pipeline corridor is 330 mi^2 (855 km^2) (Table 7).

2.4.5. Fiber Optic Cable Installation

The fiber optic cable would either be bundled with the natural gas pipe or would be buried separately adjacent to the pipeline. If bundled, there would be no impacts beyond those described for the pipe lay. If a separate lay, then the cable lay represents a second lay operation across Cook Inlet. It is assumed that using a tug or similarly sized vessel would result in the same impact corridor as for pipelaying operations. The amount of cable that could be laid in a day is more than the amount of pipeline as there would not be the need to stop and weld sections, and the size of trench to excavate would be smaller. Nonetheless, we conservatively assume that the area ensonified daily (with two tugboats operating simultaneously) is the same as for the pipe lay, or 21.1 mi^2 (54.6 km^2) (Table 7), and the total 35-day exposure 330 mi^2 (855 km^2).

The potential marine mammal exposures to harassing noise levels produced during the cable lay will be estimated assuming a separate barge-based lay operation.

2.4.6. Mooring Placement for the Lightering Station

There are two impacts associated with the placement of the lightering station: the physical footprint of the anchor mooring system (Figure 2, and Figure 4) at the location where the mass anchors would be placed and the acoustical impact zone from tugboat thruster operation during mooring placement. The footprint of the anchors is 0.007 ac (0.003 ha) with the total for the 10 anchors at 0.07 ac (0.03 ha) (Table 7). When including the anchors and chains, the mooring system footprint forms a 2,300 ft x 1,700 ft (700 m x 520 m) oval centered around the mooring buoys, equating to 70.5 acres (28.5 hectare). It is conservatively assumed that tugboats operating with bow thrusters generate noise exceeding the 120-dB harassment threshold out to 1.7 mi (2.7 km). The area ensonified for construction of the lightering station would be 7.1 mi^2 (18.4 km^2) (Table 7). A detailed description of the lightering station is provided in Section 2.1.2.

2.4.7. Vessel Travel Corridors and Port Operations

Vessel traffic associated with Project activities would peak during the operations phase of the Project when both supply and concentrate shipping are occurring (See Section 2.2.1). Areas crossed by marine transport includes lower Cook Inlet (Figure 13) and extend to marine areas crossed by marine transport vessels including concentrate bulk carriers from Cook Inlet through Shelikof Strait, and through the Aleutian Islands (Figure 13); and marine line haul barges from Cook Inlet to West Coast ports either through established marine routes across the Pacific Ocean or following near coast maritime routes along the GOA and Southeast Alaska (Figure 13). Within lower Cook Inlet vessel traffic between Diamond Point port and Nikiski port is also possible.

Cook Inlet supports a wide variety of vessel traffic ranging from the smallest fishing vessels to crude oil tankers (Nuka Research & Planning Group, LLC 2006). Vessel traffic is well established along the eastern side of lower Cook Inlet from vessels transiting to deep draft ports in Homer, Drift River Oil Terminal, Nikiski Industrial Facilities, Port of Alaska and Port Mackenzie, and light draft ports in Port Graham, City of Seldovia, Williamsport, and Tyonek (Nuka Research & Planning Group, LLC 2015). Fewer vessels travel on the western side of lower Cook Inlet (Nuka Research & Planning Group, LLC 2015).

Cape International, Inc. and Nuka Research & Planning Group, LLC (2006) completed a vessel traffic study in Cook Inlet that included vessel traffic between January 1, 2005 to July 15, 2006. During this period, approximately 704 deep draft vessels made calls in Cook Inlet ports, and from 500 to 900 commercial fishing vessels operated in the five different fisheries throughout Cook Inlet, predominantly from mid-May through mid-September (Cape International, Inc. and Nuka Research & Planning Group, LLC 2006). Another study conducted between June 1, 2007 and May 31, 2008, that used Automatic Identification System (AIS) data from a receiver in Cook Inlet, recorded 395 deep-draft vessel voyages and estimated a 6 percent decrease in vessel traffic compared to the 2005-2006 study (Cape International, Inc. 2008). The most recent Cook Inlet vessel traffic study from 2010, again using AIS data, recorded 480 vessel port calls or transits in Cook Inlet (Cape International, Inc. 2012). This study only considered marine vessels of more than 300 gross tons (GT) and all smaller vessels having a fuel capacity of at least 10,000 gal (37,854 L) (Cape International, Inc. 2012). Using the AIS vessel movement data, Cape International, Inc. (2012) mapped vessel movement activity and showed most vessel transits occurred on the east side of Cook Inlet.

Vessel traffic recorded in 2010 was lower than traffic recorded in 2005-2006. Part of this reduction in vessel traffic may be attributed to the Agrium Corporation fertilizer plant and ConocoPhillips liquid natural gas (LNG) plant closures, which in 2005-2006 accounted for 28 and 36 vessel port calls respectively in Nikiski (Cape International, Inc. and Nuka Research & Planning Group, LLC 2006).

The existing Williamsport landing area, in a cove on the west shore of Iliamna Bay, has a landing ramp that serves as the east terminus of a 14.5-mi (23.3 km), State-maintained, gravel road between Williamsport and Pile Bay and is generally open from June to October. Data from 2010 document that landing craft and other vessels under 300 GT travel between Homer and Williamsport during the summer months (Cape International, Inc. 2012). Smaller vessels are then portaged by truck between Williamsport and Pile Bay for use on Lake Iliamna and the Kvichak River. In addition, from April to October a larger landing craft makes approximately 8 trips per month between Homer and Williamsport during periods of +15-ft tides transporting fuel, supplies, and equipment for villages and communities along Iliamna Lake (Cape International, Inc. 2012).

ERM-West Inc. and Det Norske Veritas (2010) analyzed vessel traffic data on the Aleutian Islands area between August 1, 2008 and July 31, 2009 using AIS data. A total of 15,788 vessel tracks were recorded in the study period. Of these, almost 70 percent were the result of domestic traffic (primarily fishing vessels, tugs, government vessels, and other vessels). However, nearly 75 percent of the number of vessels that operated through or near the Aleutian Islands during the analyzed period consisted of deep draft vessels, the vast majority transiting via the North Pacific Great Circle Route (ERM-West Inc. and Det Norske Veritas 2010).

The North Pacific Great Circle Route is the shortest transportation distance for vessels travelling between northwestern North America (e.g., Vancouver and Seattle) and East Asia (e.g., Shanghai and Yokohama). Along this route, vessels pass through Unimak Pass in the eastern Aleutian Islands and Amchitka Pass in the western Aleutians traveling approximately 620 mi (1,000 km) within the Bering Sea.

Container ships, bulk carriers, general cargo vessels, LNG, and gas carriers, roll on/roll off and car carriers, cruise ships, crude oil tankers, chemical carriers, and refrigerated cargo ships accounted for 1,717 vessels that completed 4,743 vessel transits through the Aleutians Islands (ERM-West Inc. and Det Norske Veritas 2010).

The PLP Project would contribute an additional 25 supply barges per year during the construction phase, 33 cargo/fuel barges and 27 bulk carrier vessels that would make port calls into Diamond Point port annually during the operations phase, and 5 barges (equipment removal) per year during the closure period. This increase in traffic during the operations phase would represent an approximately 12.5 percent[2] vessel traffic increase in lower Cook Inlet when compared to 2010 data. Vessel traffic through the Aleutian Islands would increase by approximately 1 percent based on 2008-2009 traffic[3]. Vessel traffic studies specific to the GOA are not available, but traffic is expected to be similar to that of the North Pacific Great Circle route through the Aleutians.

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[2] (60 estimated PLP annual port calls/480 port calls in 2010) x 100 = 12.5 percent estimated increase.

[3] (54 estimated PLP annual concentrate bulk carrier vessel transits/4,743 nondomestic vessel transits from 2008-2009) x 100 = 1.2 percent estimated increase.

The vessel traffic impact zone includes waters of lower Cook Inlet to include Iliamna Bay, Cottonwood Bay, Ursus Cove, and Cook Inlet waters between Ursus Cove and Anchor River where vessel traffic and their ensonified areas could be reasonably expected (Figure 13). This vessel traffic impact zone also includes marine areas crossed by marine transport vessels, including concentrate bulk carriers, from Cook Inlet through Shelikof Strait, and through the Aleutian Islands out to the limits of the Exclusive Economic Zone (EEZ) (Figure 13); marine line haul barges from Cook Inlet transiting to west coast ports through the GOA out to the limits of the EEZ (Figure 13); and potential fuel barge traffic between Diamond Point port and Nikiski ports (Figure 13). Each vessel transit route was designed as a 4-nautical mile (nm) (4.6 mi, 7.4 km) wide corridor, plus a 1.2 nm (1.4 mi, 2.2 km) general vessel noise (different from thruster noise) ensonified area on either side of the corridor, based on Warner et al. (2014), to account for possible noise effects to marine mammals (Figure 14, Figure 15), or a total impact zone width of 6.4 nm (7.4 mi, 11.8 km) (Table 7).

3. SPECIES POTENTIALLY AFFECTED

Nine species of marine mammals, currently listed under the ESA and under the jurisdiction of NMFS, occur seasonally or year-round within the Action Area (Table 8). Humpback whales from the threatened Mexico Distinct Population Segment (DPS) typically summer off the Pacific Northwest, while whales from the endangered Western North Pacific DPS largely summer off Kamchatka. However, a small fraction of both populations has been found in GOA waters (Wade et al. 2016). Most humpback whales found in lower Cook Inlet are from the Hawaii DPS, which was delisted in 2016. The endangered Cook Inlet beluga whale summers in upper Cook Inlet with a portion of the population wintering in lower Cook Inlet venturing as far south as Kamishak Bay in the past (Shelden et al. 2015). Steller sea lions breed on the Barren Islands at the mouth of Cook Inlet and can be found feeding throughout the lower inlet and have been observed as far north as the Port of Anchorage, Alaska. The listed fin whale is found near the mouth of lower Cook Inlet, although there are a few records from inside Cook Inlet. North Pacific right whales, blue whales, sei whales, Western North Pacific DPS of gray whales, and sperm whales do not inhabit Cook Inlet, but all do occur within the GOA and/or Bering Sea with ranges overlapping travel corridors considered as part of the Action Area.

Table 8. NMFS-listed species occurring within the Project Action Area.[1]

Common Name	Latin Name	ESA Status	Population	Critical Habitat
Humpback Whale	*Megaptera novaeangliae*	Threatened	Mexico DPS	Proposed Yes
Humpback Whale	*Megaptera novaeangliae*	Endangered	Western North Pacific DPS	Proposed Yes
Fin Whale	*Balaenoptera physalus*	Endangered	North Pacific	N/A
Sei Whale	*Balaenoptera borealis*	Endangered	North Pacific	N/A
Blue Whale	*Balaenoptera musculus*	Endangered	North Pacific	N/A
North Pacific Right Whale	*Eubalaena japonica*	Endangered	North Pacific	No
Gray Whale	*Eschrichtius robustus*	Endangered	Western North Pacific DPS	N/A
Sperm Whale	*Physeter catodon*	Endangered	North Pacific	N/A
Beluga Whale	*Delphinapterus leucas*	Endangered	Cook Inlet Stock	Yes
Steller Sea Lion	*Eumetopias jubatus*	Endangered	Western DPS	Yes

[1] Obtained from the NMFS Alaska Protected Resource Division website mapper [https://www.fisheries.noaa.gov/resource/data/alaska-endangered-species-and-critical-habitat-mapper-web-application] on March 11, 2020.

The Action Area also overlaps with beluga whale and Steller sea lion critical habitat but avoids both North Pacific Right whale critical habit units (Southeast Bering Sea [SEBS] and Western GOA).

4. STATUS OF LISTED SPECIES

Nine ESA-listed species (10 distinct population segments) under the jurisdiction of the NMFS have been identified as occurring within the Action Area (Table 8). The ESA status, biological status, and use of the Action Area of each are addressed below.

4.1. Humpback Whale (*Megaptera novaeangliae*)

4.1.1. ESA Status

The humpback whale, as with most great whales, was protected under international convention in 1966, although illegal whaling continued to occur well into the 1970s and possibly 1980s. They were listed as endangered under the Endangered Species Conservation Act in 1969, and again under the ESA in 1973. On September 8, 2016, NMFS published a rule, effective October 11, 2016, stating that ESA protection for the Hawaii DPS (Central North Pacific stock) is no longer warranted, while the Mexico DPS (California/Oregon/Washington stock) was down-listed to threatened status. The small Western North Pacific DPS (Western North Pacific stock) remains endangered.

4.1.2. Biological Status

4.1.2.1. Abundance and Trends

There are numerous population estimates for North Pacific humpback whales and they vary depending on survey and modeling techniques. An intensive 3-year (2004-2006) photo-identification study (Structures of Population, Levels of Abundance and Status of Humpback Whales [SPLASH]) was conducted to determine the population structure and abundance of North Pacific humpback whale populations (Calambokidis et al. 2008, Wade et al. 2016). The results of the study provided a best estimate overall abundance of 18,302 for the entire North Pacific; the estimate is higher than the pre-exploitation population estimated by Rice (1974). The SPLASH data (Calambokidis et al. 2008, Barlow et al. 2011) further provided estimates for the three North Pacific humpback whale stocks occurring in the Action Area (see *Distribution and Habitat Use* below): California/Oregon/Washington stock – 2,034; Central North Pacific stock – 10,103; and Western North Pacific stock – 1,107. Combined, these three stocks represent 72 percent of the current North Pacific population. Since protection in 1966, the North Pacific population has grown at an annual rate of about 6 to 7 percent (Carretta et al. 2019). Muto et al. (2019) identify the annual rate of increase for the Central North Pacific stock as at least 7 percent.

4.1.2.2. Distribution and Habitat Use

Humpback whales use coastal areas and generally are found in shelf edge, shelf, and inland waters (Figure 16). Three stocks of humpback whales potentially inhabit the Action Area. The California/ Oregon/Washington stock (Mexico DPS) winters in the nearshore waters off Mexico and Central America, and summers off California, Oregon, and Washington. The Central North Pacific stock (Hawaii DPS) winters in Hawaiian waters and migrates to summer feeding areas in the coastal waters of British Columbia, Southeast Alaska, the GOA, the eastern Bering Sea, and the Aleutian Islands. The California/Oregon/Washington and Central North Pacific stocks overlap in southern British Columbia. The

Western North Pacific stock (Western North Pacific DPS) winters off the coast of Asia and primarily summers in Russian waters, although it overlaps with the summer distribution of the Central North Pacific stock in the Bering Sea and along the Aleutians. Based on genetic analysis and movements of known animals, there appears to be some annual interchange between these three stocks, and all three stocks can be found in the GOA (Wade et al. 2016). On September 8, 2016, NMFS provided humpback whale guidance indicating that individuals from all three of the above stocks, identified by Wade et al. (2016) as the Mexico DPS, Hawaii DPS, and Western North Pacific DPS, can occur in the GOA summer feeding grounds. The majority (89 percent) of the whales that were photo-identified were from the Hawaii DPS and 10.5 percent from the Mexico DPS (Wade et al. 2016). Only 0.5 percent were from the Western North Pacific DPS. Humpback whales from the Mexico DPS have been reported to occur within lower Cook Inlet (Section 4.1.4 describes the proposed critical habitat) based on photo-identification, while the seasonal presence of whales from the Western North Pacific DPS within the inlet is inferred based on records within the GOA (NMFS 2019b).

4.1.2.3. Feeding and Prey Selection

For the most part, humpback whales prey on krill (euphausiids) and schooling fish with the composition dependent on the feeding location. The most important prey off California are anchovies and the krill species *Euphausia pacifica* (Rice 1963). This and other species of krill are important in Alaska along with Pacific herring (Frost and Lowry 1981, Krieger and Wing 1984). Nemoto (1957) found stomachs of humpbacks taken during Japanese whaling in the North Pacific to contain almost entirely euphausiids. There is no information on humpback diet in lower Cook Inlet, although both krill and small schooling fish are available.

4.1.2.4. Reproduction

Humpback whale calving and breeding occurs on the warmer-watered wintering grounds. The high population growth rate (average annual rate of 6 to 7 percent) since the 1960s is partially explained by a higher reproduction rate compared to other large whales. Females sexually mature at 4 to 6 years of age and gestation periods are less than 12 months (NMFS 1991). The calving interval is generally 2 to 3 years, but some whales have calved in consecutive years (NMFS 1991).

4.1.2.5. Natural Mortality

Identified natural mortality in the North Pacific has been limited to occasional killer whale (*Orcinus orca*) predation, although red tide events and possibly parasite overload has been implicated in deaths of North Atlantic humpback whales (NMFS 1991). Killer whales have been observed killing humpbacks in Southeast Alaska (Dolphin 1987), and the rake marks on whale flukes have been attributed to killer whale attacks, although there is speculation that some marks are due to attacks on juveniles by false killer whales (*Pseudorca crassidens*) on Hawaiian wintering grounds (NMFS 1991).

4.1.2.6. Threats

The final humpback whale recovery plan (NMFS 1991) identified six threats at the time of publication that could potentially impede recovery of the species at large: subsistence hunting, debris and fishing gear entanglement, vessel strike, acoustical disturbance, habitat degradation (from coastal development in Hawaii), and competition for resources with humans. Subsistence hunting is not a threat of concern in the

North Pacific, and while humans do utilize resources that are food for Alaskan humpback whales (e.g., Pacific herring), there is not yet any evidence that competition is negatively affecting whales. Vessel strike is an issue, as humpback whales are one of the more vulnerable whales to vessel strike (Jensen and Silber 2004) largely because they occur in continental shelf waters where vessel traffic is greatest, and they are the most commonly struck whale in Alaska (Neilson et al. 2012). Neilson et al. (2004) studied humpback whale entanglement in Southeast Alaska and discovered that between 52 percent and 78 percent of the whales examined bore unambiguous scars from gear entanglement, an identified cause of mortality (Muto et al. 2019).

4.1.2.7. Acoustical Ecology

Humpbacks produce a variety of vocalizations ranging from 20 hertz (Hz) to 10 kilohertz (kHz) to locate prey, coordinate communal feeding efforts, attract mates, and for mother-calf communication (Au et al. 2004b, Vu et al. 2012). NMFS categorizes humpback whales in the low-frequency cetacean functional hearing group, with an applied frequency range between 7 Hz and 35 kHz (NMFS 2018b). Depending on its strength and duration, anthropogenic noise can result in social disturbance, physical discomfort, and masking of intraspecific humpback communication. Although difficult to detect visually, evidence that individual humpbacks are responding to elevated noise levels has been inferred by whales leaving/avoiding ensonified areas and reducing the duration and frequency of intraspecific vocalizations (NRC 2005, Nowacek et al. 2007).

4.1.3. Species Use of the Action Area

Humpback whales are regularly sighted during Kachemak Bay whale-watching tours based out of Homer and have been recently recorded near the proposed pipeline corridor (near Anchor Point) (Owl Ridge Natural Resource Consultants, Inc. [Owl Ridge] 2014). Small numbers were regularly observed during annual/biennial beluga whale surveys conducted by NMFS, generally south of Anchor Point. Between 1993 and 2016, NMFS recorded 28 humpbacks in Kamishak Bay and near Augustine Island (Figure 18). ABR marine wildlife studies in Cottonwood Bay, Iliamna Bay, and Iniskin Bay from 2006 -2012 which included monthly helicopter-based surveys did not report any humpback whale sightings (ABR 2015). ABR (Figure 20; 2018 survey; unpublished data) observed 22 humpback whales within Kamishak Bay southwest of Augustine Island in 2018. However, ABR did not record any humpback whales during systematic sea otter surveys within Kamishak Bay during March, May, June, and October 2019 (Obritschkewitsch and Gall 2019). Small numbers of humpback whales are expected to seasonally (summer/fall) occur within the Cook Inlet portion of the Action Area. Humpback whales are more common in the shelf and shelf edge waters of the GOA and Bering Sea and are expected to occur in the vicinity of all proposed travel corridors outside within the GOA. The majority are expected to be members of the unlisted Hawaii DPS (Wade et al. 2016).

4.1.4. Proposed Critical Habitat

Designated critical habitat was recently proposed for both the Mexico DPS and the Western North Pacific DPS (NMFS 2019a), portions of each which fall within the Action Area, especially lower Cook Inlet (Mexico DPS) and along the proposed western traffic corridor between Cook Inlet, through the Aleutian Islands at Unimak Pass out to the extent of the EEZ (both Mexico DPS and Western North Pacific DPS) (Figure 13, Figure 15).

4.2. Fin Whale (*Balaenoptera physalus*)

4.2.1. ESA Status

North Pacific fin whales were listed as endangered under the Endangered Species Conservation Act in 1970 and the ESA in 1973 and received full protection from commercial whaling in 1976 under the International Whaling Commission. Between 1925 and 1975, nearly 48,000 fin whales were harvested in the North Pacific (Chapman 1976). No critical habitat has been designated for the North Pacific fin whale, although a final recovery plan was published on July 30, 2010.

4.2.2. Biological Status

4.2.2.1. Abundance and Trends

Prior to commercial whaling, an estimated 25,000 to 27,000 fin whales seasonally inhabited the eastern North Pacific (Ohsumi and Wada 1974). By 1974, this stock was thought to have been reduced to between 38 percent and 50 percent of the original population (Rice 1974, Chapman 1976), although the methods used to estimate the decline may not be reliable (Barlow et al. 1994). Because this species occurs both in shelf edge and pelagic waters of the North Pacific, much of the population occurs outside nearshore marine mammal survey areas. Survey results from Moore et al. (2002) and Zerbini et al. (2006) were combined by Muto et al. (2019) to produce the current population estimate of 5,700 animals for western Alaskan waters (although the data are dated and does not include the full Alaskan range for this species). Zerbini et al. (2006) also estimated that this Northeast Pacific stock has increased at an annual rate of 4.8 percent since 1987.

4.2.2.2. Distribution and Habitat Use

Fin whales are cosmopolitan in their distribution in that they are found in all the oceans of the world, including polar regions, although they are rare in the tropics and the Arctic Ocean (Figure 16). They are found in both pelagic and shelf waters, and especially use shelf edge upwelling and mixing zones. The migratory pattern of eastern North Pacific fin whales is not fully understood, although they are found in Alaska during summer (Mizroch et al. 2009) and off California all year (Clapham et al. 1997).

4.2.2.3. Feeding and Prey Selection

Fin whales feed primarily on krill and schooling fish such as anchovies, Pacific herring (*Clupea pallasii*), and walleye pollock (*Theragra chalcogramma*) (Rice 1963, Clapham et al. 1997). Euphausiids dominated the prey of fin whales taken from British Columbia whaling stations in the 1960s (Flinn et al. 2002).

4.2.2.4. Reproduction

It is assumed that North Pacific fin whales become sexually mature at about 10 years of age, although there is evidence that those in heavily exploited populations can mature in as little as 6 years (Gambell 1985, Ohsumi 1986). The calving interval may also vary depending on exploitation, with heavily hunted populations having intervals closer to 2 years (Christensen et al. 1992) and unhunted populations closer to 3 years (Agler et al. 1993).

4.2.2.5. Natural Mortality

There is little information on natural mortality. It is assumed that they are occasionally attacked by killer whales, but there is little evidence to confirm this.

4.2.2.6. Threats

NMFS identified 11 potential world-wide threats to fin whale recovery (NMFS 2010a), with three that were deemed relatively important to recovery (medium or greater impact): vessel strike, direct harvest, and climate change. The vessel strike database maintained by NMFS (Jensen and Silber 2004) show fin whales to be the species most likely to be struck by a vessel largely because of their prevalence near commercial shipping lanes. Direct harvest is currently not a recognized threat in the North Pacific, and while climate change is a global concern, exactly how it could affect North Pacific populations of fin whales is unknown.

4.2.2.7. Acoustical Ecology

There is no direct information about the hearing abilities of fin whales, but Southall et al. (2007) estimated the hearing range of low frequency cetaceans to extend from approximately 7 Hz to 22 kHz based on the inner ear morphology of other baleen whales. Baleen whale calls, especially fin whale calls (known for their characteristic 20 Hz moans), are also predominantly at low frequencies, mainly below 1 kHz (Richardson et al. 1995), and their hearing is presumed good at corresponding frequencies. Thus, the auditory system of baleen whales is almost certainly more sensitive to low-frequency sounds than that of the small-to-moderate-sized tooth whales.

4.2.3. Species Use of the Action Area

Fin whales are rarely observed within Cook Inlet and most sightings occur near the mouth of the inlet. The NMFS 1993-2016 Cook Inlet beluga whale survey database contains 10 fin whale records (Figure 21). A single whale was observed between Anchor Point and Homer, and another in mid-inlet west of Homer. The remaining 8 records are from the very mouth of the inlet where it opens to the GOA. ABR marine wildlife studies in Cottonwood Bay, Iliamna Bay, and Iniskin Bay from 2006-2012 which included monthly helicopter-based surveys did not report any fin whale sightings (ABR 2015). None were observed by ABR 2018 and 2019 surveys (Gall 2018, Seiser and Gall 2018a-e, Obritschkewitsch and Gall 2019) or Owl Ridge (2014). It is possible, but unexpected, that fin whales would be encountered during planned PLP activity in lower Cook Inlet. Outside the inlet, within the GOA, fin whales are much more common, especially within Shelikof Strait and along the shelf edge (Brueggeman et al. 1987, 1988, 1989; Zerbini et al. 2006). Fin whales are also common along the Bering Sea shelf (Friday et al. 2012, 2013; Springer et al. 1996). During the summer months they are likely to be found in the vicinity of the proposed GOA and Bering Sea travel corridors (Figure 16).

4.3. North Pacific Right Whale (*Eubalaena japonica*)

4.3.1. ESA Status

A primary target of the 19th Century whaling industry, worldwide right whale populations (including those in the North Pacific) were reduced to critically low levels by the early 20th Century. As many as 37,000 North Pacific right whales were taken between 1839 and 1909, with 80 percent of these taken in the 1840s alone (Scarff 2001). They were first protected under an international agreement in 1935, although Japan and the Soviet Union did not sign the original agreement and continued hunting these whales well into the 1960s. In 1970, North Pacific right whales were afforded additional protection under the Endangered Species Conservation Act. They are currently listed as endangered under the ESA. A final recovery plan was published in June 2013 (NMFS 2013).

4.3.2. Biological Status

4.3.2.1. Abundance and Trends

Two separate populations of North Pacific right whales have been identified: a western population of about 400 whales that summers in the Sea of Okhotsk and winters off the coasts of China and Japan, and an eastern population of about 30 whales (minimum of 26) that summers in the Bering Sea and migrates along the western coast of the U.S. to Baja, California. Although neither of these population estimates have been validated, they still represent a fraction of the tens of thousands of whales that once inhabited the North Pacific (Scarff 2001). The limited data on population abundance is not sufficient to determine trends.

4.3.2.2. Distribution and Habitat Use

The potential historic range of the North Pacific right whale included the entire North Pacific with greater use in the eastern and western North Pacific and less use in the central North Pacific (Clapham et al. 2004) (Figure 17). Nineteenth Century whaling efforts concentrated on the GOA, Bering Sea, and the Sea of Okhotsk. The several hundred whales that were killed by Soviet and Japanese whalers in the 1960s were also taken in these areas. Winter calving grounds or migration routes (Waite et al. 2003) are largely unknown based on the paucity of sightings, although the waters offshore of Southern California and northwest of the Hawaiian Islands have been identified as candidate wintering grounds based on winter habitat preferences of North Atlantic right whales (Good and Johnston 2009). Based on recent sightings, the Sea of Okhotsk, nearby Kamchatka Peninsula, the Bering Sea north of the Alaska Peninsula, and Albatross Bank in the GOA south of Kodiak Island are the only known summer feeding grounds (Brownell et al. 2001, Scarff 2001, Tynan et al. 2001, Clapham et al. 2004, Wade et al. 2011a, b).

4.3.2.3. Feeding and Prey Selection

The preferred prey of North Pacific right whales is calanoid copepods. Diet studies from whales harvested in the 1960s by the Japanese revealed that whales in the GOA fed primarily on *Neocalanus cristatus*, while whales from the eastern Aleutian Islands contained mostly *N. plumchrus* (Omura 1958, 1986; Omura et al. 1969). A single net tow conducted in the vicinity of whales feeding on surface zooplankton over Albatross Bank found a mix of euphausiids and copepods that included *N. cristatus*, *N. plumchrus*, *N. flemingeri*, and *Calanus marshallae* (Wade et al. 2011b, NMFS 2013). Repeated sightings (3 consecutive years) of right whales presumably feeding at Albatross Bank suggest that the bank supports significant densities of zooplankton, leading to the designation of the bank as critical habitat (GOA Critical Habitat Area; Figure 17).

4.3.2.4. Reproduction

Little is known about reproduction in North Pacific right whales. The sighting of a possible calf in the Bering Sea in 1996 (Goddard and Rugh 1998), and the observations of a few subadults (Wade et al. 2011b), indicate that at least limited breeding has occurred since cessation of Soviet whaling in the 1960s. However, the number of breeding females in the eastern North Pacific population is small, which combined with the low population, limits the ability for these whales to find viable mates (NMFS 2013). Based on Kraus et al. (2007), the average age at first calving is 9 to 10 years and the calving interval for North Atlantic right whales is 3 to 5 years.

4.3.2.5. Natural Mortality

The natural mortality rate for North Pacific right whales is likely to be similar to that for North Atlantic right whales: 17 percent in yearlings and 3 percent in subadults based on photo-identification data (Kraus 1990), although specific causes are not fully known. However, mortality from anthropogenic sources is likely lower for the North Pacific whales as fishing and shipping traffic is less intense than in the Atlantic habitats (NMFS 2013). Still, any anthropogenic mortality is serious given there may only be 30 whales in the eastern North Pacific population.

4.3.2.6. Threats

NMFS (2013) identified multiple threats to this population including anthropogenic noise (from ships, oil and gas development, and military sonar and explosives), vessel interactions (including vessel strikes and disturbance from whale watching boats and other vessels), contaminants and pollutants, disease, interaction with marine debris and commercial fishing, research, predation and natural mortality, directed hunting (past illegal harvest), competition for resources (with other whale species), and loss of prey base due to climate and ecosystem change. All these threats were ranked by NMFS (2013) as either low or unknown due largely to the isolation and size of this population.

4.3.2.7. Acoustical Ecology

As with other baleen whales, there are no direct measurements of hearing abilities for right whales. These whales vocalize at frequencies <1 kilohertz (kHz) and presumably hear best in that range, although Southall et al. (2007) estimated that the hearing of low frequency cetaceans to range from approximately 7 Hz to 22 kHz based on the inner ear morphology of other baleen whales. Chronic vessel noise is a recognized concern for this species as the nominal frequencies generated by surface ships are also <1 kHz (Simmonds and Hutchinson 1996) and could interfere with the whale's communication space (Clark et al. 2009).

4.3.3. Species Use of the Action Area

Historically (between 1940 and 2005) North Pacific right whales have been observed in the southeastern Bering Sea (Shelden et al. 2005) and may occur in the vicinity of the proposed GOA and Bering Sea travel corridors (Figure 17). None of the Action Area overlaps with North Pacific right whale critical habitat. Travel corridors (concentrate shipping and supply barging) that have been designated for this Project (Figure 17) were purposely located to avoid both the SEBS and GOA units.

4.3.4. Critical Habitat

Critical habitat was designated for this species in 2006. At that time, the whale was classified as the North Pacific population of the northern right whale (*Eubalaena glacialis*). In 2008, it was reclassified as the North Pacific right whale (*E. japonica*). Two areas were designated, the 35,780-mi^2 (92,670 km^2) Bering

Sea Critical Habitat Area located north of the Alaska Peninsula and the smaller GOA Critical Habitat Area found south of Kodiak Island (Figure 17).

4.4. Gray Whale (*Eschrichtius robustus*)

4.4.1. ESA Status

Two gray whale stocks potentially occur in the action area, the Eastern North Pacific DPS and the Western North Pacific DPS. The Eastern North Pacific DPS of the gray whale was removed from the Endangered Species List (NMFS 1994) and is not addressed in this assessment. In contrast, the Western North Pacific DPS, heavily exploited during international whaling from the 1840s to the mid-1960s, is estimated at 290 (minimum 271) individuals (Cooke et al. 2017) and is listed as endangered under the ESA.

4.4.2. Biological Status

4.4.2.1. Abundance and Trends

The Western North Pacific DPS of gray whales is critically endangered. Weller et al. (2002) estimated about 200 animals were known occur between Russia and China; only 8 percent to 9 percent of the original population (Bradford et al. 2003). More recent population estimates derived from photo-identification data for Sakhalin and Kamchatka, Russia in 2016 indicate a population of 290 (minimum 271) animals and the combined Sakhalin Island and Kamchatka populations between 2005 and 2016 increased at an average rate of 2 percent to 5 percent annually (Cooke 2017, Muto et al. 2019).

4.4.2.2. Distribution and Habitat

Gray whales occur along the eastern and western margins of the North Pacific (Figure 18). The Western North Pacific stock summers in the Sea of Okhotsk feeding off Sakhalin Island and the eastern coast of Kamchatka Peninsula (Jones and Swartz 2009). They winter in waters off the Korean Peninsula, southern Japan, and tropical waters off southeastern China (Weller et al. 2002, Jones and Swarts 2009). Through tagging, photo-identification, and genetic matches, it is known that some whales migrate to winter breeding grounds in Mexican waters with the Eastern North Pacific gray whale population (Weller et al. 2012).

4.4.2.3. Feeding and Prey Selection

Predominantly bottom feeders, gray whales are restricted to feed in shallow continental shelf areas. As suction feeders, they feed alone or in small groups primarily on swarming mysids, amphipods, and polychaete tube worms, and opportunistically on other food including crabs, baitfish, herring and crab larvae, cephalopods, and megalops (Jefferson et al. 2008, Jones and Swartz 2009). Specifically, the Western North Pacific stock feeds off Sakhalin Island and the eastern coast of Kamchatka Peninsula (Jones and Swartz 2009). Most foraging observations of this stock have occurred in a feeding area off Sakhalin Island, near Piltun Lagoon where the dominant prey are benthic amphipods (*Pontoporeia affinus*) in shallower waters (<66 ft, <20 m) or ampliscid amphipods in deeper waters (130-164 ft, 40-50 m) (Würsig et al. 2000, Brownell et al. 2010).

4.4.2.4. Reproduction

In general, gray whales reach sexual maturity from 6 to 12 years for both sexes. Mating occurs during the southerly migration to the wintering grounds and continues through winter, during which both sexes are thought to mate with multiple partners. Gestation varies from 11 to 13 months and females generally calve once every 2 years. Calves are generally weaned after 7 to 8 months, ending the bond between mother and calf (Jones and Swartz 2009). Studies from 1995 to 2007 of the Western North Pacific DPS provide limited data, however, one whale first observed as a yearling in 2001 was observed with a calf in 2007 and, thus, was positively determined to be sexually mature at 6 years (Bradford et al. 2009).

4.4.2.5. Natural Mortality

Killer whales (*Oricinus orca*) are the only known predator of gray whales, although scarring indicates that many attacks of adult whales are not fatal. Calves are most vulnerable and the primary predation targets during the northward migration to feeding areas. Gray whales are infested with external parasites and commensals, including the host-specific barnacle, *Cryptolepas rhachianecti*, which forms embedded colonies in the skin and cyamids, or whale lice, are also prevalent feeding on skin. The skin parasites are considered mutualists and are not harmful to the whales. Gray whales are also less prone to internal parasites than other cetaceans (Rice and Wolman 1971).

4.4.2.6. Threats

Brownell et al. (2010) identified lethal and sublethal threats to this population. Lethal threats including entrapment and entanglements in fishing gear, vessel strike, and deliberate killing. Sublethal threats include anthropogenic noise from offshore construction associated with oil and gas development and seismic surveys, contamination of prey from offshore oil and gas production or oil transport, direct effects from oil spills, shipping noise in migratory routes, physical disturbance of prey from construction (onshore or offshore) that disturbs sediment or increases runoff, and physical modification of the coastal zone by urban developments. Also, loss of prey due to climate and ecosystem change is an unknown but potentially high threat.

4.4.2.7. Acoustical Ecology

Gray whales vocalize (and presumably hear) at mostly low frequencies between 100 Hz to 4 kHz, possibly up to 12 kHz, within the presumed 7 Hz to 22 kHz hearing range for baleen whales (Southall et al. 2007). It is thought that the low frequencies may circumvent the natural background noise (e.g., waves, bubbles, ice movement, and currents) that occurs in nearshore waters (Jones and Swartz 2009). Manmade noise, however, is often at lower frequencies and may mask whale communication or impact their ability to navigate and forage. Jones and Swartz (2009) note that gray whales increase the call types, rates, and loudness to compensate for the increased noise in the soundscape.

4.4.3. Species Use of the Action Area

The range of the Western North Pacific stock of gray whale overlaps portions of the proposed vessel routes in the Bering Sea and GOA (Figure 18). Weller et al. (2012) confirmed a few individuals of the Western North Pacific DPS (photographed in the Sakhalin Islands on multiple occasions) were occasionally found wintering with the Eastern North Pacific stock in Mexico (Laguna San Ignacio). Presumably, this interchange included passage through Alaskan waters along traditional gray whale coastal migration routes. Since vessel traffic is planned to occur year-round, it is possible that individuals from the Western North Pacific DPS may occur in the vicinity of the proposed GOA and Bering Sea travel corridors (Figure 18) during migration.

4.5. Sperm Whale (*Physeter catodon*)

4.5.1. ESA Status

Sperm whales were listed as endangered under the Endangered Species Conservation Act in 1969 and ESA in 1973. There is no designated critical habitat, but a recovery plan was finalized in 2010 (NMFS 2010b). Although they remain the most abundant of all large whale species, sperm whales were afforded listing status based on population depletion due to commercial whaling.

4.5.2. Biological Status

4.5.2.1. Abundance and Trends

Rice (1989) estimated the North Pacific population prior to exploitation at 1,260,000. Based on Whitehead's (2002) model, the current North Pacific population is 152,000 to 226,000, although Croll et al. (2007) using Whitehead's data with a different model estimated the current population at only about 80,000, which would represent a 94 percent decline from Rice's (1989) pre-exploitation population. Although trend data are unavailable, the stock is likely continuing to increase at somewhere near its reproductive growth rate since cessation of whaling (Muto et al. 2019).

4.5.2.2. Distribution and Habitat Use

Sperm whales are cosmopolitan in their distribution and are exceeded only by killer whales in the extent of their range (NMFS 2010b). Although sperm whales are found near the shelf edge, they are largely pelagic in distribution (Figure 18). Based on historical whaling records, whales were killed in Alaska and British Columbia in summer in deeper offshore waters, although most cows, calves, and immature bulls remained south of latitude 50°N (NMFS 2010b). Of nearly 60,000 sperm whales killed in the North Pacific north of 50°N, approximately 57,000 were males (Mizroch and Rice 2006). Based on tagging studies, whales appear to annually move along the U.S. west coast into the GOA and the Aleutians (NMFS 2010b). The 6,514 sperm whales killed off British Columbia between 1908 and 1967 were concentrated offshore of Vancouver Island with males found largely along the shelf edge and females more offshore (Nichol et al. 2002). Sperm whales are also often concentrated around oceanic islands and shelf edges where upwelling occurs.

4.5.2.3. Feeding and Prey Selection

Sperm whales feed on a variety of prey, although their diet is dominated by medium- and large-sized squids found at extreme water depths (NMFS 2010b). Rice (1989) found mesopelagic fish to be important in the more northern latitudes.

4.5.2.4. Reproduction

Sperm whales first conceive at about age 9 (Rice 1989) and rarely become pregnant after age 40 (Whitehead 2003). The calving interval is long at 4 to 6 years (Best et al. 1984). The longer interval is due in part to a gestation period of well over a year and a 2-year lactation period (Best et al. 1984). Females form social groups and during spring mating season are attended by roving mature bulls.

4.5.2.5. Natural Mortality

Killer whales have been observed attacking and killing sperm whales (Pitman and Chivers 1998), although killer whale predation appears to be a low mortality factor based on the rarity of observed attacks (NMFS 2010b).

4.5.2.6. Threats

Current recognized threats to sperm whales include vessel strike, reduced prey base due to climate change, contaminants and pollutants, legal or illegal harvest at biologically unstainable rates, and anthropogenic shipping noise (NMFS 2010b). All threats are considered low or unknown.

4.5.2.7. Acoustical Ecology

Based on ear anatomy, sperm whale hearing appears to have a hearing function similar to bottlenose dolphins (Ketten 1994, 1997) with an estimated range between 150 Hertz (Hz) and 160 kHz (Southall et al. 2007). Most vocalizations (clicks) occur at frequencies below 4 kHz with some acoustical energy reaching 20 kHz (Thode et al. 2002) and are used for both communication and echolocation. Source levels of clicks have been recorded as high as 236 dB re 1 µPa @ 1 m (Møhl et al. 2003).

4.5.3. Species Use of the Action Area

Given the abundance of sperm whales in the eastern North Pacific and their pelagic distribution, sperm whales are not likely to be encountered within Cook Inlet or along designated travel corridors outside the inlet over continental shelf waters but could be encountered near travel corridors extending to pelagic offshore waters. Sperm whales are more common in latitudes south of Alaska (Figure 18).

4.6. Sei Whale (*Balaenoptera borealis*)

4.6.1. ESA Status

As with most large whales, the sei whale is listed as endangered under the ESA. Because of their pelagic distribution and fast swimming speed, they were one of the last species to be targeted by the commercial whaling industry. Approximately 300,000 sei whales were harvested worldwide, mostly during the modern whaling period, with a reported 61,500 taken in the North Pacific between 1947 and 1987 (Carretta et al. 2019). Tillman (1977) estimated that an original North Pacific population of 42,000 was reduced to between 7,260 and 12,620 animals by 1974. A couple of hundred sei whales were taken by shore-based whaling off California, and about 4,000 where killed off British Columbia, mostly between 1955 and 1969 (Gregr et al. 2000). Given the number of whales that remained at the cessation of whaling, and the time since then, some have speculated that the North Pacific population has grown and may no longer warrant ESA status. However, virtually no confirmed sei whale sightings have occurred off the west coast of the U.S. or British Columbia since the end of whaling, and Barlow (2010) estimated the current abundance off California, Oregon, and Washington at only 126. No critical habitat has been designated for this species, although an updated recovery plan was finalized in 2012.

4.6.2. Biological Status

4.6.2.1. Abundance and Trends

Other than Tillman's (1977) estimate of between 7,260 to 12,620 sei whales occurring in the North Pacific in 1974, there are no meaningful estimates based on recent surveys. Barlow (2010) estimated the U.S. west coast population at only 126, but this number is based on aerial and shipboard surveys that were conducted primarily over continental shelf waters, a habitat feature rarely used by this pelagic species. Without current abundance estimates, a trend in the population cannot be computed.

4.6.2.2. Distribution and Habitat Use

North Pacific sei whales are pelagic in their distribution, and their range has been described as anywhere south of the Aleutian Islands and north of a line connecting Baja California and Japan (NMFS 2011) (Figure 18). In general, seasonal distribution of sei whales is unpredictable with sporadic "influxes" occurring at some locations (Clapham et al. 1997).

4.6.2.3. Feeding and Prey Selection

North Pacific sei whales feed on a variety of marine prey. They are unusual in that they will gulp-feed on schooling fish and euphausiids much like a humpback whale, but also skim feed at the surface on calanoid copepods similar to a right whale. Sei whales killed off California fed largely on anchovies (*Engraulis mordax*) and krill (*E. pacifica*) (Rice 1977, Clapham et al. 1997).

4.6.2.4. Reproduction

Based on the sample of sei whales killed off Central California, Rice (1977) found these whales to sexually mature at about 10 years of age, with a 13-month gestation period and 3-year calving interval. The calving season extended from September to March.

4.6.2.5. Natural Mortality

Rice (1977) estimated the annual adult mortality rate at 0.088 for females and 0.103 for males.

4.6.2.6. Threats

NMFS (2011) identified several potential threats to North Pacific sei whales, most of which were rated low or the potential risks were unknown. However, NMFS (2011) did identify a medium threat from Japanese scientific research whaling. Between 1988 and 2009, Japan killed 592 sei whales in the northwestern North Pacific (International Whaling Commission 2010). More recently, Japan withdrew from the International Whaling Commission in 2019 and resumed whaling in Japanese waters for three species of baleen whales including sei whales. The 2019 sei whale kill cap was set at 25. Hence, the threat identified in 2011 was realized in 2019.

NMFS (2011) also identified a loss of prey base due to climate and ecosystem change as an unknown but potentially high threat.

4.6.2.7. Acoustical Ecology

As with other baleen whales, sei whales vocalize at low frequencies generally less than 3 kHz (Thompson et al. 1979, Knowlton et al. 1991, McDonald et al. 2005, Rankin and Barlow 2007, Baumgartner et al. 2008). Both Rankin and Barlow (2007) recorded calls from Hawaiian waters, the only records from the North Pacific and identified two low calls downward sweeping from 100 Hz to 44 Hz and 39 Hz to 21 Hz. Similarly, Baumgartner et al. (2008) recorded downward sweeping calls from 82 Hz to 34 Hz off Massachusetts. These calls fall at the low end of the presumed 7 Hz to 22 kHz hearing range for baleen whales (Southall et al. 2007).

4.6.3. Species Use of the Action Area

Sei whales are a summer visitor to the GOA (Leatherwood and Reeves 1983), although their annual presence may be irregular (COSEWIC 2003). They were taken by both shore-based (Gregr et al. 2000) and ship-based (Fujino 1964) whaling in the GOA, but they are not included in the Alaska stock assessment reports (Muto et al. 2019). This species of whale is very pelagic in distribution and does not inhabit Cook Inlet or near-shore waters. It might be encountered by offshore vessel traffic associated with the Project (Figure 18).

4.7. Blue Whale (*Balaenoptera musculus*)

4.7.1. ESA Status

Blue whales were first protected in the North Pacific in 1966 under the International Convention of the Regulation of Whaling and are currently listed as endangered under ESA. Nearly 10,000 blue whales were killed in the North Pacific between 1910 and 1965 (Ohsumi and Wada 1972), averaging 180 per year, from an original population variously estimated at between 4,900 and 6,000 whales (Omura and Ohsumi 1974, Rice 1974). A draft revised recovery plan was prepared in 2018 (NMFS 2018c), but no critical habitat has been designated.

4.7.2. Biological Status

4.7.2.1. Abundance and Trends

Whaling data suggest the previous existence of five stocks of blue whales in the North Pacific (Reeves et al. 1998), with two – Aleutian Islands and eastern GOA – occurring in Alaska. Acoustical studies on whale call variation by Stafford et al. (2001) support that there are separate northeastern North Pacific and northwestern North Pacific subpopulations with both stocks seasonally overlapping in the GOA (Stafford 2003). Photographs of a blue whale recently taken in the GOA matched with a Southern California whale (Calambokidis et al. 2009) resulting in NMFS designating all whales found from the GOA to the tropical eastern North Pacific as members of the Eastern North Pacific stock. Calambokidis et al. (2010) estimated this stock at 2,497 animals based on mark-recapture analysis of photographs collected from 2005 to 2008, and further estimated an annual growth rate of a little less than 3 percent per year.

4.7.2.2. Distribution and Habitat Use

Blue whales are cosmopolitan in their original distribution and inhabit both pelagic and shelf edge waters (Figure 16). Blue whales summering in Alaska were once speculated to winter in pelagic waters north of

Hawaii (Berzin and Rovnin 1966). At least 1,380 blue whales were killed by shore-based whalers in British Columbia between 1908 and 1967 (Nichol et al. 2002), indicating the waters immediately offshore of Queen Charlotte Sound once supported a sizable summering blue whale population. Since 1997, 12 blue whales have been sighted off British Columbia. In July 2004, three blue whales were recorded between 100 and 150 miles (160 and 241 kilometers) southeast of Prince William Sound, representing the first sightings in the region in over three decades (Calambokidis et al. 2009). Another three were recorded the same year, but in the western Aleutian Islands, and were acoustically matched with blue whales summering in the western North Pacific (Rankin et al. 2006). Stafford (2003) collected data from seafloor hydrophones and recorded blue whale calls from both eastern and western North Pacific populations in the GOA. It is unclear whether current observed use in Alaska is due to whales re-establishing old migration routes or is a result of increased observer effort. However, Calambokidis et al. (2009) felt that the whales observed in the GOA in 2004 were members of the California feeding stock (which winters in tropical waters from Costa Rica to Baja) that had moved farther north that summer, perhaps because of inadequate feeding resources farther south. There are no reliable estimates of the Western North Pacific stock.

4.7.2.3. Feeding and Prey Selection

Blue whales are fairly selective in their feeding patterns with *E. pacifica*, a species of krill, universally dominating their diet (Rice 1986, Reeves et al. 1998).

4.7.2.4. Reproduction

The reproduction pattern of blue whales is similar to other large baleen whales; the gestation is just less than 1 year, calving interval probably 2 to 3 years, and age at attainment of sexual maturity is thought to be between 5 and 15 years (Reeves et al. 1998).

4.7.2.5. Natural Mortality

Other than a few records of killer whales attacking blue whales (Tarpy 1979, Sears 1990), there is little information on the natural mortality of these large cetaceans.

4.7.2.6. Threats

The 2018 draft recovery plan for the blue whale (NMFS 2018c) identified multiple threats to recovery of the blue whale. Six potential stressors were deemed to be of low or no threat to recovery and included environmental contaminants and pollutants, disease, behavioral disturbance from vessel interactions, research, predation and natural mortality, and competition for resources. Direct hunting (whaling) was a threat considered under control, while the severity of four other threats (ship strike, entanglement in marine debris and fishing gear, anthropogenic noise, and loss of prey base due to climate and ecosystem change) were unknown, largely due to unreported or undetected effects. Shipping noise, in particular, is of concern due to the overlap in sound frequency of vessel noise and whale calls (Redfern et al. 2017), although it is unclear whether there are any consequences at the individual or populations level.

4.7.2.7. Acoustical Ecology

Blue whales produce three kinds of call in the Northeast Pacific termed “A call”, “B call”, and “D call” (Širović et al. 2015). The “A call” is a series of relatively long and rapid low-frequency pulses, which are usually followed by a "B call", a long call with a downsweep in frequency. Combined, the two calls are considered a reproduction-related song (McDonald et al. 2001). The third call, "D call", is more variable in frequency and repetition patterns and is considered a more social call (McDonald et al. 2001). All three calls are composed of frequencies less than 100 Hz (Oleson et al. 2007). There is no information on hearing range for blue whales, but they are presumed to hear within a range of 7 Hz to 22 kHz based on the structure of baleen whale ears (Southall et al. 2007).

4.7.3. Species Use of the Action Area

Blue whales formerly concentrated in the Aleutian Islands region of Alaska before they were actively hunted by modern whalers. Recently, blue whales have been acoustically recorded in the GOA between Southeast Alaska and Kodiak Island (Stafford 2003, Calambokidis et al. 2009). However, the number of whales summering there is probably small. Of the approximately 2,500 blue whales comprising the eastern North Pacific population (Calambokidis et al. 2010), only a small fraction is known to travel north of California in summer, and the number of individuals from the western North Pacific population that ventures as far as the Alaska Peninsula or the GOA would be small given the small size of the population and the distance from more western feeding areas.

Blue whales are a pelagic species unlikely to be found in shallow shelf waters or within Cook Inlet. Only vessel routes in the offshore waters of the GOA and Bering Sea have a small chance of encountering blue whales (Figure 16).

4.8. Beluga Whale – Cook Inlet Stock (*Delphinapterus leucas*)

4.8.1. ESA Status

The isolated Cook Inlet stock of the beluga whale was listed under the ESA as endangered in 2008 after declining from about 1,300 animals in 1979 (Calkins 1989) to an estimated 278 animals in 2005 (Hobbs et al. 2015). Subsistence harvest best explains the observed decline as approximately 10 to 15 percent of the stock was removed annually between 1994 and 1998. A conservation plan was finalized in 2008 (NMFS 2008a) and critical habitat was designated in 2011 (Figure 22). NMFS finalized the recovery plan for Cook Inlet beluga whales in 2016 (NMFS 2016).

4.8.2. Biological Status

4.8.2.1. Abundance and Trends

The most recent estimate (2018 biennial aerial survey data) of abundance for the Cook Inlet beluga population is 279 individuals (95 percent probability interval is 250 to 317) (Shelden et al. 2019a). Over the last 10 years (2008–2018) the estimated trend in the population is -2.3 percent per year (Shelden et al. 2019a).

4.8.2.2. Distribution and Habitat Use

Prior to the decline, this DPS was believed to range throughout Cook Inlet and occasionally into Prince William Sound and Yakutat (Nemeth et al. 2007). However, the range has contracted coincident with the population reduction (Speckman and Piatt 2000, Rugh et al. 2010), with most of the population inhabiting the Susitna Delta in June, compared to only half the population in the past. This summer contraction in range persisted in the 2018 survey (Shelden et al. 2019a). During summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth et al. 2007). Critical Habitat Area 1 (Figure 22) reflects this summer distribution. Historically, beluga whales were recorded in lower Cook Inlet during June and July, but only 3 whales have been sighted in the lower inlet during NMFS summer annual and biennial aerial surveys since 1996 (Shelden et al. 2017).

Based on past observations (Hobbs et al. 2005), wintering beluga whales concentrated in deeper waters in the mid-inlet to Kalgin Island, and in shallow water along the west shore of Cook Inlet to Kamishak Bay (Critical Habitat Area 2; Figure 22). Some whales may also have wintered in and near Kachemak Bay. However, beluga whale tagging studies conducted from 2000 to 2003 found that only a few whales explored waters as far south as Chinitna Bay (Hobbs et al. 2005).

4.8.2.3. Feeding and Prey Selection

In the late spring and summer, Cook Inlet belugas concentrate in river mouths of upper Cook Inlet where they feed upon seasonal runs of eulachon (Hobbs et al. 2006) and salmon (Moore et al. 2000). During the remaining part of the year they feed more on cod, sculpins, and flounders (NMFS 2008b). Stomach contents from 53 Cook Inlet beluga whales harvested from 1992 to 2010 indicated that salmon and eulachon were the primary prey during the late spring and summer, while the few samples from the fall and early spring indicated a greater reliance on saffron cod, Pacific cod, walleye pollock, flounders, and shrimp (Quakenbush et al. 2015, NMFS 2016).

4.8.2.4. Reproduction

Belugas become sexually mature at between 8 and 13 years of age (Burns and Seaman 1986). Based on captive whales, conceptions can range from February to June (Robeck et al. 2005) although most conceptions in the Cook Inlet population occur from March to May (Shelden et al. 2019b). Gestation is 15.5 months (Robeck et al. 2015), and the calving interval is 2 to 3 years (Sergeant 1973). Calkins (1983) thought most calving in Cook Inlet to occur from mid-May to July, while Shelden et al. (2019b) considered calving to extend to mid-August based on data from strandings.

Pregnancy rates are highest for the 12- to 21-year-age class (Burns and Seaman 1986). Of 10 pregnant females that stranded in Cook Inlet, ages ranged from 14 to 41, with only 2 over 29 years of age (Shelden et al 2019c). Calving rates in Cook Inlet have mostly been low. The average rate between 2006 and 2012 was 3.3 percent, but the value was inflated with a single year (2006) average of 12 percent (Hobbs et al. 2015). Calving rates in some years were as low as 0.5 percent.

4.8.2.5. Natural Mortality

Natural mortality includes stranding due to entrapment in shallow water from receding tides and killer whale predation. However, most tidal strandings do not involve mortalities (Muto et al. 2019). Only 4 killer whale predation events were recorded between 1999 and 2008 (Shelden et al. 2003, Vos and Shelden 2005, Hobbs and Shelden 2008), and not all attacks were fatal.

4.8.2.6. Threats

The Cook Inlet beluga whale recovery plan (NMFS 2016), identified 10 types of potential threats to recovery of the stock, three of which had a high level of relative concern: catastrophic events, cumulative effects of multiple stressors, and noise. Catastrophic events include a major oil spill, climate change, earthquakes, volcano eruptions, disease outbreaks, lethal mass strandings, and failure of key salmon runs. Because the Cook Inlet stock is a relatively small and isolated population living in a geologically dynamic landscape coupled with offshore oil and gas activity, its vulnerability to these threats is compounded. With the presence of Anchorage, the largest city in the state, human activity within Cook Inlet is high. Cumulative effects from multiple sublethal stressors can lead to health concerns of both individuals and populations, leading to the inability of the population to recover. These stressors include exposure to harmful chemical pollutants from runoff or vapors, with jet fuel vapors and spill runoff a specifically recognized threat in Cook Inlet given the number of airports located around the inlet. Pesticide runoff is also a recognized threat but use of pesticides is not high in Alaska. Cook Inlet is naturally noisy due to currents, rivers, and sea ice dynamics. While beluga whales have evolved to live in such a noisy environment, it may limit their "communication space" and communication could be compromised by anthropogenic noise sources. NMFS (2016) ordered 16 anthropogenic noise sources in Cook Inlet from highest to lowest threat to recovery based on intensity, frequency (tonal range), duration, and frequency of occurrence. Tugboat noise topped the list, an activity proposed for this Project during pipeline laying.

4.8.2.7. Acoustical Ecology

Auditory thresholds for beluga whales have been described at between 2 kHz and 130 kHz (Finneran et al. 2005), with maximum sensitivity between 10 kHz and 70 kHz (Wartzok and Ketten 1999). Odontocetes hear and communicate at frequencies well above the frequencies of fill placement and vessel propellers/thrusters (Wartzok and Ketten 1999). Beluga whales have a well-developed and well-documented sense of hearing. White et al. (1978) measured the hearing of 2 beluga whales and described hearing sensitivity between 1 kHz and 130 kHz, with best hearing between 30 kHz to 50 kHz. Awbrey et al. (1988) examined their hearing in octave steps between 125 Hz and 8 kHz, with average hearing thresholds of 121 dB re1 µPa at 125 Hz and 65 dB re 1 µPa at 8 kHz. Johnson et al. (1989) further examined beluga hearing at low frequencies, establishing that the beluga whale hearing threshold at 40 Hz was 140 dB re 1 µPa. Ridgway et al. (2001) measured hearing thresholds at various depths down to 300 m at frequencies between 500 Hz and 100 kHz. Beluga whales showed unchanged hearing sensitivity at this depth. Lastly, Finneran et al. (2005) measured the hearing of 2 belugas, describing their auditory thresholds between 2 kHz and 130 kHz. In summary, these studies indicate that beluga whales hear from approximately 40 Hz to 130 kHz, with maximum sensitivity from approximately 30 kHz to 50 kHz. It is important to note that these audiograms represent the best hearing of belugas, measured in very quiet conditions. These quiet conditions are rarely present in the wild, where high levels of ambient sound may exist.

4.8.3. Species Use of the Action Area

Understanding the seasonal distribution of beluga whales in Cook Inlet is paramount to the recovery of this endangered population. Systematic surveys to understand Cook Inlet beluga whale distribution and abundance began with fixed-wing aircraft surveys in the late 1970s and continues today using a combination of aerial and acoustical survey methodologies. Shelden et al. (2015) compiled all available survey data (up to 2014) that included opportunistic sightings, fixed-wing aircraft and helicopter surveys (various surveys by the Alaska Department of Fish and Game, Minerals Management Service, and NMFS), and satellite tagging (Hobbs et al. 2005, Goetz et al. 2012) to document seasonal changes in beluga distribution. The combined results indicated that beluga whales have always preferred upper Cook Inlet, but even more so since population declines beginning in the 1990s.

Satellite telemetry studies (Hobbs et al. 2005, Goetz et al. 2012) determined that Cook Inlet belugas remain in Cook Inlet throughout the year and most of the population currently winters mid-inlet between the Forelands and Fire Island. Rugh et al. (2010) examined historical Cook Inlet beluga records between 1978 and 1979, 1993 and 1997, and 1998 and 2008 and detected a distinct contraction northward in their range, which has continued to contract based on surveys conducted to 2014 (Shelden et al. 2015). In the 1970s, the core summer distribution extended into lower Cook Inlet south to the Kenai River and Tuxedni Bay, but nearly the entire population now summers within Turnagain Arm and Susitna Delta (Shelden et al. 2015). In support, Castellote et al. (2015) acoustically monitored for Cook Inlet beluga whales at 13 moorings year-round from 2008 to 2013. No whales were detected during the summer at the three moorings (Kenai River, Tuxedni Bay, and Homer Spit) located in lower Cook Inlet.

Beluga whale fall, winter, and spring distribution also appears to have contracted farther north, with most of the population wintering in upper Cook Inlet with occasional visits to the lower Cook Inlet in the region of Kalgin Island (Shelden et al. 2015). Beluga whales prefer open pack ice (Goetz et al. 2012), a habitat feature that may now be more prevalent in upper Cook Inlet due to climate change, or alternatively the northern contraction might be explained as a reduced population using a smaller number of preferred habitats (Shelden et al. 2015). The acoustical monitoring conducted by Castellote et al. (2015) indicated that large numbers of beluga whales winter near the Beluga River and Trading Bay in upper Cook Inlet with smaller numbers at Kenai River and Tuxedni Bay in the lower Inlet. No whales were acoustically recorded at Homer Spit, the southernmost mooring. Based on the combined studies compiled by Shelden et al. (2015) and the acoustical studies by Castellote et al. (2015), very few beluga whales currently winter in lower Cook Inlet south of Tuxedni Bay. The only records of beluga whales inhabiting lower Cook Inlet around Augustine Island from the datasets compiled by Shelden et al. (2015) are single sightings in March 1978, April 1978, and August 1979, before range contraction was evident.

PLP-supported marine mammal surveys, data not included in the publications mentioned above, have been conducted in lower Cook Inlet beginning in 2006. ABR conducted helicopter-based surveys for marine mammals during 98 survey periods between early 2006 and late 2012, with 26 survey periods between 2006 and 2008 and 72 survey periods between 2009 and 2012. Fall and spring (August to November and February to April) surveys were twice-monthly in occurrence, whereas late spring-summer (May to July) surveys and mid-winter (December to January) surveys were conducted monthly (ABR 2015). The June-July surveys were conducted only from June 2009 onward. The study area for the ABR 2006 to 2012 surveys generally included nearshore areas and bays (Bruin Bay, Ursus Cove, Cottonwood Bay, Iliamna Bay, and Iniskin Bay) between Contact Point and the east side of Oil Bay (ABR 2015). During these surveys, ABR recorded beluga whales on three different occasions: a single whale between Iniskin Bay and Oil Bay in September 2007, three whales within Iliamna Bay (near Williamsport) in October 2007, and a single whale within Iliamna Bay near White Gull Island in July 2012 (Figure 23) (ABR 2015).

Additional marine mammal surveys by ABR include incidental observations of seabirds and marine mammals in the nearshore and offshore marine waters of Kamishak Bay in 2018 during April 15 to 19, April 28 to May 3, May 14 to 19, June 12 to 15, July 7 to 11, and July 12 to 14 (Seiser and Gall 2018a-e). Observations were collected from the bridge of the *M/V Susitna*, and from a 16-ft skiff, using standard line-transect protocol for seabird surveys. Also, an aerial transect survey, targeting sea otters, was conducted from north of Augustine Island to Kamishak Bay in 2019 (March, May, June, and twice in October). No Cook Inlet beluga whales were observed during these surveys (Obritschkewitsch and Gall 2019).

The entire portion of the Action Area within Cook Inlet occurs south of the Forelands (lower Cook Inlet) (Figure 22) and includes the bays where ABR (2015) recorded belugas during earlier surveys (2007 and 2012) and a proposed travel corridor that extends to Nikiski, passing near the mouth of the Kenai River. Based on all current knowledge of beluga seasonal distribution, the Project could realistically encounter beluga whales during any winter vessel activity to and from Nikiski. It is possible, however, that small numbers of beluga whales might occasionally enter the lower Cook Inlet Action Area at any time of the year, but, other than at or near the Nikiski travel corridor, no substantial beluga whale use of the Action Area is expected.

4.8.4. Critical Habitat

A portion of the Action Area falls within Designated Critical Habitat Area 2, or portions of Cook Inlet where beluga whales have historically occurred during the fall and winter.

In the Final Rule (76 FR 20180), published in 2011, NMFS identified five primary constituent elements (PCEs) essential for conservation of the species and that require special management considerations or protection. They are:

- PCE #1 – Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) (Mean Lower Low Water) and within 5 mi (8 km) of high and medium flow anadromous fish streams
- PCE #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
- PCE #3 – The absence of toxins or other agents of a type or amount harmful to beluga whales
- PCE #4 – Unrestricted passage within or between the critical habitat areas
- PCE #5 – Absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales

The potential effect the proposed Project might have on these PCEs is addressed in Section 6.

4.9. Steller Sea Lion (*Eumetopias jubatus*)

4.9.1. ESA Status

Steller sea lions are found in all continental shelf waters from central California, north to Alaska, through the Aleutian Islands to Kamchatka Peninsula, then south to northern Japan. Due to substantial population declines in the western portion of its range, the Steller sea lion was first listed as threatened under the ESA in 1990, with critical habitat designated in 1993 (NMFS 2008b). In 1997, NMFS identified two DPSs, a Western and an Eastern, and reclassified the Western DPS as endangered based on persisting decline

(NMFS 2008b). The Western DPS (which inhabits Cook Inlet) declined more than 80 percent between the late 1960s and 2000 at consistently monitored rookeries and haulout sites. Critical habitat designated in 1993 (50 Code of Federal Regulation [CFR] 45269) includes a 20 nm (23 mi, 37 km) buffer around all major haulouts and rookeries, and three large offshore foraging areas, within the area used by the Western DPS (Figure 24). A recovery plan was developed in 2008.

4.9.2. Biological Status

4.9.2.1. Abundance and Trends

The minimum abundance estimate for the Western DPS of Steller sea lions is 53,624 animals, which is based on pup and non-pup estimates in Alaska in 2018 (Muto et al. 2019). This is down from a 1950s population estimated for Alaska alone at 140,000 (Merrick et al*.* 1987). Strong evidence suggests that pup and non-pup counts of this DPS were at their lowest levels in 2002 and have increased at 1.52 percent and 2.05 percent, respectively, between 2002 and 2018 (Muto et al. 2019). However, the data also show strong regional differences across the range in Alaska, with positive trends in the GOA and eastern Bering Sea east of Samalga Pass and generally negative trends to the west in the Aleutian Islands (Muto et al. 2019).

In contrast, the Eastern DPS increased at a 3.1 percent annual rate between the 1977 and 2002 (Pitcher et al. 2007) and 4.25 percent rate (based on pup counts) from 1987 to 2017 (Muto et al. 2019). Declines in the small number of Steller sea lions that inhabit central California have been offset by modest increases in northern California and Oregon, and more dramatic increases in Southeast Alaska and British Columbia. The current minimum population estimate is 43,021 (Muto et al. 2019).

4.9.2.2. Distribution and Habitat Use

Steller sea lions are found in all continental shelf waters from central California, north to Alaska, through the Aleutian Islands to Kamchatka Peninsula, then south to northern Japan. During summer Steller sea lions feed mostly over the continental shelf and shelf edge. Females attending pups forage within 20 nm (23 mi, 37 km) of breeding rookeries (Merrick and Loughlin 1997), which is the basis for designated critical habitat around rookeries and major haulout sites. During winter, some of these sea lions may venture far out to sea in pursuit of prey (NMFS 2008b).

4.9.2.3. Feeding and Prey Selection

Steller sea lions are generalists, feeding on a wide variety of fish and cephalopods (Calkins and Goodwin 1988). In Alaska and British Columbia, schooling fish such as Pacific cod (*Gadus macrocephalus*), Pacific hake (*Merluccius productus*), walleye pollock, Pacific herring, Pacific sand lance (*Ammodytes hexapterus*), squid, and salmon are of great importance, as well as rockfish (Calkins and Goodwin 1988, Calkins 1998). Small schooling fish and salmon are eaten almost exclusively during summer, cod during winter, and pollock year-round (Merrick and Calkins 1996, NMFS 2008c).

4.9.2.4. Reproduction

Female Steller sea lions reach sexual maturity at 3 to 6 years of age and can continue to breed into their early twenties (Mathisen et al. 1962, Pitcher and Calkins 1981). Males are sexually mature at 3 to 7 years of age but are not physically mature enough to challenge for breeding rights until about 10 years of age

(Thorsteinson and Lensink 1962, Pitcher and Calkins 1981, Raum-Suryan et al. 2002). Sexually mature females are capable of pupping annually, and studies in the 1970s and 1980s found early gestation pregnancy rates of 97 percent (NMFS 2008c). However, during periods consistent with nutritional stress, pregnancy will be terminated early (intrauterine mortality or premature birthing) (Calkins and Goodwin 1988). During the decline of the Western DPS population in the 1970s and 1980s, pregnancy rates during late-term gestation dropped to between 55 and 67 percent (NMFS 2008c), and for lactating females, the late-term pregnancy rate was even lower suggesting that nursing compounds the energetic stress of reproduction during periods of low food availability. Females with better body condition were more likely to maintain pregnancy (NMFS 2008b).

4.9.2.5. Natural Mortality

About 20 percent of a stable Steller sea lion population dies annually from natural mortality including trampling, disease, senescence, and killer whale predation (NMFS 2008b). Killer whales have been implicated as a possible factor for the observed sea lion decline, or at least as a limit preventing recovery. Williams et al. (2004) explained that the foraging demands of even a relatively few killer whales could account for high sea lion losses. However, other studies have shown that sea lions are a relatively small component of the diet of mammal-eating killer whales for the Western DPS (6 to 22 percent; Wade et al. 2007), and that killer whales using Kenai Fjords annually ate from 3 to 7 percent of the local sea lion population, or only about a quarter of the annual natural mortality (Maniscalco et al. 2007). A decline in the carrying capacity resulting in nutritional stress and lower reproduction rates remains the most viable explanation for the dramatic decline of the Western DPS of Steller sea lions from the 1970s to the 2000s (NMFS 2008b).

4.9.2.6. Threats

Potential threats most likely to result in direct human-caused mortality or serious injury of this stock include subsistence harvest, entanglement in fishing gear and marine debris, incidental take, illegal shooting, and disturbance. The total estimated annual level of human-caused mortality and serious injury for Western U.S. Steller sea lions from 2013 to 2017 is 247 sea lions (Muto et al. 2019). This total includes 204 Steller sea lions in the Alaska Native subsistence harvest and 36 in U.S. commercial fisheries. Estimates of entanglement in fishing gear and marine debris are based solely on stranding reports in areas west of 144°W longitude and may underestimate the entanglement of western stock animals that travel to parts of Southeast Alaska (Muto et al. 2019). Disturbance of Steller sea lion haulouts and rookeries can potentially cause disruption of reproduction, stampeding, or increased exposure to predation by marine predators (NMFS 2008b).

4.9.2.7. Acoustical Ecology

Steller sea lion’s hearing sensitivity is like that of other otariids. Steller sea lion in-air hearing ability ranges from approximately 0.25 kHz to 30 kHz; however, hearing of one individual was found to be most sensitive to noise from 5 kHz to 14.1 kHz (Muslow and Reichmuth 2010). Underwater, the best hearing range of a Steller sea lion has been measured at from 1 kHz to 16 kHz in a male individual and maximum hearing sensitivity of a female individual at 25 kHz, showing a marked sexual dimorphism (though hearing characteristics may also vary based on age or size of the individual). Generalized hearing ranges from 60

Hz to 39 kHz (NMFS 2018b). Steller sea lions use both aerial and underwater vocalizations during breeding, territorial disputes, and rearing of pups (Kastelein et al. 2005).

4.9.3. Species Use of the Action Area

NMFS June aerial surveys (1993-2016) in Cook Inlet recorded low numbers of Steller sea lions and most were near the mouth of the inlet where major haulouts/rookeries are found (Figure 25) (Shelden et al 2013, 2015, 2017). In helicopter-based marine wildlife surveys of Cottonwood Bay, Iliamna Bay, Iniskin Bay, Ursus Cove, and Bruin Bay conducted by ABR from 2006 to 2012, Steller sea lions showed two peaks of abundance, one from late March through mid-May and another from late October through mid- or late November (ABR 2015) (Figure 26). Steller sea lions were recorded in most months, except June through August, suggesting that this species essentially abandons the Cottonwood Bay, Iliamna Bay, and Iniskin Bay areas during the summer. The survey of Steller's sea lions showed few pronounced spatial patterns other than that they consistently occurred in the Iniskin Islands, especially at Big Rock and two nearby intertidal rocks; there also is one record of a Steller's sea lion at White Gull Island. However, none of these has been determined as a major haulout by NMFS. In offshore waters, sea lions occurred in scattered locations in the open bight between Iliamna and Iniskin bays (ABR 2015). Only one Steller's sea lion was recorded during the 8 helicopter-based surveys of the Ursus Cove and Bruin Bay in September 2012 (ABR 2015).

ABR incidental observations of seabirds and marine mammals in the nearshore and offshore marine waters from north of Augustine Island to Kamishak Bay in 2018 observed 14 sea lions during April and May (see Section 4.8.2.2) (Seiser and Gall 2018a-e) (Figure 27). In 2019 ABR (Obritschkewitsch and Gall 2019) recorded 7 sea lions from north of Augustine Island to Kamishak Bay during May aerial surveys targeting sea otters and reported an additional 3 sea lions hauled out on a rock south of Augustine Island during a survey of pinniped haulout sites. No sea lions were reported during these same surveys when conducted in March, June, and October (Obritschkewitsch and Gall 2019). These observations suggest sea lion use of Kamishak Bay and the area north of Augustine Island is seasonal.

Major haulout sites and rookeries are in the Action Area near the mouth of Cook Inlet (Ushagat Island, Sud Island, and Nagahut Rocks), but not within the inlet itself. All vessel traffic from outside Cook Inlet associated with this Project, including the GOA and Bering Sea, (as with any traffic entering or exiting Cook Inlet) will pass within 20 nm (23 mi, 37 km) of these haulouts and rookeries (see Section 4.9.4 Critical Habitat).

4.9.4. Critical Habitat

Critical habitat for Steller sea lions has been designated as marine waters extending 20 nm (23 mi, 37 km) from around all major rookeries and haulouts in Alaska west of 144°W. There is no critical habitat within the portion of the Action Area that could potentially be affected by proposed construction, but vessel traffic (supply, fuel, and concentrate cargo vessels) from outside Cook Inlet would pass through designated critical habitat (within 20 nm) of three major haulout sites and/or rookeries within the Barren Islands: Ushagat Island, Sud Island, and Nagahut Rocks (Figure 13, Figure 15, and Figure 24). Further, vessel routes southward along the Southeast Alaska coast or westward through Unimak Pass into the Bering Sea would pass within 20 nm (23 mi, 37 km) of several haulouts and/or rookeries. The Final Rule for the designation of Steller sea lion critical habitat did not impose any "inherent restrictions on human activities in an area designated as critical habitat", although NMFS does prohibit vessel entry within 3 nm (3.5 mi, 5.6 km) of all Steller sea lion rookeries west of 150° W, which includes Cook Inlet and the proposed westward vessel route. NMFS also prohibits trawl fishing within 10 nm (11.5 mi, 18.5 km) of all major haulouts and rookeries within the GOA, Bering Sea, and Aleutian Islands. This management restrictions were imposed prior to designating critical habitat. All vessel traffic associated with the Project will follow designated travel lanes, none of which will pass within 3 nm (3.5 mi, 5.6 km) of a major haulout or rookery for marine safety reasons as well as to avoid disturbance to sea lions.

5. CONSEQUENCES OF PROPOSED ACTION

Effects of the Action are all consequences to listed species or critical habitat 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 (two-part test). Effects of the Action may be later in time and may include consequences occurring outside the immediate area involved in the Action (50 CFR 402.17).

PLP's proposed Project has the potential to affect listed humpback whales, fin whales, sei whales, blue whales, sperm whales, Cook Inlet beluga whales, and Steller sea lions and/or their critical habitat through:

- Disturbance from construction of Diamond Point port, dredging of the port approach, the natural gas pipeline and fiber optic cable placement, installation of spread anchor mooring system, vessel maneuvering associated with construction, and disturbance from maintenance operations for the natural gas pipeline and fiber optic cable. Disturbance includes alteration of seafloor habitat and acoustical disturbance due to excessive underwater noise.
- Acoustical disturbance and increased vessel strike risk from increased port construction and operation vessel traffic.
- Whale entanglement in anchor chains.
- Incidental spills of petroleum lubricants and fuels from fueling and operation of equipment.
- Accidental spill of diesel and/or hazardous materials during marine transportation or port transfer.
- Foraging habitat (and prey) loss from the Diamond Point port causeway and marine jetty construction (placement of caissons), dredging of the port approach, and pipeline and fiber optic cable construction (trenching and sidecasting).

Table 9 provides a summary of Project components and activities, potential effects, and results of the two-part test. These potential effect – disturbance, vessel strike, entanglement, incidental spill, accidental spill, and foraging habitat loss – are discussed below.

Table 9. Summary of Project components and activities, potential effects, and two-part test.

Project Components and Activities	Potential Effect	"But For"	"Reasonably Certain to Occur"
Construction Phase			
Construction of the Diamond Point Port	Disturbance	Yes	Yes
	Vessel strike	Yes	No
	Loss of foraging habitat and loss of prey	Yes	Yes
Dredging of Diamond Point Port Approach	Disturbance	Yes	Yes
	Vessel strike	Yes	No
	Loss of foraging habitat and loss of prey	Yes	Yes
Construction of the Lightering Station	Disturbance	Yes	Yes

Project Components and Activities	Potential Effect	"But For"	"Reasonably Certain to Occur"
	Vessel strike	Yes	No
Construction of the Diamond Point Port Access Road	Disturbance	Yes	Yes
	Loss of foraging habitat and loss of prey	Yes	Yes
Construction of the Natural Gas Pipeline and Fiber Optic Cable (subsea)	Disturbance	Yes	Yes
	Vessel strike	Yes	No
Maritime Transport	Disturbance	Yes	Yes
	Vessel Strike	Yes	No
Operations Phase			
Maintenance Dredging of Diamond Point Port Approach	Disturbance	Yes	Yes
	Loss of foraging habitat and loss of prey	Yes	Yes
Vessel Lightering Operations	Disturbance	Yes	Yes
	Vessel strike	Yes	No
	Entanglement	Yes	No
Maritime Transport (Barges)	Disturbance	Yes	Yes
	Vessel Strike	Yes	No
Maritime Transport (Concentrate Vessels)	Disturbance	Yes	Yes
	Vessel Strike	Yes	Yes
Maintenance and repair operations of the natural gas pipeline and fiber optic cable (subsea)	Disturbance	Yes	Yes
	Vessel Strike	Yes	No
Reclamation and Closure Phase			
Maintenance Dredging of Diamond Point Port Approach	Disturbance	Yes	Yes
	Loss of foraging habitat and loss of prey	Yes	Yes
Maritime Transport	Disturbance	Yes	Yes
	Vessel Strike	Yes	No
Maintenance and repair operations of the natural gas pipeline and fiber optic cable (subsea) (or pipeline decommissioning)	Disturbance	Yes	Yes
	Vessel Strike	Yes	No
Potential Accidental Actions or Upset Conditions			
Incidental Diesel Spills (Marine) – Up to 10 gal (38 L)	Injury	Yes	Yes
Accidental Diesel Spills (Marine) – 10 to 1,000 gal (38-3,785 L)	Injury	Yes	Yes
Accidental Diesel Spills (Marine) – >1,000 gal (3,785 L)	Injury	Yes	No
Concentrate Spill (Marine)	Injury	Yes	No
Chemical Spill (Marine)	Injury	Yes	No

5.1. Disturbance

Relative to marine mammals, man-made noise introduced into the marine environment can result in impaired hearing, disturbance of normal behaviors (e.g., feeding, resting, social interactions), masking calls from conspecifics, disruption of echolocation capabilities, and masking sounds generated by approaching predators. Behavioral effects may be incurred at ranges of many miles, and hearing impairment may occur at close range (Madsen et al. 2006). Behavioral reactions may include avoidance of, or flight from, the sound source and its immediate surroundings, disruption of feeding behavior, interruption of vocal activity, and modification of vocal patterns (Watkins and Schevill 1975, Malme et al. 1984, Bowles et al. 1994, Mate et al. 1994). Long-term exposure can lead to fitness-reducing stress levels, and in some cases, physical damage leading to death can occur (e.g., Balcomb and Claridge 2001).

The hearing of baleen whales remains unmeasured, but anatomical analyses suggest they are low-frequency specialists with good sensitivity at less than 2 kHz (Wartzok and Ketten 1999). Odontocetes (toothed whales), however, are high-frequency specialists. For example, beluga have their best hearing sensitivity between 30 kHz and 80 kHz (Finneran et al. 2005). Most pinnipeds have peak sensitivities between 1 kHz and 20 kHz (NRC 2003), with phocids such as ringed and harbor seals peaking at over 10 kHz and showing good sensitivity to approximately 30 kHz (Wartzok and Ketten 1999). Also, pinniped sensitivity to underwater noise relates to their evolutionary adaptation to the underwater environment. Kastak and Schusterman (1998) found that northern elephant seals, which forage at great depths and spend prolonged periods underwater, have better underwater hearing sensitivity than in-air, while sea lions, which spend considerably more time at the surface or hauled out, exhibited the reverse.

5.1.1. Threshold Shift

When exposed to intense sounds, the mammalian ear will protect itself by decreasing its level of sensitivity (shifting the threshold) to these sounds. Stereocilia are the sound sensing organelles of the middle and inner ear. They are the “hairs” of the specialized cells that convert sound wave energy to electrical signals. When sound intensity is low, the hairs will bend towards the incoming waves, thereby increasing sensitivity. If the sound intensity is high, the hairs will bend away to reduce wave energy damage to the sensitive organelles, which includes a reduction in sensitivity. If the sound levels are loud enough to damage the hairs, the reduction in sensitivity will remain, resulting in a shift in hearing threshold. These threshold shifts can be temporary (temporary threshold shift [TTS]) or permanent (permanent threshold shift [PTS]) (Weilgart 2007) depending on the recovery ability of the stereocilia and connecting hair cells. Over-activation of hair cells can lead to fatigue or damage that remains until cells are repaired or replaced.

Exposure to intense impulsive noises can disrupt and damage hearing mechanisms in mammals, leading to a threshold shift. However, these threshold shifts are generally temporary (TTS), as the hair cells have some ability to recover between and after the intermittent sound pulses. No impulsive noise source is associated with construction operations with the possible exception of bottom strike noise from clamshell bucket dredging (which has an impact radius of something less than 66 ft [20 m]).

Long-term exposure to continuous noise, even noise of moderate intensity, can lead to a PTS. This is because the continuous wave energy does not allow hair cells to recover. If the exposure is long enough, the ability to replace damaged hair cells after the exposure has ceased is also reduced, and the threshold shift becomes permanent.

The primary underwater noise associated with the port construction is associated with cutter suction dredging of the port approach zone and the backhoe dredging and fill placement associated with seating the caissons. Concerning the latter, Culloch et al. (2016) recently evaluated the impacts of construction of a gas-pipeline off the coast of Ireland, which included backfilling and rock placement, with results suggesting that while for some species (harbor porpoise and minke whale) there was short-term displacement, "there were no long-term populations effects as a result of construction-related activity or vessel traffic." Cutter section dredging would last for several weeks and represents a more continual noise source. Continuous underwater noise also emanates from anchor-handling vessels during laying of the gas pipeline and fiber optic cable, and from vessels using thrusters to hold position during placement of lightering station anchors. All these noise sources are addressed further in this BA.

5.1.2. Masking

Masking occurs when louder noises interfere with marine mammal vocalizations or their ability to hear natural sounds in the environment (Richardson et al. 1995), which limits their ability to communicate, detect prey, or avoid predation or other natural hazards. Masking is of particular concern with baleen whales because low-frequency anthropogenic noise, such as typical construction noise, overlaps with their communication frequencies. Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects from shipping noises (Watkins 1986, Scheifele et al. 2005, Holt et al. 2009, McDonald et al. 2009, Melcón et al. 2012).

PLP's planned dredging of the port approach, pipeline and fiber optic cable placement, port construction, and vessel traffic would have some additive effect to the overall anthropogenic noise budget.

Most auditory studies on pinnipeds to date indicate that pinnipeds can hear underwater sound signals (such as higher frequency calls) in noisy (low frequency) environments, a possible adaption to the noisy nearshore environment (due to wind, waves, and biologics) they inhabit (Southall et al. 2000). Southall et al. (2000) found northern elephant seals, harbor seals, and California sea lions lack specializations for detecting low-frequency tonal sounds in noise, but rather were more specialized for hearing broadband noises associated with schooling prey.

The extent of masking associated with PLP's marine operations is a function of the duration a noise source is within hearing proximity of a marine mammal, and the additive noise from PLP's activity to overall anthropogenic noise levels in lower Cook Inlet. Working with killer whales, Crystal et al. (2011) found masking effects from vessels are eliminated at speeds less than 10 knots (kt) (18.5 km/hr). Whether this would apply also to other odontocetes such as beluga whales is unknown. However, odontocetes compensate for masking effects from vessel noise by increasing call intensity (Lombard effect), although the fitness implications of doing so is unknown. Given the ability for pinnipeds to hear well in noisy backgrounds (Southall et al. 2000), combined with the short duration of exposure from a moving vessel, masking concerns due to vessel noise are not particularly significant for these marine mammals.

Masking is of greater concern with large baleen whales. Although masking might increase the risk of large baleen whales to killer whale predation, the increased risk is slight and minimal given the overall low predation risk. Communication masking is the primary issue, given the rate at which large baleen whales normally communicate. Communication masking is a function of the loss of communication space because of noise relative to the available communication space during quiet conditions (Clark et al. 2009). The size of communication space for a given species, in turn, is a function of call frequency range and call intensity. Clark et al. (2009) studied potential communication space loss from vessel traffic for singing fin and humpback whales and calling North Atlantic right whales. They found that for the source band (18 to 28 Hz) in which fin whales sing, source levels from a passing vessel (181 dB) were essentially the same as the source level from the whale (180 dB), while for humpback source bands (224 to 708 Hz), vessel source levels (167 dB) were much lower than whale source levels (170 dB). Thus, for both species there was little loss of communication space from the passing ship. The vessel noise associated with PLP's pipeline and fiber optic cable placement would include limited operation of small tugs traveling at speeds less than 10 kt (18.5 km/hr), a great difference from the large commercial ships that have raised concern in the past. However, these tugs will generate increased noise levels during thruster use to maintain position or during anchor handling operations.

5.1.3. Chronic Disturbance

Continued exposure to low levels of noise and disturbance can lead to chronic stress, potentially further leading to stress-related responses such as immune system suppression, reproductive failure, slowed growth, and an overall decline in fitness. Chronic stress is exposure to stressors that last for days or longer and does not apply to a passing vessel. However, disturbance noise from a passing vessel (acute stress) can add to the overall stress budget (known as the allostatic load; Romero et al. 2009) of an individual marine mammal contributing to general distress and deleterious effects. Additional vessel passes would contribute further to the stress load.

In general, baleen whales seem less tolerant of continuous noise (Richardson and Malme 1993) and, for example, often detour around stationary drilling activity when received levels are as low as 119 dB re 1 μPa rms (Malme et al. 1983, Richardson et al. 1985, 1990). These studies are the basis for the threshold for harassment take from continuous noise defined at 120 dB re 1 μPa rms. Humpback whales have been especially responsive to fast moving vessels (Richardson et al. 1995), and often react with aerial behaviors such as breaching or tail/flipper slapping (Jurasz and Jurasz 1979). Humpback whales have also shown a general avoidance reaction at distances from 1.2 mi to 2.5 mi (2 km to 4 km) of cruise ships and tankers (Baker et al. 1982, 1983), although they have displayed no reactions at distances to 0.5 mi (800 m) when feeding (Watkins et al. 1981, Krieger and Wing 1986), and temporarily disturbed whales often remain in the area despite the presence of vessels (Baker 1988, Baker et al. 1992). Odontocetes are probably less sensitive to acoustical disturbance from vessels because of their lower sensitivity to the low frequency noise generated by cavitating propellers. However, the presence of oceanic tug/barges could be disturbing to odontocetes when in proximity, such as the coincidence of beluga whales and barging in confined nearshore summer breeding or feeding habitat in Cook Inlet. Williams et al. (2009) found that Southern Resident killer whales travel greater distances in the presence of vessels, presumably to avoid these vessels, leading to increased energy expenditure and reduced fitness.

Most information on the reaction of sea lions to boats relate to disturbance of hauled out animals. For safety reasons, none of the proposed barging routes would come within a distance likely to disturb sea lion rookeries or haulouts. There is little information on the reaction of these pinnipeds to ships while in the water other than some anecdotal information that sea lions are often attracted to boats (Richardson et al. 1995).

PLP's port construction, dredging of port approach, and pipeline and fiber optic cable placement would have some additive effect to the overall anthropogenic noise budget, especially since there currently are limited anthropogenic noise sources within lower Cook Inlet around Augustine Island when compared to other locations in Cook Inlet.

5.1.4. Other Disturbance

Besides noise disturbance, both construction and operational activities could visually disturb listed species and their habitat. Fill discharge and dredging at the proposed port location and trenching during pipeline and fiber optic cable installation could temporarily suspend sediments that might visually impair whales or pinnipeds from using the affected area or bury benthic resources. For example, resuspension and deposition of sediments during pipe and cable trenching operations can temporarily modify the efficiency of filter-feeding invertebrates (Last et al. 2011, Szostek et al. 2013), while minerals suspended in the water column can damage the gills of larval fish (Au et al. 2004a, Wong et al. 2013), especially cod recruits born from pelagic eggs (Hammar et al. 2014).

Consequences of the Action on suspended sediments would vary based on site-specific conditions (e.g., bathymetry, currents, tides), material (e.g., sand versus silt), and sources (e.g., dredge type). Taormina et al. (2018) considered the extent of sediment resuspension impacts from marine trenching to be negligible based on reviewed literature.

NMFS (2017) reviewed estimates of impacts due to turbidity from mechanical dredging, cutterhead dredging, and jet plow technology. According to this review, total suspended solids (TSS) as a measure of turbidity for mechanical dredging, independent of bucket type or size, can expect elevated suspended sediment concentrations at several hundreds of milligrams per liter (mg/L) above the background in the immediate vicinity of the bucket but would settle rapidly within a 2,000 ft (610 m) radius of the dredge location (NMFS 2017). Cutterhead dredges use suction to entrain sediment that is then pumped through a pipeline to a designated discharge site. Production rates vary greatly based on pump capacities and the type (size and rotational speed) of cutter used, as well as distance between the cutterhead and the substrate. Sediments are re-suspended during lateral swinging of the cutterhead as the dredge progresses forward. Based on a NMFS (2017) review, elevated suspended sediment levels are expected to be present only within a 1,000-ft (305-m) radius of the of the cutterhead dredge. TSS concentrations associated with cutterhead dredge sediment plumes typically range from 11.5 to 282.0 mg/L with the highest levels detected adjacent to the cutterhead dredge and concentrations decreasing with greater distance from the dredge (Nightingale and Simenstad 2001). Jet plow technology has been shown to minimize impacts to marine habitat caused by excessive dispersion of bottom sediments, but some increased turbidity and resuspension of sediments can be expected. Based on the Applied Science Associates, Inc. model used by the ESS Group, Inc. (2008), the maximum suspended sediment concentration at 65 ft (20 m) from the jet plow is 235.0 mg/L, with concentrations decreasing to 43.0 mg/L within 656 ft (200 m) from the plow (NMFS 2017). In almost all cases, the majority of re-suspended sediments resettle close to the dredge area within 1 hour, although very fine particles could settle during slack tides only to be re-suspended by ensuing peak ebb or flood currents (Anchor Environmental 2003).

The release of water resulting from the consolidation of dredged sediment may temporarily increase suspended sediment concentration, thus elevating turbidity in the receiving waterbody (Iliamna Bay). However, by discharging the water through settling ponds or other controls prior to the water entering

Iliamna Bay, remaining sediment in the water will be allowed to settle out of suspension, thereby eliminating listed species exposure to elevated concentrations of suspended sediment.

Increased concentrations of suspended sediment and redeposition could occur because of leveling the footprint and the placement and filling of caissons, dredging of the port vessel approach channel, and installation of the natural gas pipeline and fiber optic cable. Re-suspension of sediments should be minimal from construction of the Diamond Point port increased concentrations of suspended sediment and redeposition would occur in Iliamna or Cottonwood Bay during the preparation of the seabed and placement of caissons for the dock structure. Such conditions could persist for up to several hours after the completion of construction. The duration and extent of the increase in suspended sediment concentrations would depend on the amount of fine sediment in the fill material and disturbed seafloor material, as well as weather conditions (i.e., tides and wind-driven currents and waves would disperse suspended sediment even as it settles to the seabed).

Short-term increases in re-suspended sediment concentrations in the water column would occur from construction of the pipeline. Increases in suspended sediment during trenching would be larger and longer-term than for horizontal directional drilling (HDD) (section 4.16.4.6 in USACE 2020). During HDD construction of the pipeline terminus on the Kenai Peninsula, short-term increases in suspended sediment concentrations would occur, but would not be greater than concentrations routinely occurring in Cook Inlet under natural processes, nor would they persist for more than a day or two because of the vigorous currents that occur there (section 4.16.4.6 in USACE 2020).

5.1.5. Project Components Contributing to the Stressor

Construction activities that could acoustically or visually disturb cetaceans and pinnipeds include using a backhoe excavator to prepare the caisson foundation at the port site, placement of fill material into the caissons, dredging of the port channel approach, anchor handling during pipeline and fiber optic cable installation, operation of vessel thrusters during installation of the mooring anchors at the lightering station, and a general increase in vessel traffic associated with port operation.

PLP's proposed port construction, pipeline and fiber optic placement, and vessel movements directly associated with construction would contribute to existing vessel traffic noise in lower Cook Inlet and would be the dominant noise sources in the area north of Augustine Island during the period that construction of the port, pipeline, and cable occur. Existing vessel traffic noise on the west side of lower Cook Inlet is currently limited to fishing vessels and barges that call mainly at Williamsport during the summer months (section 2.4.7). At times, the noise from all these activities may temporarily disturb marine wildlife, resulting in acute stress levels (Romero et al. 2009) and adding to the animal's overall stress budget for all animals affected.

The primary underwater noise associated with pipeline and fiber optic cable placement emanates from the small tugs when handling the barge anchors. Increased cavitation from tugs while pulling anchors does produce noise levels above Level B thresholds. As discussed in detail in Section 2.4.4, the daily ensonified area from pipeline construction is estimated at 21.1 mi^2 (54.6 km^2) for the two tugboats that would be operating, which assumes a 1.7-mi (2.7-km) noise (above threshold) radius for small anchor handling tugs. This follows the same approach NMFS used for the CIPL project. A fiber optic cable is planned to be buried adjacent to the pipeline as a separate, but following, project. It is conservatively assumed that the impact zones associated with cable-laying are the same as for pipe-laying (Table 7).

Similar short-term acoustical harassment is expected from excavator dredging and filling of caissons during causeway and marine jetty construction. No information was found on the underwater noise generated by placement of fill directly into caissons, although Dickerson et al. (2001) measured a barge emptying fill at a placement site and found that underwater noise levels exceeded the 120-dB threshold out to 443 ft (135 m). Reine et al. (2014a) measured a backhoe dredging operation and found that while bottom strikes were relatively loud (179.4 dB at source), they are impulsive noise sources and the radius to the 160-dB threshold would be less than 66 ft (20 m). Backhoes do produce continuous noise during scooping, which Reine et al. (2014a) found to exceed the 120-dB noise threshold also out to only 66 ft (20 m) (Table 4). However, in this BA the impact zone for both caisson filling and backhoe dredging activity is being conservatively analyzed at a 984-ft (300-m) radius, based on the impact radius for sea otters identified by USFWS for similar activities (Table 7).

Noise disturbance would also occur as a result of cutter suction dredge for dredging and maintenance activities of the Diamond Point port vessel approach. Reine et al. (2012b, 2014a) and Greene (1987) found cutter suction dredge noise levels ranged from 167 to 178 dB re 1 µPa rms @ 1 m with distances to Level B disturbance ranging from 735 ft (224 m) to 2,605 ft (794 m) (Table 4). The noise disturbance zone was conservatively calculated as 2,605 ft (794 m) from the cutter suction dredge.

Re-suspension of sediments would occur from activities that disturb the marine substrate such as construction placement of caissons for the Diamond Point port, dredging of the navigation channel and basin, construction of the port access road, or installation of the natural gas pipeline and fiber optic cable. The duration and extent of the increase in suspended sediment would depend on the amount of fine sediment in the seafloor as well as weather conditions and marine currents. The activities that would result in the largest re-suspension of sediment are dredging of the navigation channel and basin, and pipeline and fiber optic cable installation. Using available information on a variety of dredging equipment (section 5.1.4) these activities have the potential to generate small sediment plumes up to 2,000 ft (610 m) that are expected to settle out of the water column within a few hours to days. Fill placement for construction of the Diamond Point port access road would occur during low tide, and BMPs such as use of armor rock would reduce erodibility of road fill. Mitigation measures are considered unnecessary for either fill placement or pipeline construction activities.

A lightering station would be constructed in Iniskin Bay. It is assumed that the placement of the lightering station will require the use of a tugboat or similar vessel maintaining position using thrusters. Hence, the impact zone for the lightering station is based on the 1.7-mi (2.7 km) radius to the 120-dB threshold used to account for thruster and anchor-handling noise during the CIPL consultations (see Section 2.4.6).

The time to complete each construction activity varies from 10 to 12 days for placement of the lightering station anchors, up to 40 days each for the pipeline and fiber optic cable subsea placement, and from 120 to 180 days for the initial dredging of the vessel approach. Although these activities are temporary disturbance issues with construction, the primary source of long-term disturbance is the increase in vessel traffic (discussed in Section 2.4.7) in the GOA and Cook Inlet over the 20-year operation period as a result of the Project, especially during the operation phase. Tugboats pulling/pushing barges produce sound source levels of 170 dB re 1 µPa @ 1 m (from CIPL project based on Warner et al. [2014] and adjustment based on Wales and Heitmeyer [2002]). Based on the practical spreading model, the distance to the 120-dB continuous noise threshold is 1.4 mi (2.2 km). From a disturbance standpoint, barge operations would cast a 2.8-mi (4.4-km) wide swath of sound levels above threshold. A concentrate ship, a bulk carrier less than 656 ft (<200 m) in length traveling at 13 kt (24.1 km/hr), has a measured source value of 188.3 dB re 1 µPa @ 1 m (Hemmera, SMRU Canada, and JASCO 2014) based on a vessel passage study near Vancouver, B.C. (Hemmera, SMRU Canada, and JASCO 2014, Warner et al. 2014). Based on the spherical spreading model, the distance to the 120-dB threshold is 1.6 mi (2.6 km). Warner et al. (2014) found that the spherical spreading model best matched their observed transmission loss for frequencies above 5 kHz (odontocete hearing range). For lower frequencies in the best hearing range for baleen whales, Warner et al. (2014) found that their range-dependent acoustic model (RAM) was more suitable for low frequency propagation but they did not provide a range to distance. McKenna et al. (2012) also measured bulk carriers of less than 656 ft (<200 m) and found source values to range from 184.2 and 187.4 dB re 1 µPa @ 1 m when traveling at 14 kt (25.0 km/hr), with received levels at less than 120 dB re 1 µPa @ 1 m at the 1.9 mi (3 km) measured distance, supporting the spherical model results from Warner et al. (2014). This suggests that the noise levels exceeding 120 dB from a concentrate bulk carrier vessel when traveling at cruise speed (13 kt to 15 kt [24.1 km/hr to 27.8 km/hr]) would be contained within the 6.4 nm (7.4 mi, 11.8 km) wide travel corridor

Overall, the disturbance risk to listed species within the Cook Inlet portion of the Action Area is very small given the low species densities (see Section 6) and limited impact range of construction, with the possible exception of any winter vessel traffic to and from Nikiski passing near the mouth of the Kenai River where some portion of the beluga whale population still winter (Castellote et al. 2015, Shelden et al. 2015). Disturbance to some level is likely to occur with increased vessel traffic, especially along the two Gulf of Alaska coastal routes, but noise disturbance would be limited to the brief transit time of the passing vessels.

5.2. Vessel Strike

Collisions with marine vessels have been implicated in the deaths of marine mammals (Goldstein et al. 1999, Laist et al. 2001, Jensen and Silber 2004, Panigada et al. 2006, Van Waerebeek et al. 2007, Berman-Kowalewski et al. 2010). Whale mortality from vessel strike is usually a result of blunt force injury from striking the vessel bow (blunt trauma), or lethal wounding from propeller cuts (sharp trauma) (Moore et al. 2013). Worldwide (Laist et al. 2001, Jensen and Silber 2004) and in waters off the state of Washington (Douglas et al. 2008), fin whales are the most common cetacean killed by vessels. This may be a function of a greater population size or higher density in shipping lanes as opposed to a greater biological vulnerability (Douglas et al. 2008). Douglas et al. (2008) also noted that fin whales were more susceptible to blunt trauma from a bow strike, while gray whales were more likely to be injured by sharp trauma from a propeller strike. Neilson et al. (2012) documented 108 vessel strikes in Alaska from 1978 to 2011 and found the clear majority to involve humpback whales in Southeast Alaska. All these records indicate that baleen whales are more susceptible to vessel strike than toothed whales. Of the 292 large whale vessel strikes recorded by NMFS between 1975 and 2002 (Jensen and Silber 2004), only 17 (6 percent) involved sperm whales and only one a killer whale. There is one record of a suspected lethal vessel strike involving a Cook Inlet beluga whale (Neilson et al. 2012), a sharp trauma from a propeller blade, and Kaplan et al. (2009) recorded what appeared to be marks from a small propeller on at least 2 whales during photo-identification studies conducted from 2005 to 2008.

Vessel speed is the primary factor in the probability of a vessel strike occurring as well as the probability of the strike being lethal (Jensen and Silber 2004, Vanderlaan and Taggart 2007). The large whale vessel strike database (Jensen and Silber 2004) indicates that only 3 of the 58 whale strikes (5.2 percent), where the speed was known, involved vessels traveling at less than 10 kt (18.5 km/hr). Vanderlaan and Taggart (2007) analyzed the vessel strike database (Jensen and Silber 2004) and found that the probability of a strike actually being lethal (as opposed to survivable) was also low (<20 percent) for strikes at speeds less than 8 kt (15 km/hr), but high (>50 percent) at speeds greater than 12 kt (22 km/hr). This and additional information were used to develop the 10 kt (18.5 km/hr) restriction now enforced in North Atlantic right whale (NMFS 2008c) habitat off New England. Conn and Silber (2013) estimated that implementation of this vessel speed rule reduced the risk of vessel collisions with right whales by 80 to 90 percent. Laist et al. (2014) evaluated the effectiveness of the restriction 5 years after it was implemented and concluded that it was statistically significant in reducing whale deaths. The number of whale deaths attributed to vessel strike within the restricted area reduced from 0.72 whales killed per year during the 18 years prior to the rule to zero during the 5 years after the restriction was implemented.

Pinnipeds are far less susceptible to vessel strike, likely because of their visual awareness both above and below water, and their maneuverability. Of 6,197 strandings of six species of pinnipeds in central California between 1986 and 1998, only 5 exhibited vessel-strike damage.

5.2.1. Project Components Contributing to the Stressor

Vessel strikes are most likely to occur where large whale concentration areas overlap with shipping traffic. For example, Neilson et al. (2012) compiled collision records from Alaska and found that while two collisions were reported from Cook Inlet, the majority (76 percent) were from Southeast Alaska where constricted waterways are more likely to place whales within shipping routes. Most of the remaining collisions occurred in Prince William Sound and Resurrection Bay where travel lanes are constricted.

Construction support tugboats, dredgers, pipe laying vessels, and construction barges offer very little risk of collision to marine mammals. First, tugs with barges in tow travel at less than 10 kt (18.5 km/hr), the threshold above which vessel collision is of greatest concern (Jensen and Silber 2004, Silber and Bettridge 2012). Once in the construction area, tug traffic would be limited to occasional maneuvering of barges. All other vessel traffic in lower Cook Inlet north of Augustine Island associated with the Project would be limited to travel speeds (through the water) less than 10 kt (18.5 km/hr) to protect sea otter pups, a measure that would also protect cetaceans and pinnipeds (Figure 1). Further, many of the tugboats used in the towing operations would have their propellers recessed into the vessel hull to prevent bottom-strike in shallow waters and inside protective nozzles. These configurations reduce or eliminate the risk of sharp trauma from contact with the moving propeller blades. The remaining risk, albeit low, is from a potential collision with the bow of a towing (pulling) vessel passing through marine mammal concentration areas. However, ocean tugs are also designed to push up against other vessels and do not generally have sharp, bulbous bows. They may push aside a marine animal rather than strike it with full blunt force, depending on strike angle (Silber et al. 2010).

Construction vessels pose little risk to sea lions, as they are maneuverable and aware enough to easily avoid vessel contact (Lawson and Lesage 2013). Vessel collision risk to highly maneuverable Cook Inlet beluga whales is also very low; none of the 89 definite whale/ship collisions reported by Neilson et al. (2012)

involved a barge. However, any mortality for the small Cook Inlet beluga population poses a population level risk.

Based on the imposed low vessel speed (<10 kt [<18.5 km/hr]) and low animal density for all species involved (and maneuverability by beluga whales and sea lions), vessel strike is a very low risk for listed whales and Steller sea lions in the area north of Augustine Island (and all of the Action Area within lower Cook Inlet). The risk of vessel strike increases outside of Cook Inlet, especially in the shelf waters of the GOA where listed whales and sea lions are more common, especially for humpback and fin whales that regularly inhabit the waters around the Barren Islands, within Shelikof Strait, and along the Southeast Alaska coast. Greatest concern is with the concentrate bulk carrier vessels (but not supply barges) that will be traveling at speeds greater than 10 kt (18.5 km/hr) outside of the area north of Augustine Island. For these species, the risk of vessel strike is higher outside Cook Inlet than within the Inlet, due to greater animal densities and greater concentration vessel speeds. However, given the rarity of vessel strike when compared to the existing levels of vessel traffic in the Action Area and the low maximum speeds (<15 kt [<28 km/hr]) of the project vessels, vessel strike is considered not reasonably certain to occur.

5.3. Entanglement

Large whales, especially humpback whales, are susceptible to entanglement in fishing gear both in the Gulf of Maine (Robbins and Mattila 2001), along the U.S. West Coast (NMFS 2019c), and Southeast Alaska (Neilson et al. 2004). In 2018, 46 confirmed whale entanglements were reported off the U.S. West Coast involving humpback (34), gray (11), and fin (1) whales (NMFS 2019c). All entanglements where the source was confirmed were associated with fishing gear including buoyed ropes attached to Dungeness crab and spot prawn pots, and gillnets. BMPs and new regulations were developed for the California 2018-2019 Dungeness crab fishery, which focused on preventing line slack. Taut moorings (anchor chains under tension) are much less likely to cause entanglement than slack ones (Benjamins et al. 2014).

There are several records of marine mammal entanglement with moorings, especially vessel moorings, and a fin whale became wrapped in an anchor cable in Uyak Bay (Kodiak Island) and eventually drowned (Benjamins et al. 2014). The latter case was unusual as it involved anchor chain and cable, not generally considered to pose a risk to whales. Apparently, the fin whale was feeding with its mouth open and anchor/anchor cable became wedged in the corner of the whale's mouth and then in twisting to escape the whale wrapped the cable several times around its body. Benjamins et al. (2014) noted that humpback, fin, and right whales have become entangled in anchor moorings and anchor chains of yachts and other vessels, and in some cases may become attracted to moorings and purposely rub against them. There was, however, little information on smaller cetaceans or pinnipeds becoming entangled.

Benjamins et al. (2014) assessed entanglement risk on marine megafauna and found the highest risk was to large baleen whales due to their long body length, rigid flexibility, inability to detect objects at distance compared to echo-locating Odontocetes, and foraging style (risk was higher mouth entanglement for lunge and filter-feeding baleen whales). Benjamins et al. (2014) further assessed the risk of six different mooring configurations on marine megafauna based on the biological characteristics of the animals involved and physical features of the moorings including the ability to keep chains taut. The key points in the risk assessment in reducing entanglement risk from both fishing gear and industrial moorings is the maintenance of taut anchor chains (See Section 7.4).

Marine debris has been identified as an injury and mortality factor in Alaskan Steller sea lions. Raum-Suryan et al. (2009) recorded 386 individual sea lions entangled in debris at Southeast Alaska and northern British Columbia haulout sites from 2000 to 2007, with an entanglement incidence of 0.26 percent. Packing bands (54 percent) were the most common entangling material with both nets and rope comprising 7 percent of the entanglement material each. These figures do not include sea lions that might have died at sea due to entanglement, but they do illustrate the susceptibility of this pinniped to net and rope entanglement, including, perhaps, fishing nets entrained on mooring chains.

5.3.1. Project Components Contributing to the Stressor

The Project would not involve the use of fishing gear, but a spread anchor mooring system at the lightering station, which uses anchor chains, would be present in the Action Area and might pose an entanglement risk to large whales. During construction, the pipeline barge would be held in place using a spread of anchor cables. However, all anchor chains and cable would be stretched tight and non-kinking, greatly reducing the entanglement risk to the few whales inhabiting lower Cook Inlet north of Augustine Island. The overall risk of entanglement with chains and cables is considered very low.

Fishing nets and other fishing debris is a recognized threat to listed marine mammals. While this Project does not involve fisheries, derelict nets, ropes, and other debris could be entrained on anchor chains and cables where they could become an entanglement threat to marine mammals. The risk is dependent on the rate of gear loss in Cook Inlet and whether a tidal or current path leads to the Project moorings, our current understanding of which is unknown. Thus, the risk is unknown, but probably low compared to the more than a thousand active setnets in Cook Inlet and the mitigation measures (periodic inspection) planned (see Section 7.4).

5.4. Incidental Spills

Incidental spills (1-10 gal [3.8-38 L]) are those that can be safely and quickly controlled at the time of release by personnel present, are of limited quantity, environmental exposure, and potential toxicity. Generally incidental spills do not have the potential to become an emergency within a short time. Incidental spills may result from the normal operation of equipment or vessels, such as incidental discharges of bilge water that might contain oils or oily detergents from deck washdown operations; releases of small volumes of hydraulic fluids, motor fuels and oils, and other fluids used in equipment operation up to 10 gal (38 L). The accumulation of several small spills can lead to impaired marine waters.

PLP and their construction contractors must comply with all laws and regulations related to spill prevention and preparedness or petroleum lubricants and fuel, including 40 Code of Federal Regulation (CFR) part 110, 18 AAC 75, and those related to vessel-to-vessel transfer, including 33 CFR part 144. Construction operations would implement spill prevention control measures, and in the event of a spill would facilitate a rapid response and cleanup operation. Spill prevention measures include design standards, use of established procedures (e.g., fuel transfer procedures), regular equipment inspections and maintenance, and personnel training. They also focus on spill response by requiring pre-staged spill response equipment, pre-identification of sensitive areas, personnel training, and regular spill drills. ADEC review of oil discharge prevention and contingency plans and spill response drills conducted by or participated in by the ADEC are important tools for ensuring adequacy and compliance of PLP's plans with State of Alaska requirements in 18 AAC 75 for spill response prevention, preparation, and readiness.

5.4.1. Project Components Contributing to the Stressor

PLP and their construction contractors must comply with all laws and regulations related to spill prevention and preparedness or petroleum lubricants and fuel, including 40 CFR part 110, and those related to vessel-to-vessel transfer, including 33 CFR part 144. Construction operations would implement spill prevention control measures, and in the event of a spill would facilitate a rapid response and cleanup operation. Spill prevention measures include design standards, use of established procedures (e.g., fuel transfer procedures), regular equipment inspections and maintenance, and personnel training. They also focus on spill response by requiring pre-staged spill response equipment, pre-identification of sensitive areas, personnel training, and regular spill drills. Agency inspections are also important elements of assuring spill response prevention, preparation, and readiness.

Given the required fuel BMPs it is unlikely that an incidental fuel spill would result in the escape and travel of enough fuel to result in any consequential exposure to a listed marine mammal under NMFS jurisdiction. Incidental spills during refueling of construction or operational equipment are not considered a significant risk to listed whales and sea lions. Multiple spills over time could result in water impairment and perhaps contamination of sea lion prey associated with the causeway/marine jetty (e.g., mussels), but BMPs should prevent water impairment from occurring.

5.5. Accidental Spills

Accidental spills are large spills requiring mobilization of forces to control, contain, and clean up. A fuel barge related spill could be large were a vessel or transported fuel tank to rupture, usually due to a collision, sinking, fire, or running aground, or it could involve a significant fuel release during transfer due to human error or equipment malfunction. Diesel fuel and lubricants are necessary to power construction type equipment and vehicles construction, operations, and reclamation activities. Consumption would be highest during construction and operations. During operations PLP would transport up to 4 million U.S. gal (15 million liters) of diesel at a time (depending on the size of fuel barge available) to the Diamond Point port in double-hulled barges, with an annual total of up to 16 million gal (60.5 million liters). Marine fuel transport and transfer operations in Alaska are regulated by both federal and state agencies, more specifically, the USCG, U.S. Environmental Protection Agency (EPA), and the ADEC. The USCG requires Vessel Response Plans (VRP) that comply with Code of Federal Regulations 33 CFR 155 subparts D, F, G, and I.

5.5.1. Risk of an Accidental Diesel Spill

Owl Ridge (2018) conducted a project specific oil spill risk assessment based upon modeling from the *Spill Baseline and Accident Casualty Study* (Glosten 2012) prepared for the *Cook Inlet Risk Assessment* (CIRA) (Nuka Research & Planning Group, LLC 2015), which included 16 years (1995-2010) of spill incident data collected by the ADEC, the USCG, and other sources. The study evaluated the risk of an oil spill based on the following assumptions: 4 fuel tanker ports of call, a total of 60 concentrate and mine supply cargo ports of call, and 270 lightering (workboat) barge[4] trips projected to occur annually within the Action Area during the operations phase. The study results showed that the highest oil spill risk for non-tank vessels is due to transfer error and equipment failure, while allision (where one object is moving and the other is stationary, for example colliding with a rock) and transfer error are the highest risks for tank barges (those that transport stored fuel). However, in all cases the overall risk is very low (Table 10).

Table 10. 50th and 95th percentile spill risk by vessel type.[1]

Vessel Type	50th Percentile Spill Risk (10–1,000 gal [38-3,785 liters])		95th Percentile Spill Risk (2,000–300,000 gal [7,571-1.1 million liters])	
	Spills/Year	Years/Spill	Spills/Year	Years/Spill
All Vessels Combined	$2,829.0 \times 10^{-6}$	353	282.9×10^{-6}	3,535
Non-tank Vessels	$1,725.7 \times 10^{-6}$	579	172.6×10^{-6}	5,795
Tank Barge	242.8×10^{-6}	4,118	24.3×10^{-6}	41,183
Workboat	860.4×10^{-6}	393	86.0×10^{-6}	11,622

[1] Owl Ridge 2018.

Small spills from 10 to 1,000 gal (38 to 3,785 L) were estimated for the Project with a potential occurrence in the "hundreds" of years per spill, while spills in the 2,000- to 300,000-gal (7,571- to 1.1 million-liters) range were estimated with a potential occurrence in the thousands of years. These results are consistent with similar studies by the Bureau of Ocean and Energy Management (BOEM 2016) that estimated the annual probability of a 300,000-gal (1.1 million liters) fuel barge transportation spill to 1.5×10^{-4} spills/year or 6,600 years/spill (section 4.27.4.5 in USACE 2020). Consequently, large spills greater than 1,000 gal (3,785 L) are not reasonably certain to occur during the life of the Project, and risks for small spills in the 10-gal to 1,000-gal (38 to 3,785 L) are possible.

The International Maritime Organization (IMO) (2016) has adopted measures to reduce the risk of pollution and damage to the environment. The measures include the use of navigational routes that keep vessels 50 nm (92.6 km) from the land (except for crossing the Aleutian Island Archipelago) to allow for repair of, or time to launch an emergency response effort before a vessel runs aground. PLP vessel transportation corridors across the Aleutian Islands are consistent with the IMO guidance. The IMO measures are expected to be effective at reducing the risk of spills in the Aleutian Islands Archipelago from a vessel running aground.

Oil effects to marine wildlife that could result include skin contact with the oil, ingestion of oil, respiratory distress from hydrocarbon vapors, contaminated food sources, fouled baleen or fur, and displacement from feeding areas (Geraci 1990). Actual impacts would depend on the extent and duration of contact, and the characteristics (age) of the oil. If a marine animal were present in the immediate area of fresh oil, it is possible that it could inhale enough vapors to affect its health. Inhalation of petroleum vapors can cause

[4] Owl Ridge (2018) study assumed 270 lightering (workboat) barge trips for the project. However, updates to the project description has decreased the number of lightering barge trips to 162. A reduction in workboat traffic would result in a reduction in spills frequency. The spill risk results for workboat were calculated for 270 workboats and are therefore an overestimate of spill risk.

pneumonia in humans and animals due to large amounts of foreign material (vapors) entering the lungs (Lipscomb et al. 1994). Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill. Long-term ingestion of pollutants, including oil residues, could affect reproductive success, but data is lacking to determine how oil may fit into this scheme for marine wildlife.

Oil can reduce the thermal effects of hair on sea lions resulting in death if significantly oiled, especially for pups. Following the *Exxon Valdez* oil spill, Calkins et al. (1994) found no evidence of oil toxicity damage to Steller sea lions stranded or live-sampled, and the ultra-low sulfur diesel (ULSD) fuel that PLP would be transporting quickly evaporates and dissipates relative to heavier oils (TRB and NRC 2014).

5.5.2. Fate and Transport of a Transit Oil Spill

In the event of an accidental oil spill, emergency response actions to prevent, minimize, control and/or clean up would start immediately and follow an ADEC approved spill response plan (yet to be prepared; see Section 7.5). The effectiveness of the response would depend on the strategies employed, sea conditions, distance of the accident from the recovery team, and other factors, including the chemical properties of the product spilled. Diesel largely evaporates within hours (TRB and NRC 2014) often before recovery can be completed. The longer the oil remains in the marine environment the harder it is to recover.

The potential impact of a spill from a vessel during transit on listed wildlife species is not only a function of the volume of the spill, but also the location and transport of the spill relative to the location of where species of concern are. A diesel spill occurring in proximity to a high use wildlife area would have less time to dissipate before reaching wildlife than a spill occurring far away, resulting in a higher risk of wildlife contacting diesel. In that way, a spill that occurs in lower Cook Inlet in proximity to sea lion or beluga whale habitat would have a higher risk to these species than a spill in open sea many miles away.

SLR International Corporation (SLR) (in Owl Ridge 2018) conducted oil spill trajectory modeling for a 1,000-gal (3,785 l) Ultra-Low Sulphur Diesel (ULSD) spill due to a grounding or allision on Augustine Rocks (lat. 59°13’25.9” N, long. 153°21’56.69” W) using the General NOAA Operating Modeling Environment (GNOME). While this location is outside of the Action Area, it is 7 miles (11.3 km) from a Project vessel navigation corridor in Cook Inlet and provides some relevance to understanding the potential consequences of the Project. The spill scenario was separately evaluated by season: winter (December) and spring (March). Neither of the scenarios account for spill response measures that would be implemented immediately to stop the spread of the spill and recover released fluids.

GNOME modeling for the Augustine Rocks allision 1,000 gal (3,785 L) spill scenario, regardless of season, showed the fate of the oil was to be transported out of Kamishak Bay southward and out of Cook Inlet where it either evaporates/disperses or ends up on the shorelines of Shuyak and Afognak islands within about 4 days.

5.5.3. Risk of Concentrate Spills

A spill of concentrate into the marine environment could result from either a break in the concentrate pipeline along the Diamond Point port access road in Iliamna Bay, or from the lightering of concentrate.

The Project includes design features to minimize the potential for concentrate to reach the environment. The concentrate pipeline would be installed along the mountain (farthest from water) side of the road, which would minimize the chances of concentrate reaching marine waters in case of a pipeline rupture.

Concentrate would be loaded onto the lightering facilities at the port and transferred between lightering vessels and bulk carriers as an over-water operation at the lightering station. Procedures for reducing the potential for spills and release of fugitive dust for the over-water transfers, as described in Section 2.2.2.2, are considered to be effective. The probability of a large-volume release from over-water transfer is so low as to rule out the scenario as extremely unlikely (section 4.27.6.8 in USACE 2020).

The risk of concentrate spills was reviewed by the Pebble Project PFEIS in Section 4.27.6 Concentrate Spills. The fate of concentrate spills represents low risk to the marine environment. The metals in the copper-gold concentrate are not immediately soluble in water. Over years to decades, metals could leach out of the concentrate into surrounding water, increasing the potential for contamination in water (section 4.27.6.9 in USACE 2020). Due to extreme tidal fluctuations and strong currents in lower Cook Inlet, however, any potential contamination would be constantly diluted, and it is unlikely that there would be any measurable impacts. Some oxygen gas would likely be present in well-circulated tidal waters, such that sulfide minerals could be oxidized in the marine environment and produce a small amount of acid (section 4.27.6.9 in USACE 2020). However, due to the time required for acid generation and constant dilution, no measurable impacts would be expected (section 4.27.6.9 in USACE 2020).

Spill databases from the USCG and ADEC have no records specific to concentrate spills from marine vessels in Alaska (section 4.27.6.4 in USACE 2020). Historically, at ports serving mines around the world, there have been concerns with spills and escapement of fugitive dust during overwater transfer of concentrate into bulk cargo vessels. Transfer operations technology has dramatically improved in recent years (section 4.27.6.4 in USACE 2020). PLP’s proposed method of overwater transfer of concentrate into bulk carrier vessels would greatly reduce the potential for spills and/or fugitive dust generation. Considering the absence of reported over water concentrate spill incidents in Alaska and concentrate transfer Best Management Practices (BMPs) proposed by PLP, concentrate spills are unlikely and not reasonably foreseeable for the Project.

5.5.4. Risk of Chemical Spills

Chemical reagents, some of which are hazardous materials, would be shipped annually. A list of chemical reagents and chemicals planned for the Project was provided in Table 6. Reagents and chemicals would be shipped in their original, approved-for-shipping, containers. These original containers would be placed inside steel shipping containers (secondary containment) and shipped to the mine site prior to unloading from the steel shipping containers. The Diamond Point port design and operation would comply with all applicable federal and State of Alaska regulations including inspections, training, container and packaging, and spill prevention and response requirements.

Many of the reagents would be shipped in pellet form. If spilled on dry land, the pellets would be recovered and placed back into containment. If spilled into water, pellets would sink. Solubility of reagents varies and is further described in the Pebble Project PFEIS Section 4.27.7.1. Fate and Behavior of Spilled Reagents.

A review of ADEC, USCG, and DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) spill records revealed that releases of hazardous or very hazardous substances beside fuel are rare and determined that because reagents would be transported in relatively small volumes in secondary containment, the probability of a marine spill of reagents in lower Cook Inlet is very low (See PFEIS Section 4.27.7.2. Historical Data and Probability of Reagent Spills).

The pathway for a chemical spill to affect a listed species or critical habitat would start with a barging accident that affected the chemical container. That container would need to be breached and the contents come into contact with the environment. Finally, there would need to be receptors (listed species) present to be exposed to the contaminated water (or air in the case of sea lions). Any hazardous potential of the chemicals (Table 6) would be quickly diluted if a spill were to occur within marine waters. Spill rates of hazardous materials from marine vessels are extremely low (section 4.27.6.4 in USACE 2020) and not reasonably foreseeable for the Project.

5.5.5. Project Components Contributing to the Stressor

Project components that involve marine transport of fuel (whether as cargo or to power the vessel) have the potential for an accidental spill should a fuel tank be breached due to a collision, allision, or fire. Thus, vessel traffic associated with construction, operations, or reclamation and closure pose some level of risk. However, as mentioned above, spills >1,000 gal (3,785 L) are not reasonably likely to occur and, therefore, the risk is de minimis. Only spills of between 10 and 1,000 gal (38 to 3,785 L) are considered possible, but the risk is still minor given the potential occurrence in the "hundreds" of years per spill. The risk of a chemical spill is extremely low and not evaluated further.

SLR Consulting conducted fate and transport modeling for a hypothetical 1,000-gal (3,785 L) spill originating from an allision with Augustine Rocks, near the transportation routes in lower Cook Inlet. The modeling indicated that regardless of season, the fuel was transported out of Kamishak Bay and Cook Inlet with 62 percent of the volume either evaporated or dispersed within 3 days and most of the remaining (about 300 gal [1,136 L]) beached along the shorelines of Shuyak and Afognak islands.

Approximately 300 gal (1,136 L) (30 percent) of the spill would reach shore before evaporating or dispersing. However, such a spill scenario would trigger an immediate containment and cleanup response limiting the amount of fuel transported beyond the immediate area of the point of origin. The amount of fuel ultimately beached or reaching wildlife high-use areas is dependent on at amount of fuel contained.

Accidental diesel spills could affect listed whales or sea lions should they be present when a spill occurred. However, the low volume (10-1,000 gal [38 to 3,785 L]) of spill considered coupled with the low densities of the listed species of concern suggests that the risk of an accidental spill harming a listed whale or sea lion, or their prey, is very remote.

5.6. Effects to Foraging Habitat and Prey

For the listed species addressed in this assessment, nearly all feed on small schooling fish, shrimp, squid, and zooplankton. All these prey species could become contaminated from spills leading to bioaccumulation or biomagnification of toxins in listed species (Eisler 1987, Almeda et al. 2013a, b), although diesel has a low specific gravity and does not sink; thus, rarely reaches the seafloor. Plankton appears to be particularly sensitive to oil (ITOPF 2014a); however, small schooling fish generally do not live long enough to bioaccumulate large amounts of toxins, and fish are able to metabolize polycyclic aromatic hydrocarbons, the oil contaminant of greatest concern (Eisler 1987). Further, because of its high viscosity, fuel oil is less readily incorporated into live tissue and, thus, is less bioavailable than, for example, crude oil (ITOPF 2014b).

Vessel activity can directly affect plankton, fish eggs, fish larvae, and small fish through hull shear, entrainment through the propulsion system, exposure to turbulence in the propeller wash, and wake stranding (Odom et al. 1992). However, studies have found it difficult to detect vessel-related mortality (Holland 1986, Odom et al. 1992), and have found fish larvae to be relatively resilient.

Construction impacts to foraging habitat include permanent and temporary loss of benthic habitat from construction of the Diamond Point port and access road, port navigation channel, lightering station, natural gas pipeline, and fiber optic cable. Increased turbidity during construction might deter sea lions from accessing prey in the water column, but these pinnipeds are highly mobile, and effects would be short-term. Beluga whales are not expected to be present during summer construction. Direct beluga whale habitat loss would last for the life of the Project but represents only a miniscule portion of designated critical habitat within Cook Inlet.

Potential stressor effects on designated critical habitat are further discussed in section 6.1.6 (North Pacific right whale, and humpback whale), section 6.2.6 (beluga whale), and 6.3.6 (Steller sea lion). Overall, there is a very low risk to the prey and habitats used by listed whales and sea lions in the Action Area from proposed construction and operation activities.

6. PROJECT EFFECTS

This chapter includes the analysis of the combined effects from Project construction, operations, and closure and reclamation activities. Project effects are evaluated as to where there is no pathway to an effect (no effect), the effect is not likely to occur (improbable), where there is no meaningful way to measure, detect or evaluate the effect (negligible), the effect has little biological consequences (very low), or the effect is potentially significant (leading to a potential take). Avoidance and minimization measures PLP would implement to address these impacts are found in Section 7.0.

6.1. ESA-listed Large Whales

6.1.1. Disturbance

Lower Cook Inlet supports a small number of humpback whales and fin whales, some of which might be present in the Action Area while construction activities are occurring. Also, sei, blue, sperm, North Pacific right, and gray whales may occur in the vicinity of GOA and/or Bering Sea vessel travel corridors (although corridors have been placed to avoid right whale critical habitat). The primary noise associated with the port construction would be the backhoe leveling operations and placement of fill within the concrete caissons. Based on measurement by Dickerson et al. (2001) and Reine et al (2014a), the distance to the 120-dB harassment threshold for both backhoe operations and caisson fill is something less than the 984-ft (300-m) exclusion zone both the USFWS and NMFS will likely impose on this Project (see Section 5.1.5). With the combination of such a small impact radius, nearshore shallow water, low whale density, and the shutdown measures that would be imposed, it is highly unlikely that the port construction will take any humpback or fin whales.

The primary noise source during pipeline and fiber optic cable placement emanates from the small tugs during dynamic positioning (DP) thruster operation while maneuvering the barge, and drive propeller cavitation noise produced while handling anchors. The daily ensonified area by the two tugboats that would be operating during pipeline and fiber optic installation is 21.1 mi^2 (54.6 km^2) (Table 7). Assuming a Cook Inlet humpback whale density estimate of 0.006 whales per mi^2 (0.0023 whales per km^2) based on NMFS beluga whale surveys (Shelden et al. 2019a), and 35 days to complete each pipelay and cable-lay, the number of humpback whales potentially exposed by underwater construction noise is approximately 4 whales, without mitigation, for both operations combined. With mitigation (shutdown at a whale's approach to the exclusion zone) and the likelihood of whales avoiding the construction area, the potential takes should be well less than 1 whale. Therefore, the risk of acoustical disturbance during construction is very low. Fin whale densities in Cook Inlet are much lower than humpback whales (essentially too low to calculate a reasonable take), so there is no calculated take. With mitigation, the risk of fin whale take during construction is negligible. North Pacific right whales, sei whales, blue whales, gray whales, and sperm whales do not inhabit Cook Inlet.

The operation of the proposed Diamond Point port would result in increased marine traffic in lower Cook Inlet and along designated travel corridors in the GOA. During the four years of construction, approximately 25 supply barge calls will occur each year at the port location, while during the 20 years of operation, barge traffic (29 supply barge and 4 fuel barge calls) will occur annually along either the proposed southern coastal travel corridor (Southeast Alaska) and the southern offshore corridor (GOA pelagic route); and 27 concentrate ships traveling along the proposed western route to Unimak Pass where the vessel will link with the Great Circle Route. It is proposed that the Action Area of each of the three GOA routes extends 621 mi (1,000 km) from Cook Inlet (beyond 621 mi [1,000 km] the routes are essentially extending outside the GOA), and each corridor is 6.4 nm (7.4 mi, 11.8 km) wide. Barge and concentrate bulk carrier vessel traffic will occur year-round, including periods when most large whales are at their wintering grounds outside Alaska. (However, North Pacific right whales appear to winter in Alaska and humpback whales can now be found in the GOA during all months [Straley et al. 2018] suggesting some level of risk occurs year-round). What percentage increase in traffic due to the Project during this time period is unknown, but overall (year-round) traffic increases would be minimal on established vessel traffic lanes in the GOA and through the Aleutians Islands (section 2.4.7). It is expected that some whales will be exposed to vessel noise during these transits, but that noise levels will not rise to the level of take. The levels can, however, contribute to the whale's allostatic stress budget (Romero et al. 2009). Thus, increased vessel traffic is expected to have a very low disturbance risk listed large whales.

6.1.2. Vessel Strike

To avoid vessel strike of marine mammals inhabiting lower Cook Inlet north of Augustine Island, PLP will impose a speed limitation of 10 kt (18.5 km/hr) for all vessels entering these waters (Figure 1). Reducing vessel speeds to less than 10 kt (18.5 km/hr) significantly reduces the strike risk to Cook Inlet whales and other marine mammals (Jensen and Silber 2004, Silber and Bettridge 2012). No restrictions will be imposed for vessel traffic outside lower Cook Inlet north of Augustine Island; however, 195 of the annual vessel calls (29 supply barge calls, 162 lightering barge trips, and 4 fuel barge calls) during the operations phase involve barges that normally travel at speeds less than 10 kt (18.5 km/hr). Of the four designated travel corridors, barges would use the northern route connecting with Nikiski, the southern coastal route along the Southeast Alaska coast, and a more direct southern route across the pelagic waters of the GOA (Figure 15). Thus, vessel strike risk to Cook Inlet belugas (Nikiski route), coastal populations of fin and humpback whales (Southeast Alaska route), migrating Western North Pacific gray whales, or pelagic populations of fin, sei, blue, and sperm whales (GOA route) from barging activities is negligible based on vessel speed.

The ore concentrate bulk carrier vessel will limit speeds within lower Cook Inlet north of Augustine Island to less than 10 kt (18.5 km/hr) to avoid striking listed whales (and sea otters) (Vanderlaan and Taggart 2007) but will operate at normal speeds (13 kt to 15 kt [24.1 to 27.8 km/hr]) outside these waters (Figure 1). All concentrate ships will follow the western designated travel corridor through Shelikof Strait to Unimak Pass where they will link with the Great Circle Route travel lane to Asia. The ships will remain over continental shelf waters during the entirety of this 620-mi (1,000-km) route from Cook Inlet to Unimak Pass, thereby avoiding any encounters with pelagic populations of fin, sei, blue, and sperm whales. These ships will, however, traverse through areas known to be used by summering populations of fin and humpback whales (Brueggeman et al. 1987, 1988, 1989; Zerbini et al. 2006), especially Shelikof Strait and along ocean banks near the Semidi and Sanak Islands, and along some sections of gray whale migration routes. Neilson et al. (2012) and Douglas et al. (2008) noted that vessel strikes of humpback and fin whales occurred most often where whale concentrations overlapped with shipping lanes, especially in narrow choke areas. Shelikof Strait may qualify as an area of higher vessel strike risk, but the alternative of traveling around the southern edge of Kodiak Island would involve crossing designated critical habitat (GOA unit) for North Pacific right whales, and through longer stretches of gray whale migration routes.

The Handysize concentrate bulk carrier vessels proposed for this Project cruise at speeds between 13 kt (24.1 km/hr) and 15 kt (27.8 km/hr). While increased speed reduces the time a vessel is present in the vicinity of whales (Vanderlaan et al. 2009), the risk of a collision with a vessel bow (Clyne 1999) and the likelihood of a lethal collision (Laist et al. 2001) increases greatly with speeds above 10 kt. Lethal collision risk increases most dramatically with speed increase from 10 kt (18.5 km/hr) to 15 kt (27.8 km/hr) (Vanderlaan and Taggart 2007). Thus, the concentrate bulk carrier vessel has a higher collision risk than the barges proposed for this Project.

Neilson et al. (2012) collected all available reports on Alaskan whale/vessel collisions from 1978 to 2011 and found 108 definite or possible whale collisions. The majority (93) were humpback whales and the remainder included 3 fin whales, 1 gray whale, and 1 sperm whale. Thus, approximately 3 whales were struck annually over the 34-year study period, with less than 1 whale per year a definite mortality. Two of the collisions (1 humpback and 1 fin) occurred between Cook Inlet and Unimak Pass, but both were in shallow waters outside the proposed travel corridor. The one gray whale strike in Alaska also occurred in shallow waters (Southeast Alaska). Consequently, while concentrate bulk carrier vessel speed increased the collision risk, actual vessel strike numbers from Alaska suggest that the overall risk to humpback, fin, and gray whales is very low. Vessel strike of a North Pacific right whale is improbable by avoiding travel across critical habitat units.

6.1.3. Entanglement

The spread anchor mooring system at the lightering station, would include chains for anchoring to the seafloor, which could pose an entanglement risk for large whales such as humpback and fin whales. The spread anchor moorings are of greater concern because of their placement in deeper water that is more likely to be frequented by humpback whales. However, the size of the chain (2-in [5.1-cm]) and the weight of the chain leg (Figure 5) (of approximately 3,500 pounds [1,588 kilograms] per 100 ft [30.4 m]), would keep the chain relatively taut and prevent kinking, avoiding, or minimizing entanglement risk (Benjamins et al. 2014). None of the proposed anchoring systems involves slack line, which is the primary cause of marine mammal entanglement (Benjamins et al. 2014). Therefore, because taut anchor chain will be used at all moorings, entanglement risk in mooring chains is negligible to humpback whales (likelihood of entanglement for other large whales is improbable due to lack of presence at the lightering station location).

Anchor chains and cable, however, could entrain derelict fishing gear (and other debris) and therefore, pose a secondary entanglement threat to large whales (see Section 5.3). The risk of secondary entanglement is unknown but would be partially mitigated by annual inspection and cleaning of the anchor chains and cables (see Section 7.4).

6.1.4. Incidental Spill

Humpback whales and fin whales are not found in shallow-water harbors (Diamond Point port) where incidental spills are most likely to occur. PLP and their construction contractors must comply with all laws and regulations related to spill prevention and preparedness for petroleum lubricants and fuel, including 40 CFR part 110, and those related to vessel-to-vessel transfer, including 33 CFR part 144. Construction operations would implement spill prevention control measures, and in the event of a spill would facilitate a rapid response and cleanup operation. The required operation safeguards would minimize the occurrence of spills, size, and extent. The maximum volume for this type of spill is only 10 gal (38 L), which would quickly spread, evaporate, disperse, and degrade in the water due to the high flushing rate of Cook Inlet waters. There is an improbable likelihood of a large whale exposure to an incidental spill.

6.1.5. Accidental Spill

As discussed in Section 5.5, the risk of a small accidental oil spill (10-1,000 gal [38 to 3,785 L]) or chemical spill associated with the proposed port operations is very low and the likelihood of a humpback whale encountering such a spill is negligible and for all other large whales it is improbable. In addition, PLP and their construction contractors must comply with all laws and regulations related to spill prevention and preparedness related to fuel transfer, including 49 CFR part 144. Based on oil spill prevention preparedness and the spill modeling, there is an improbable likelihood for the occurrence of a large accidental diesel (>1,000 gal [3,785 L]) or chemical spill, thus, large whale exposure to such a spill is improbable.

6.1.6. Effects on Critical Habitat

Of the large whales, critical habitat has been designated only for the North Pacific right whale. Two critical habitat units – SEBS and GOA – have been established in Alaskan waters, but the Action Area has been established to avoid both. Critical habitat was recently proposed for both the Mexico DPS and Western North Pacific DPS of humpback whale (NMFS 2019a). All Project activities within lower Cook Inlet and the western travel corridor fall within Mexico DPS critical habitat, as do portions of the southern offshore and southern coastal travel corridors. Proposed critical habitat for the Western North Pacific DPS humpback whale does not fall within Cook Inlet, but most of the western travel corridor and small portions of the two southern travel corridors cross proposed critical habitat.

The proposed rule for designating humpback whale critical habitat identified three “biological features essential to the conservation of the species”: prey, migratory corridors and passage, and soundscape. The Project is unlikely to affect humpback whale prey or the whales’ ability to move about lower Cook Inlet or the GOA. However, construction, operation, and reclamation phases of the Project will introduce underwater noise into the soundscape, largely from vessel operations (Section 5.1.5). Still, the affected area (underwater noise levels exceeding harassment thresholds) from any given underwater noise activity is extremely small relative to the area proposed for critical habitat.

The maximum underwater sound produced by the Project would be noise emanating from anchor-handling tugs when maneuvering anchors during pipeline construction, which during any given day affects an area of approximately 21.1 mi^2 (54.6 km^2 based on a 1.7-mi (2.7-km) distance to the harassment threshold (120 dB) for continuous noise. This represents only a small fraction (0.5 percent) of the proposed Unit 6 (lower Cook Inlet) designated critical habitat (4,458 mi^2 [11,545 km^2]) and an extremely small portion of the entire proposed critical habitat for both the Mexico DPS (232,827 mi^2 [603,018 km^2]) and Western North Pacific DPS (40,236 mi^2 [104,211 km^2]) of humpback whale. The potential Project effects to humpback whale critical habitat are considered negligible when considering the very small size of the potential impact area and the mitigation measures that will be in place.

Construction of the Diamond Point access road, Diamond Point port, natural gas pipeline and fiber optic cable, and lightering station, includes both temporary and permanent effects on benthic habitats, but very little impact is expected to the water column where humpback whales feed. There will be some temporary disturbance of sediments resulting in increased turbidity during dredging of the navigation channel (and within the port footprint) and the placement of the pipeline and the fiber optic cable, but conditions are expected to return to normal within hours to days.

6.2. Beluga Whale – Cook Inlet Stock

6.2.1. Disturbance

All proposed construction activity, including port and road construction, dredging, construction supply barging, and pipeline and fiber optic cable placement would occur during the summer months when nearly all beluga whales are found approximately 170 mi (275 km) farther north in upper Cook Inlet (Susitna Flats). However, except for a single beluga recorded in July 2012 near White Gull Island, all beluga whales documented between Iniskin Bay and Oil Bay and in Iliamna Bay were recorded outside of summer months (ABR 2015). Disturbance could occur during the stressful winter period, which might affect whales that normally experience little traffic during the winter. Castellote et al. (2018) found anthropogenic noise levels in upper Cook Inlet to be loud enough to mask beluga whale communication and Small et al. (2017) could not rule out that anthropogenic noise was resulting in beluga whale spatial displacement within critical habitat. The acoustical disturbance risk in wintering beluga whales is considered very low but could increase should winter activity by beluga whales in the Action Area increase.

6.2.2. Vessel Strike

Vessel strike risk from the slow moving (less than 10 kt [18.5 km/hr]) tug/barge is very low. As mentioned earlier, there is only one record of a lethal vessel strike involving a Cook Inlet beluga whale (although Kaplan et al. [2009] did record what appeared to be marks from a small propeller on at least 2 whales during photo-identification studies conducted from 2005 to 2008). Beluga whales, a maneuverable toothed whale, may be somewhat susceptible to strike by a fast-moving small fishing boat as the known strike marks suggest, but they are very unlikely to be struck by a tug/barge or dredger moving at less than 10 kt (18.5 km/hr). Still, while the risk can be considered negligible, it cannot be completely ruled out, especially if there is any winter barge traffic to and from Nikiski. Concentrate ships pose a greater strike risk when traveling at cruise speeds, but these vessels will not enter beluga whale critical habitat and will be reducing speeds within lower Cook Inlet north of Augustine Island to less than 10 kt (18.5 km/hr).

6.2.3. Entanglement

Although beluga whales have been entangled in fishing gear, especially nets, entanglement in mooring and other anchoring chains has not been recognized as constituting a threat. Based on body length, foraging style, detection distance, and body flexibility, the entanglement risk for small toothed whales is similar to that for pinnipeds, and much less than for large whales (Benjamins et al. 2014). However, given the non-kinking anchoring chains proposed for this Project, entanglement risk to mooring chains and cables is considered negligible. Anchor chains and cable, however, could entrain derelict fishing gear (and other debris) and therefore pose a secondary entanglement threat to beluga whales. The risk of secondary entanglement is considered negligible because risk would be partially mitigated by annual inspection and cleaning of the anchor chains and cables, and none of the mooring locations fall within beluga whale critical habitat or locations where these whales have ever been recorded.

6.2.4. Incidental Spill

Spill prevention control measures would be implemented during construction activities and in the event of a spill would facilitate a rapid response and cleanup operation. The required operation safeguards would minimize the occurrence of spills and limit the size and extent of any spill to the immediate area. Potential incidental spills in Cook Inlet would quickly dissipate due to the high flushing rate of Cook Inlet waters. Further, beluga whales would not be present during the summer activities and current winter use in lower Cook Inlet north of Augustine Island is unclear. Few beluga whales have been documented in the area during the winter in recent years (ABR 2015, Castellote et al. 2015, Shelden et al. 2015). Finally, an incidental spill of less than 10 gal (38 L) is extremely small relative to the size of available beluga whale habitat within Cook Inlet (3,103 mi^2 [7,800 km^2]). The likelihood of a beluga whale being exposed to such a small spill and concentrations of concern is improbable.

6.2.5. Accidental Spill

A significant diesel or chemical spill in the winter might affect beluga whales if they were present. However, the spill risk modeling (Section 5.5.1) indicates that the risk of a small (10-1,000 gal [38 to 3,785 L]) oil or chemical spill is negligible (if not inconsequential), while the risk of such a small spill exposing a beluga whale at concentrations of concern is improbable. The risk of a larger (>1,000 gal [3,785 L]) spill even occurring is improbable.

6.2.6. Effects on Critical Habitat

Portions of the proposed mine access in Iliamna Bay, the Diamond Point port, and natural gas pipeline and fiber optic cable would be constructed within designated beluga whale critical habitat. Vessel traffic associated with supply barging and lightering will also occur within critical habitat. Potential Project effects on critical habitat is determined below based on impacts to PCEs.

PCE #1 – The definition of PCE #1 is "Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) (Mean Lower Low Water) and within 5 mi (8 km) of high and medium flow anadromous fish streams". High and medium flow anadromous streams, seasonally supporting large numbers of salmon and eulachon, are extremely important components in the survival of Cook Inlet beluga whales. The most important of these streams include the Susitna, Little Susitna, Matanuska, Knik, Beluga, and Kenai rivers when anadromous fish runs are present (late spring to early fall). These are large rivers ranging from 25 mi (40 km) to over 300 mi (500 km) in length. Only small anadromous streams occur within 5 mi (8 km) of Project components. These include Cottonwood, Williams, Brown's Peak, and Y-Valley creeks, and a few unnamed streams, none of which are much longer than 3 mi (4.8 km) in length, and none of which are presumed to qualify as a "high and medium flow anadromous stream." Further, anadromous fish would have completed their runs by winter when beluga presence is most likely.

PCE #2 – This PCE recognizes the primary prey species consisting of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole. All these fish live in the water column (salmon and eulachon), demersal zone (cod and pollock), or are epifaunal (sole). None of the planned construction or operation activity would have a significant effect on the water column or demersal zone. Temporary loss of benthic habitat would occur at areas abutting construction sites from disturbances that include dust/sediment deposition and equipment scarring. The access road and port fill placement areas and dredging impact areas include a 30-ft (9.2-m) wide zone around Project footprints to account for this type of potential disturbance. Most temporary benthic habitat loss would occur because of dredging activities and pipeline and fiber optic construction (Table 11). Construction dredging of the navigation channel and turning basin, and maintenance dredging approximately every 5 years, would affect 81.1 ac (32.8 ha) of benthic habitat (Table 11). This dredging will impact sedentary infaunal species such as clams and polychaetes, but these resources should recover quickly (Shigenaka 2014) and continue to provide a source of prey for epifaunal flounders and sole. In addition, pipeline and fiber optic cable placement in Ursus Cove and Cottonwood Bay combined will temporarily impact an estimated 137.9 ac (55.8 ha) of benthic habitat due to trenching (Table 11). Relative to beluga whale prey resources, the habitat impacts from dredging or pipeline/cable-laying are considered temporary (impacts from repeated dredging would be considered permanent if beluga whales were more dependent on infaunal prey such as clams). Permanent loss would result from the placement of in-water structures at the port (7.5 ac [3 ha]), road construction within the intertidal zone (19.1 ac [7.7 ha]), and placement of cut/fill material into the intertidal zone from construction of onshore pads (<0.1 ac [<0.1 ha]). Collectively, this permanent loss of benthic habitat, totaling 26.6 ac (10.8 ha), represents an extremely small fraction (0.001 percent) of the 3,013 mi^2 (7,800 km^2) of critical habitat available in Cook Inlet.

Table 11. Benthic habitat loss in beluga whale critical habitat from Project construction.

			Habitat Loss Effect	
Location	**Facility**	**Activity**	**Permanent**	**Temporary**
Iliamna Bay	Diamond Point port access road	Road construction	19.1 ac (7.7 ha)	7.2 ac (2.9 ha)[1]
Iliamna Bay	Diamond Point port	Marine components (access causeway, marine jetty, concentrate bulk loader)	7.5 ac (3 ha)	2.9 ac (1.2 ha)[1]
Iliamna Bay	Diamond Point port	Construction and maintenance navigation channel and turning basin		81.1 ac (32.8 ha)[1,2]
Iliamna Bay	Diamond Point port	Onshore pads cut/fill extents	<0.1 ac (<0.1 ha)	0.1 ac (0.04 ha)[1]
Cottonwood Bay	Natural gas pipeline and fiber optic cable	Installation trench		69.1 ac (28 ha)
Subtotal Beluga Whale Critical Habitat Cottonwood and Iliamna Bays			**26.6 ac (10.8 ha)**	**160.4 ac (64.9 ha)**
Ursus Cove	Natural gas pipeline and fiber optic cable	Installation trench		68.8 ac (27.8 ha)
Iniskin Bay	Lightering station	Anchor placement footprint	<0.1 ac (<0.1 ha)	
Total Beluga Whale Critical Habitat Impacts			**26.6 ac (10.8 ha)**	**229.2 ac (92.8 ha)**

[1] Project construction footprint includes a 30 ft (9.2 m) buffer to account for areas where construction is not planned but could be temporarily affected by construction activities (e.g., soil/substrate disturbance, sediment deposition).
[2] Dredge area (71.4 ac [28.9 ha]) + 30 feet (9.2 m) buffer of sediment disturbance effects (9.7 ac [3.9 ha]) = 81.1 ac (32.8 ha).

PCE #3 – This PCE references an environment's absence of toxins or other agents of a type or amount harmful to beluga whales. Incidental spills could result in the release of small amounts of toxic petroleum products into marine waters (PCE #3). PLP operations would have plans to prevent and minimize the occurrence of spills and respond to control and clean up spills when those occur. Residual or non-recoverable spill amounts are expected to quickly dissipate due to the tidal action of Cook Inlet. While small amounts can persist in the environment, the amount of spill involved is minimal and the potential risk of an incidental spill occurring is very low given the safety measures that will be in place. Accidental spills, those larger than 10 gal (38 L), could result in greater environmental effects, but the probability of occurrence is measured in one event per hundreds to thousands of years depending on spill size with risks somewhere between negligible and improbable.

PCE #4 – This PCE recognizes that "unrestricted passage within or between the critical habitat areas" is an important ecological component for Cook Inlet beluga whales. Neither the port nor pipeline and fiber optic cable construction activity, or activity associated with operations or mine closure and reclamation, would prevent unrestricted passage of beluga whales between the critical habitat areas.

PCE #5 – This PCE concerns "in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales". Construction activities will generate in-water noise levels above ambient mainly from anchor-handling tugboats and dredgers. But these activities will occur during the summer when beluga whales are not expected to be present. During the winter, in-water noise will be produced by lightering barges moving between the port and the lightering station, and the concentrate ship entering and exiting the lightering station. The question is whether these activities would cause beluga whales to abandon winter use of the bay waters within the Action Area (especially since winter use of the portion of lower Cook Inlet is very low to begin with). Small et al. (2017) investigated spatial displacement of Cook Inlet beluga whales by anthropogenic noise in critical habitat and concluded that effects of noise levels could not be separated from environmental factors such as tide levels (the 1 factor that consistently predicted beluga occupancy). While recognizing the sample size limits of their data, Small et al. (2017) stated "we cannot conclude that noise-related predictors influence occupancy status or detectability based on available data". Therefore, is not conclusive that winter lightering activity associated with this Project would result in the abandonment of any use of the Action Area by wintering beluga whales.

Overall, the magnitude of the Project impact on Cook Inlet beluga whale critical habitat is very small relative to the amount of critical habitat available. There are no high or medium flow rivers in the Project vicinity, there are little effects expected on the prey resources important to wintering beluga whales, risks of spills impacting these whales is somewhere between negligible and improbable depending on the size of the spill, no passage of whales will be restricted, and there is currently no evidence that the proposed port operations and lightering activity will spatially displace beluga whale use of critical habitat within the Action Area based on recent research (Small et al. 2017). Thus, the overall impacts to beluga whale critical habitat are considered negligible.

6.3. Steller Sea Lion – Western DPSs

6.3.1. Disturbance

Steller sea lions are often found in shallow nearshore waters, and therefore could be present during port and pipeline construction activities and post-construction port operations.

Because the effective hearing of Steller sea lions is largely above the major frequencies of industrial noises and they appear adapted to hear important sounds in noisy backgrounds (e.g., wave action), Steller sea lions are likely not susceptible to continuous noise disturbance in open water. Also, there are no PTS concerns because Steller sea lions remain underwater for short periods of time and noise producing equipment would be operated intermittently, thus; there would be no long-duration exposures to underwater noise. The loudest noise associated with construction emanates from tugboats while handling anchors during pipeline and fiber optic cable placement (see Section 2.4.2). However, given the area of impact relative to the Action Area, and the mitigation measures that will be in place during all marine construction activity (monitoring of safety zones; Section 7.2), the potential effects are considered very low.

Increased vessel traffic associated with port operations could increase the potential of disturbing sea lions (at sea) within Cook Inlet and the GOA. As mentioned earlier, Steller sea lions do not appear to be susceptible to industrial noise, and often are found within busy harbors and near moving vessels. Also, vessel traffic will remain at least 5 nm (5.8 mi, 9.3 km) from all rookeries and haulouts. Thus, while port operations and associated vessel traffic represent a significant increase in noise levels and human activity, the risk of this activity rising to the level of take is very low based on our understanding of sea lion ecology and tolerance.

6.3.2. Vessel Strike

Sea lions are highly maneuverable and, thus, not susceptible to vessel strike, especially with construction and operation vessels traveling at less than 10 kt (18.5 km/hr). From 1978 to 2014, there have been only four confirmed sea lion mortalities in Alaska resulting from vessel collisions (NMFS, unpublished data). Collision with a tug/barge is highly unlikely and considered improbable. Concentrate vessels will, however, be traveling at speeds up to 15 kt (28 km/hr) with an increased (but still negligible) risk of collision to sea lions.

6.3.3. Entanglement

Sea lion entanglement in taut mooring cables and chains is limited due to their body size and flexibility and feeding style (Benjamins et al. 2014). However, Steller sea lions in Alaska appear to be susceptible to fishing gear entanglement (Raum-Suryan et al. 2009), including, possibly, derelict gear that has entrained on anchor and mooring chains. The risk, however, is negligible given the low sea lion densities in lower Cook Inlet north of Augustine Island and proposed annual inspection of cables and chains (see Section 7.4).

6.3.4. Incidental Spill

Incidental spills associated with port construction or pipeline and fiber optic cable laying would be limited in size and extent due to required safety measures that would be put in place. The risk of an individual incidental spill harming a Steller sea lion is very low. However, an accumulation of spill residues over time could lead to a pollution of benthic resources (such as mussels) that might establish on the caisson walls providing a contaminated food resource for sea lions. The risk is still considered very low.

6.3.5. Accidental Spill

A diesel or chemical spill might affect Steller sea lions if they were present. However, the spill risk modeling (Section 5.5.1.1) indicates that the risk of a small (10-1,000 gal [38 to 3,785 L]) oil or chemical spill is negligible, while the occurrence of a large spill (>1,000 gal [3,785 L]) is improbable (therefore the risk to sea lions is improbable).

6.3.6. Effects on Critical Habitat

The nearest critical habitat occurs approximately 25 mi (40 km) from the construction Action Area, falling well outside any reasonable impact zone due to construction noise or potential incidental spills. Vessels associated with port operations would pass through Steller sea lion critical habitat as they enter lower Cook Inlet. However, the 20 nm buffer around major haul outs and rookeries relate to restricting trawl fisheries, not maritime traffic, and the nearest a vessel would pass by a major haulout or rookery is approximately 5 nm (5.8 mi, 9.3 km), or well outside the 3 nm (3.5 mi, 5.5 km) no-entry zone for rookeries west of 144° W. It is possible that the remains of a 1,000-gal (3,785 L) accidental fuel spill could reach critical habitat based on trajectory modeling, but what diesel fuel had not evaporated would likely be too dissipated to cause significant harm. The combination of a negligible small accidental spill risk and the distance from port operations (or where in the Action Area such spill is more likely to occur) suggests that a small accidental spill causing significant harm to the nearest Steller sea lion habitat is improbable. Adverse effect to Steller sea lion critical habitat from a large spill event is improbable.

7. AVOIDANCE AND MINIMIZATION

Avoidance and minimization measures, collectively mitigation measures, are intended to limit or reduce construction or operation related impacts to listed species or critical habitat. Avoidance is the primary means for limiting construction impacts to wintering beluga whales as they would not be present during the summer construction period (although there is critical habitat for this species in the Action Area).

Minimization measures include:

- Designing a causeway and marine jetty construction method (using caissons) to minimize the overall impact to the marine environment.
- Use shore-based and electronically transmitted (virtual) aids to navigation instead of physical in-water structures.
- Employing Protected Species Observers (PSOs) to monitor shutdown exclusion zones during activities that produce underwater noise levels above harassment or injury take thresholds.
- Reducing vessel speeds to 10 kt (18.5 km/hr) while operating within lower Cook Inlet north of Augustine Island (Figure 1).
- Using state-of-the-art double-hulled barges to transport diesel fuel.

7.1. Mitigation Measures – Sediment Control

Construction mitigation measures for this Project would follow standard construction practices, including sediment control BMPs, to avoid or limit impacts to listed marine mammals or their critical habitat. Initial dredging of the navigation channel and basin and maintenance dredging over 20 years of production at the mine, construction of the Diamond Point port, placement of the caissons for causeway and marine jetty structures at Diamond Point port, construction of the access road in Iliamna Bay, and construction of the natural gas pipeline and fiber optic cable would increase suspended solids in the water column, which would be redeposited on marine substrate. The extent of these effects would be localized. The duration of these effects would be temporary while in-water activities that disturb the sediment are taking place, with the greatest impact during the construction of the navigation channel and basin (4 to 6 months). However, sediment concentrations that would prevail in the water would likely not exceed those under severe storm conditions (section 4.16.4.6 in USACE 2020). No mitigation is proposed.

Road construction below the MHW mark would utilize select rock fill consisting of durable, coarse free draining material to minimize sedimentation.

Some sediment would be resuspended during pipeline and fiber optic cable trenching operations, with settling taking hours to days. However, as discussed in detail in Section 5.1.4 and concluded by Taormina et al. (2018) based on an extensive literature review, the extent of sediment resuspension impacts from marine trenching are negligible. No mitigation is proposed.

7.2. Mitigation Measures – Noise

To mitigate for construction noise impacts to cetaceans and pinnipeds during construction, PLP would develop and implement a Marine Mammal Monitoring and Mitigation Plan (4MP). Construction activities that will produce underwater noise levels requiring monitoring by PSOs include caisson fill and backhoe activity during port construction, tugboat thruster use during placement of mooring anchors, and tugboat anchor handling activities during pipeline and fiber optic cable placement. The plan would include the use of ramp-up procedures (soft start) for noise generating activities (as necessary), establishing 984-ft (300-m) exclusion zones (shutdown safety zones) around the fill placement activities (as necessary for sea otters but will include all marine mammals), and establishing a 1.7-mi (2.7 km) exclusion zone around all tugboats during thruster or anchor-handling activity. The tugboat exclusion zone corresponds to the mitigation measures imposed on the CIPL project, which is a close representative of this Project. It is assumed that Level B take will be authorized for non-listed species under either an Incidental Harassment Authorization (IHA) or Letter of Authorization (LOA), but possibly not for listed species.

PSOs will be employed to monitor these exclusion zones and initiate activity shutdown as needed. The PSOs will follow an established set of protocols, which apply to species under both USFWS and NMFS jurisdiction, and include:

1. PSOs serving as observers will be in good physical condition and be able to withstand harsh weather conditions for an extended period. They must have vision correctable to 20/20.
2. PSOs will have the experience and ability sufficient to conduct field observations and data collection according to assigned protocols.
3. PSOs will have experience or training in field identification of marine mammals and marine mammal behavior. PSOs serving as observers will be able to accurately identify marine mammals in Alaskan waters by species.
4. PSOs will have writing skills sufficient to prepare understandable reports of observations and technical skills to complete data entry forms accurately.
5. PSOs will work in shifts lasting no longer than 6 hours with at least a 1-hour break from marine mammal monitoring duties between shifts. PSOs will not perform PSO duties for more than 12 hours in a 24-hour period (to reduce fatigue). Note that during the 1-hour break for a PSO, a crew member can be assigned to be the observer as long as they do not have other duties at that time and they have received instructions and tools to allow them to make marine mammal observations.
6. PSOs will be positioned such that the entire exclusion zone is visible.
7. PSOs will have the ability to effectively communicate orally, by radio, and in person, with project personnel to provide real-time information on marine mammals and will have the ability and authority to order appropriate mitigation responses to avoid takes of all listed marine mammals.
8. The PSOs will have the following equipment to address their duties:
    a. Range finder.
    b. Annotated chart and compass.
    c. Inclinometer.
    d. Two-way radio communication, or equivalent, with onsite project manager.

  e. Appropriate personal protective equipment.
  f. Daily tide tables for the project area.
  g. Watch or chronometer.
  h. Binoculars (7x50 or higher magnification) with built-in rangefinder or reticles (rangefinder may be provided separately).
  i. Handheld global positioning system (GPS).
  j. A copy of the Letter of Concurrence (LOC) and/or Biological Opinion (BiOp), IHA or LOA, 4MP, and all other authorizations, printed on waterproof paper and bound.
  k. Observation Record forms printed on waterproof paper, or weatherproof electronic device allowing for required PSO data entry.

9. PSOs will have stop-work authority during in-water activities in the event a listed marine mammal is observed in, or is determined by the PSO to likely enter, an exclusion zone.
10. PSOs will have no other primary duties beyond watching for, acting on, and reporting events related to marine mammals.
11. PSOs will use NMFS-approved Observation Records. Observation Records will be used to record the following:
    a. Date and time that activity and observation efforts begin and end.
    b. Weather parameters (e.g., percent cloud cover, percent glare, visibility) and sea state where the Beaufort Wind Force Scale will be used to determine the average sea-state (https://www.weather.gov/mfl/beaufort).
    c. Numbers of observed marine mammals, along with the date, time, and location of the observation.
    d. The predominant sound-producing activities occurring during each marine mammal sighting.
    e. Location of marine mammals, distance from observer to the marine mammal, and distance from the predominant sound-producing activity or activities to marine mammals.
    f. Whether the presence of marine mammals necessitated the implementation of mitigation measures to avoid acoustic impact, and the duration of time that normal operations were affected by the presence of marine mammals.
12. Prior to commencing in-water activities, PSOs will scan waters within the exclusion zone and confirm no listed marine mammals are observed to be present within this zone for 30 minutes prior to initiation of an in-water activity. If one or more listed marine mammal is observed within or near an exclusion zone, no in-water activity will begin until the marine mammals exit the zone of their own accord, and the exclusion zone has remained clear of marine mammals for 30 minutes immediately prior to activity.
13. The PSOs will continuously monitor the monitoring and safety zones during in-water activities for the presence of marine mammals and will order the in-water activities to immediately cease if one or more listed marine mammal appears likely to enter an exclusion zone.
14. Monitoring will take place during daylight conditions with adequate visibility (3.7 mi [6 km] or greater) and Beaufort Sea state (4 or less). If fill and backhoe activities were to occur at night, sufficient construction lighting will be placed to continue monitoring. For safety and production reasons, pipe-

laying and cable-laying activity must continue through all visibility conditions (although individual thruster and anchor-handling activities can temporarily cease to avoid marine mammal take).

15. If visibility degrades to less than 984 ft (300 m) during fill and backhoe activities, activity will cease until the monitoring zone visibility exceeds 984 ft (300 m) and the PSO has indicated that the zone has remained devoid of marine mammals for 30 minutes prior to additional activity. Tugboat thruster and anchor-handling activity will continue if deemed necessary for safety reasons.
16. Following a lapse of in-water activities of more than 30 minutes, the PSO will authorize resumption of activities only after the PSO provides assurance that listed marine mammals have not been present in the monitoring zones for at least 30 minutes immediately prior to resumption of operations.
17. A final report will be submitted to NMFS and USFWS within 90 calendar days of the completion of the project summarizing the data recorded as per measure 11 and submitted to Greg Balogh, NMFS PRD ANC supervisor, at greg.balogh@noaa.gov and Kimberly Klein, USFWS Incidental Take Coordinator, at kimberly_klein@fws.gov.
18. PSO records associated with all marine mammals observed during in-water activities will be transmitted to NMFS and USFWS as either an appendix to the final 90-day report, or in a separate transmittal also due at 90 days. These records will contain the information specified in item 11.
19. If PSOs observe an injured, sick, or dead cetacean or pinniped (i.e., stranded marine mammal), they shall notify the NMFS Alaska Region Marine Mammal Stranding Network at 1-877-925-7333. The PSOs will submit photos and data that will aid NMFS in determining how to respond to the stranded animal. Data submitted to NMFS in response to stranded marine mammals will include date/time, location of stranded marine mammal, species and number of stranded marine mammals, description of the stranded marine mammal's condition, event type (e.g., entanglement, dead, floating), and behavior of live-stranded marine mammals. In the case of a distressed or dead sea otter, the PSOs shall contact the Marine Mammals Management office of the USFWS at 1-800-362-5148.

Other noise mitigation includes:

- Blasting in Iliamna Bay above the high tide line for construction of the Diamond Point port would be timed to coincide when low tides are at or near minimum elevation to avoid in-water transfer of sound.

7.3. Mitigation Measures – Vessel Strike

Vessel speeds would be limited to 10 kt (18.5 km/hr) within lower Cook Inlet north of Augustine Island to mitigate potential vessel strike with marine mammals (Figure 1). During operations, concentrate bulk carriers would travel at their normal cruising speeds (13 kt to 15 kt [24.1 km/hr to 27.8 km/hr]) when traveling across the GOA or entering lower Cook Inlet but would reduce speeds to less than 10 kt (18.5 km/hr) when entering lower Cook Inlet north of Augustine Island (approaching beluga whale and sea otter critical habitat). Supply, lightering, and fuel barges will operate at their normal speeds of less than 10 kt (18.5 km/hr).

PLP will provide reference materials and guides such as the NMFS compact-disc-based training program, *A Prudent Mariner's Guide to Right Whale Protection* (NMFS, 2009) that address whale protection for mariners to bulk carrier vessels utilized for the project.

To reduce the likelihood of ship groundings, the IMO (2016) adopted the Aleutian Islands Areas to be Avoided (ATBA). For ships 400 gross tonnages and above on international voyages through the Aleutian Island region, the ATBA recommends using the Northern and Southern Great Circle routes. Vessels in transit to the Project through the Aleutian Islands would adhere to the following measures:

- Travelling in established shipping lanes.
- Sailing on routes well offshore of the Aleutian Islands whenever possible.
- Avoiding travel through the ATBA.

These measures would also reduce the likelihood of vessel strikes of Steller sea lion in the Aleutian Island region.

7.4. Mitigation Measures – Entanglement

Shore-based and electronically transmitted (virtual) aids to navigation will be used instead of physical in-water aids to navigation (i.e. navigation buoys) to avoid potential entanglement hazards.

Anchor chains associated with the lightering station could catch marine debris (e.g., derelict fishing nets or rope) and pose an entanglement hazard to marine mammals. As a normal safety precaution, mooring systems and components would be annually inspected each fall after the close of the Cook Inlet salmon setnet fishery to ensure they are in good working order. Any debris caught on the cables would be removed and properly disposed of at that time.

7.5. Mitigation Measures – Accidental Spill

To reduce the risk of an accidental spill event, the following mitigation measures will be implemented:

- PLP would develop and implement spill prevention and control plans as required by applicable regulations including 40 CFR part 110, 18 AAC 75, and those related to vessel-to-vessel transfer, including 33 CFR part 144.
- Marine vessels used to deliver fuel to Diamond Point port would be tug-barges similar to the 483-ft (147-m), 100,000-barrel (4.2 million gallons [15 million liters]) articulated tug-barges currently under construction for Crowley Marine.
- All tug-barges used to deliver fuel would be double-hulled to reduce the likelihood of oil spills from vessel collision or grounding.
- To reduce the likelihood of ship groundings, adhere to ATBA adopted by the IMO (2016). For ships 400 gross tonnages and above on international voyages through the Aleutian Island region, the ATBA recommends using the Northern and Southern Great Circle routes. Vessels in transit to the Project through the Aleutian Islands would adhere to the following measures:
    - Travelling in established shipping lanes.
    - Sailing on routes well offshore of the Aleutian Islands whenever possible.
    - Avoiding travel through the ATBA.
- The barges would have at least 12 to 14 water-tight compartments, each with an estimated capacity of approximately 300,000 gal (1.1 million L) each. In the event of flooding of one or more compartments, the vessels are designed to maintain buoyancy and stability.
- Marine radar would be used to avoid other vessels and accurately approach the marine jetty.
- A slurry pipeline would move the concentrate from the mine site to the port where it would be dewatered prior to loading onto transfer barges:

- The concentrate conveyor would be fully enclosed within a tubular structure to contain dust and shed snow.
- The barge loader would be fitted with a mechanical dust collection system and each barge would have a cover system to prevent fugitive dust and protect the concentrate from precipitation. During lightering operations, the barge's internal system would retrieve and convey concentrate to the bulk carrier via a self-discharging boom conveyor. The boom would be fully enclosed and equipped with a telescoping spout and would have mechanical dust collection to prevent spillage and fugitive dust.

Overall, the risk of a small accidental spill (<1,000 gal [3,785 L]) during project operations is very low based on the modeling discussed in Section 5.5.1.

8. DETERMINATION OF EFFECTS

Determinations of Project effects on humpback whales, fin whales, sei whales, blue whales, North Pacific right whales, gray whales, sperm whales, beluga whales, and Steller sea lions, based on the risk posed by the proposed construction of the Diamond Point access road, Diamond Point port, natural gas pipeline and fiber optic cable placement, lightering station, and increased vessel traffic relative to five potential stressors (risk categories) evaluated in Section 6 (disturbance, vessel strike, entanglement, incidental spill, accidental spill) are presented below. Risks to humpback whale (proposed), North Pacific right whale, beluga whale, and Steller sea lion critical habitat are also evaluated. A compilation of the determinations is provided in Table 12.

Table 12. Determination of effects for each ESA-listed species potentially occurring within PLP's proposed Action Area.

Species	Determination
Humpback Whale *(Mexico DPS)*	Not Likely to Adversely Affect
Humpback Whale *(Western North Pacific DPS)*	Not Likely to Adversely Affect
Humpback Whale Critical Habitat (proposed) *(Mexico DPS)*	Not Likely to Adversely Affect
Humpback Whale Critical Habitat (proposed) *(Western North Pacific DPS)*	Not Likely to Adversely Affect
Fin Whale	Not Likely to Adversely Affect
Sei Whale	Not Likely to Adversely Affect
Blue Whale	Not Likely to Adversely Affect
North Pacific Right Whale	Not Likely to Adversely Affect
North Pacific Right Whale Critical Habitat	No Effect
Gray Whale (*Western North Pacific DPS*)	Not Likely to Adversely Affect
Sperm Whale	Not Likely to Adversely Affect
Beluga Whale (*Cook Inlet Stock)*	Not Likely to Adversely Affect
Beluga Whale Critical Habitat (*Cook Inlet Stock)*	Not Likely to Adversely Affect
Steller Sea Lion *(Western DPS)*	Not Likely to Adversely Affect
Steller Sea Lion Critical Habitat *(Western DPS)*	No Effect

8.1. Humpback Whale

8.1.1. Species Determination

Detailed justifications for the species determination for humpback whales are found in Section 6.1 and summarized in the following sections.

8.1.1.1. Acoustical Disturbance

Project activities that could acoustically disturb humpback whales include underwater noise generated by backhoe dredging and caisson filling during port construction, construction noise (especially tugboat noise during anchor-handling) during natural gas pipeline and fiber optic cable subsea placement, and noise from increased vessel traffic. Harassing noise associated with port construction is limited to waters too shallow for humpback whales. Noise associated with pipeline, fiber optic cable, and mooring anchor placement could expose humpback whales (Mexico DPS only) to underwater noise exceeding harassment thresholds, but shutdown safety zones will be established and monitored by PSOs to avoid Level B or Level A harassment take (and humpback whale densities are very low here). Increased supply barge, fuel barge, and concentrate bulk carrier vessel traffic could expose humpback whales (both the Mexico DPS and Western North Pacific DPS) to relatively high levels of vessel noise within lower Cook Inlet and along all three proposed traffic corridors. However, these exposures would be limited to the brief passing of the vessel. Collectively, acoustical disturbance risk to humpback whales from both DPSs is considered very low.

8.1.1.2. Vessel Strike

Vessel strike concerns are limited to vessels traveling at speeds greater than 10 kt (18.5 km/hr). All supply and fuel barges will transit at their normal speeds of around 9 kt (16.7 km/hr) and concentrate bulk carrier vessels will reduce speeds to below 10 kt (18.5 km/hr) when entering lower Cook Inlet north of Augustine Island. Vessel strike from these vessels at these speeds is considered negligible. Vessel strike risk remains for concentrate ships when transiting lower Cook Inlet (outside the portion of lower Cook Inlet north of Augustine Island and the Mexico DPS only) and along the proposed western travel corridor connecting lower Cook Inlet with Unimak Pass (27 annual roundtrips and both DPSs). However, based on existing data, vessel strike risk appears highest in Southeast Alaska where constricted travel lanes coincide with whale concentrations, and reported strikes throughout Alaska average about 3 per year. The risk of a vessel strike associated with the concentrate ships is considered to be very low.

8.1.1.3. Entanglement

Humpback whales (Mexico DPS only) could become entangled in Project anchor cables and mooring chains, or within derelict fishing gear entrained on these chains. However, risk would be greatly limited by keeping cables and chains taut, and line would be inspected and cleaned of debris annually. Entanglement risk is negligible.

8.1.1.4. Incidental Diesel or Lubricant Spill

Effects from any incidental diesel or lubricant spill associated with port construction or operation would be limited to the shallow, nearshore waters in the vicinity of the port. Humpback whales are unlikely to inhabit these waters, especially coinciding with the brief period a spill would be present. It is improbable that humpback whales could be affected by an incidental spill.

8.1.1.5. Accidental Diesel or Lubricant Spill (10-1,000 gal [38 to 3,785 L])

A small accidental spill could occur during port construction or operation, and during pipeline and fiber optic cable construction. However, the size of the affected area would be very limited and exposure time of short duration, and occurrence would have to coincide with the presence of a whale (Mexico DPS only). The risk of exposure to a spill less than 1,000 gal (3,785 L) is negligible.

8.1.1.6. Accidental Diesel, Chemical, or Concentrate Spill (>1,000 gal [3,785 L])

The likelihood of a large diesel, chemical, or concentrate spill associated with this Project is extremely small (one in several thousand years) and not reasonably foreseeable to occur during the life of the project and, therefore, is an improbable event.

8.1.1.7. Determination

Because the risks of all potential threats posed by Project activities to humpback whales (both Mexico DPS and Western North Pacific DPS) are considered very low for acoustical disturbance and vessel strike, negligible for entanglement and small accidental spill, or the exposure event improbable for incidental spill and large accidental spill (see Section 6.1.6), the overall determination is ***May Affect, Not Likely to Adversely Affect*** for both the Mexico DPS and the Western North Pacific DPS.

8.1.2. Critical Habitat Determination (Proposed)

There is currently no critical habitat designated for any of the populations of humpback whales that inhabit Cook Inlet or the GOA, although NMFS (2019a) recently proposed critical habitat for the Mexico DPS and Western North Pacific DPS, the Endangered Species Consultation Handbook (USFWS and NMFS 1998) instructs that proposed critical habitat is to be treated similar to designated critical habitat with effects determinations made on both.

As mentioned in Section 6.1.6, the Project will have little effect on the water column in which humpback whales will feed other than an temporary increase in turbidity during dredging and pipeline/cable placement. There will be some permanent and temporary loss of benthic habitat in the shallow waters near the proposed port, but this should not influence humpback whale use of critical habitat.

The proposed Project will introduce underwater noise into the lower Cook Inlet soundscape, and at times exceed harassment thresholds levels which might result in humpback whales moving from food sources. However, based on the maximum daily ensonified area of 21.1 mi^2 (54.6 km^2), relative to the proposed critical habitat available (4,458 mi^2 [11,545 km^2]) in lower Cook Inlet alone, the scope of the effect (0.5 percent of the area in lower Cook Inlet) is extremely small. Vessel traffic, especially along the proposed southern coastal and western routes, would introduce noise into the critical habitat soundscape of both DPSs. However, the noise associated with vessels would be limited to the time the vessel passes.

Thus, the humpback whale critical habitat determination (for both the Mexico DPS and Western North Pacific DPS) is ***May Affect, Not Likely to Adversely Affect*** based on the scale of the area (habitat loss and soundscape ensonified) potentially affected relative to the area of the proposed critical habitat designations for both listed DPSs.

8.2. Fin Whale, Sei Whale, Blue Whale, Gray Whale, and Sperm Whale

8.2.1. Species Determination

Specifics in support of the determination for fin, sei, blue, gray, and sperm whales can be found in Section 6.1, and are summarized below.

8.2.1.1. Acoustical Disturbance

Based on distribution records in Alaska, none of the four pelagic whale species (fin, sei, blue, gray, or sperm whale) are expected in the vicinity of the port, natural gas pipeline and fiber optic cable construction corridor, or near any vessel traffic within Cook Inlet. All five species could be encountered along the southern offshore travel corridor crossing the GOA and fin whales inhabit the shelf waters along both the southern coastal and western travel corridors. Noise from passing vessels could briefly disturb individual whales, but population-level impacts are not expected and risks to whales are considered very low.

8.2.1.2. Vessel Strike

Vessel strike risk to fin, sei, blue, gray, and sperm whales is very low relative to supply and fuel barges traveling along the proposed southern coastal and offshore travel corridors. All these vessels travel at speeds of less than 10 kt (18.5 km/hr), the threshold below which few strikes occur. Vessel strike risk to fin whales is higher along the proposed western travel corridor where the concentrate bulk carrier vessel will travel at speeds between 13 kt (24.1 km/hr) and 15 kt (27.8 km/hr) through areas fin whales are known to feed (e.g., Shelikof Strait). However, based on the very low rate of recorded vessel strikes per year (approximately 3) in Alaskan waters, the risk of a concentrate bulk carrier vessel strike is very low and is not reasonably certain to occur.

8.2.1.3. Entanglement

Entanglement concerns are restricted to anchor chains (lightering station) in Iniskin Bay. None of the five species addressed here are known to occur in lower Cook Inlet north of Augustine Island, so an entanglement event is improbable.

8.2.1.4. Incidental Diesel and Lubricant Spill

Incidental diesel and lubricant spills would be restricted to port construction and operations and pipeline and fiber optic cable placement. None of the five species addressed in this section are known to inhabit lower Cook Inlet in the area of the proposed activity. Fin whales are occasionally observed near the mouth of the Inlet, but exposure of these whales to an incidental spill would require both a spatial and temporal overlap with the very small area the spill would affect, the likelihood of which is improbable.

8.2.1.5. Accidental Diesel or Lubricant Spill (10-1,000 gal [38 to 3,785 L])

Small accidental spills associated with construction and operation have the same exposure risk to fin, sei, blue, gray, and sperm whales as an incidental spill. A spatial-temporal overlap of whale and spill is unlikely to the point of being improbable based on spill size and whale distribution.

8.2.1.6. Accidental Diesel, Chemical, or Concentrate Spill (>1,000 gal [3,785 L])

A larger spill associated with a fuel barge accident could affect any large whale depending on location. However, the risk of such a spill is so low (one in several thousand years) that it is considered improbable.

8.2.1.7. Determination

Because Project risks to fin, sei, blue, gray, and sperm whales are considered very low (acoustical disturbance and vessel strike) or an occurrence is considered improbable (entanglement, incidental spill, small accidental spill, and large accidental spill), the determination is ***May Affect, Not Likely to Adversely Affect***.

8.2.2. Critical Habitat Determination

There is no designated critical habitat for fin, sei, blue, gray, or sperm whales in Alaska.

8.3. North Pacific Right Whale

8.3.1. Species Determination

Specific details in support of the North Pacific right whale determination summaries below can be found in Section 6.1.

8.3.1.1. Acoustical Disturbance

North Pacific right whales do not inhabit lower Cook Inlet and, therefore, would not be affected by noise associated with port construction and operation and pipeline and fiber optic cable placement. Right whales do occur in very small numbers in the GOA, especially south of Kodiak Island where critical habitat has been designated (GOA unit). However, the proposed western travel corridor has been placed north of Kodiak Island (through Shelikof Strait) purposely to avoid right whales. The only potential for acoustical disturbance is limited to the off chance of whales moving through Unimak Pass, between the SEBS and GOA units, coincident with a passing concentrate ship. However, given that the average number of vessel passages through Unimak Pass per year is approximately 54 (27 round trips) which represents a negligible increase over the existing vessel traffic, and the whale population so small, acoustical disturbance is improbable.

8.3.1.2. Vessel Strike

As with acoustical disturbance, the location of highest risk for a vessel strike encounter with a right whale is Unimak Pass. However, the likelihood of a right whale and vessel occupying the same space within the pass is so small (based on the number of annual vessel passages and the distribution and population size of this whale) that a strike event is improbable. There are no known records of North Pacific right whale strikes in Alaskan waters.

8.3.1.3. Entanglement

Entanglement concerns are limited to the anchor chains associated with the lightering station in Iniskin Bay. North Pacific right whales do not inhabit lower Cook Inlet. Therefore, there is no risk from entanglement.

8.3.1.4. Incidental Diesel and Lubricant Spill

Incidental spill of diesel and lubricants would be limited to the port construction and operation and pipeline and fiber optic cable placement in lower Cook Inlet. Right whales do not inhabit the Inlet, thus there would be no risks associated with incidental spills.

8.3.1.5. Accidental Diesel or Lubricant Spill (10-1,000 gal [38 to 3,785 L])

The area affected by small accidental spills would be limited to proposed construction and operation activities in lower Cook Inlet. North Pacific right whales do not inhabit lower Cook Inlet, so there are no risks to these whales from such small spills.

8.3.1.6. Accidental Diesel, Chemical, or Concentrate Spill (>1,000 gal [3,785 L])

The risk of a large spill occurring is very small and not reasonably foreseeable to occur during the life of the project, therefore an accidental diesel, chemical and concentrate spill is considered improbable.

8.3.1.7. Determination

In all cases, there are either no project risks to North Pacific right whales (entanglement, incidental spills, and small accidental spills), or an event is considered improbable (acoustical disturbance, vessel strike, large accidental spills). Therefore, the determination is ***May Affect, Not Likely to Adversely Affect***.

8.3.2. Critical Habitat Determination

North Pacific right whale critical habitat in the Gulf of Alaska is limited to the GOA unit south of Kodiak Island. The proposed concentrate bulk carrier vessel travel corridor has been placed to purposely avoid this unit. Thus, there are no Project risks to right whale critical habitat, and the determination is ***No Effect***.

8.4. Beluga Whale

8.4.1. Species Determination

Details in support of the beluga whale determination are found in Section 6.2 and summarized below.

8.4.1.1. Acoustical Disturbance

Beluga whales are not known to inhabit lower Cook Inlet north of Augustine Island during the summer months when most construction would occur, and there are no recent records of use of the bay in the winter. Should beluga whales begin using the bay they could be acoustically disturbed by lightering vessels traveling from port to the concentrate bulk carrier vessel. However, given the low use of lower Cook Inlet north of Augustine Island by beluga whales, and the area acoustically affected relative to the area available, the risk of winter acoustical disturbance is very low.

8.4.1.2. Vessel Strike

All vessels operating within lower Cook Inlet north of Augustine Island during construction and operations would be traveling at speeds less than 10 kt (18.5 km/hr), the threshold of vessel strike concern. Winter vessel activity within the nearshore of the portion of lower Cook Inlet north of Augustine Island, the part of the bay most likely to be used by these whales, is limited to the small, slow-moving lightering barges, which are unlikely to strike a maneuverable beluga whale. The risk of a strike is negligible based on vessel speed and low beluga whale use of lower Cook Inlet north of Augustine Island.

8.4.1.3. Entanglement

Beluga whales are very unlikely to become entangled in mooring chains, especially given the chains will be kept taut. These whales could become entangled in fishing nets and ropes that might become entrained on the anchor chains and cables. However, these anchor chains will be annually inspected, and debris removed. Conducting line maintenance in the fall right after the salmon setnet season ensures chains are clean of this debris prior to any winter use by beluga whales. Thus, entanglement risk is negligible.

8.4.1.4. Incidental Diesel and Lubricant Spill

A winter incidental diesel and lubricant spill during port operations would affect nearshore habitat used by beluga whales. However, a spill event would have to coincide with beluga whales' presence, which are two events unlikely to occur simultaneously, especially since the affected area would be limited to the vicinity of an active port. The likelihood of a beluga whale encountering an incidental spill at concentrations considered harmful is improbable.

8.4.1.5. Accidental Diesel or Lubricant Spill (10-1,000 gal [38 to 3,785 L])

A small accidental spill occurring within the winter, when beluga whale use of lower Cook Inlet north of Augustine Island is possible, would be confined to the vicinity of the port and would have the same risk as an incidental spill.

8.4.1.6. Accidental Diesel, Chemical, or Concentrate Spill (>1,000 gal [3,785 L])

A large accidental spill of diesel, chemicals, or concentrate has the potential to adversely affect beluga whales and their habitat. The effects would depend on the type of product spilled, released quantity, product properties, location, and timing. The greatest risk to beluga whales and their habitat would be from a large diesel spill associated with fuel transport. However, large diesel spills are not reasonably foreseeable to occur during the life of the project as their risk of occurrence was estimated in the hundreds to thousands of years and, therefore, are improbable events. Therefore, such an event impacting beluga whales is also improbable.

8.4.1.7. Determination

All potential Project effects to Cook Inlet beluga whales are either negligible (acoustical disturbance, vessel strike, entanglement) or improbable (incidental spill, small accidental spill, and large accidental spill). The determination, therefore, is ***May Affect, Not Likely to Adversely Affect***.

8.4.2. Critical Habitat Determination

The construction of the Diamond Point port access road, Diamond Point port, natural gas pipeline and fiber optic cable, and lightering station would result in a permanent loss of approximately 26.6 ac (10.8 ha) of critical habitat representing only 0.001 percent of the 3,013 mi^2 (7,800 km^2) of critical habitat available in Cook Inlet. From a perspective of scale, the amount of beluga whale critical habitat lost and disturbed is negligible. In addition, there are no high or medium flow anadromous streams within 5 mi (8 km) of the proposed port or lightering station, the likelihood of a spill resulting in contamination is considered either negligible (incidental or small accidental spill) or improbable (large accidental spill), no whale passage will be restricted, and there is no evidence that the noise associated with winter vessel traffic would spatially displace beluga whales from critical habitat. Thus, the determination for Cook Inlet beluga whale critical habitat is ***May Affect, Not Likely to Adversely Affect***. Details can be found in Section 6.2.6.

8.5. Steller Sea Lion

8.5.1. Species Determination

The details supporting the Steller sea lion determination are found in Section 6.3 and summarized below.

8.5.1.1. Acoustical Disturbance

Steller sea lions occur in very low numbers in lower Cook Inlet north of Augustine Island (and lower Cook Inlet in general) but in much higher numbers in the GOA. Potential acoustical disturbance during summer construction activities is expected to be low, especially with proposed monitoring of shutdown safety zones to avoid harassment take.

8.5.1.2. Vessel Strike

Steller sea lions are highly maneuverable and not at risk from vessels traveling at speeds of <10 kt (<18.5 km/hr), which includes all barging activity associated with this Project, and concentrate ships traveling within lower Cook Inlet north of Augustine Island. Outside of this part of lower Cook Inlet, concentrate bulk carrier will be traveling at faster speeds (13-15 kt [24-28 km/hr]) resulting in an increased strike risk to sea lions. However, in 30 years there were only 4 records of sea lion collisions with vessels (all ships) in Alaska suggesting the collision risk is negligible.

8.5.1.3. Entanglement

Steller sea lions are unlikely to become entangled in the taut anchor chains associated with the lightering station, but they are susceptible to entanglement in derelict fishing gear, and such gear might be entrained on the anchor chains. PLP proposes to mitigate entanglement risk by annually inspecting anchor chains and removing any debris entrained soon after the closure of the annual salmon setnet fishery. Given this mitigation and low numbers of sea lions that regularly inhabit lower Cook Inlet north of Augustine Island, the entanglement risk is considered negligible.

8.5.1.4. Incidental Diesel or Lubricant Spill

Incidental spills of diesel fuel and lubricants could occur during all construction, operation, and closure phases of the Project and could affect Steller sea lions if the animals were present at the time of the spill. An accumulation of spills at the port could lead to contamination of food resources in the immediate vicinity. However, given the low density of sea lions in lower Cook Inlet north of Augustine Island coupled with the small magnitude of the affected area, especially given the safety measures that will be in place, the risk is considered very low.

8.5.1.5. Accidental Diesel or Lubricant Spill (10-1,000 gal [38 to 3,785 L])

Given the safety measures that will be in place during construction and operation, the low densities of sea lions in lower Cook Inlet, and the mathematical likelihood of a spill occurring based on past spill records, the risk to sea lions is considered negligible.

8.5.1.6. Accidental Diesel, Chemical, or Concentrate Spill (>1,000 gal [3,785 L])

A large accidental spill of diesel, chemicals, or concentrate has the potential to adversely affect Steller sea lions, specifically if toxins were to reach rookeries, haulouts, and associated high use foraging areas. The effects would depend on the type of product spilled, released quantity, product properties, location, and timing. The greatest risk to Steller sea lions and their habitat would be from a large diesel spill associated with fuel transport. However, large diesel spills are not reasonably foreseeable to occur during the life of the project as their risk of occurrence was estimated at one in several thousand years. Therefore, as the likelihood of a large accidental spill is improbable, potential impacts to sea lions are improbable.

8.5.1.7. Determination

Project risks to Steller sea lions are very low for acoustical disturbance and incidental spill, negligible for vessel strike, entanglement, and small accidental spill, and improbable for large accidental spill. The overall determination is ***May Affect, Not Likely to Adversely Affect***.

8.5.2. Critical Habitat Determination

There is no Steller sea lion critical habitat within lower Cook Inlet, so there are no impacts associated with port, pipeline, and fiber optic cable construction, or port operation and closure. Supply barges and concentrate bulk carrier vessels will pass through 20 nm (23 mi, 37 km) of critical habitat buffers along the designated travel corridors, especially when entering and exiting Cook Inlet. However, the nearest a vessel would pass by a major haulout or rookery is approximately 5 nm (5.8 mi, 9.3 km) or well outside the 3 nm (3.5 mi, 5.5 km) no-entry zone for rookeries west of 144° W. Only a large accidental spill has the potential of impacting critical habitat, but the risk of such a spill is mathematically infinitesimal (improbable). A small spill might reach critical habitat based on trajectory modeling but would be too dissipated to cause harm. Therefore, Project risks to Steller sea lion critical habitat are inconsequential, and the determination is ***No Effect***.

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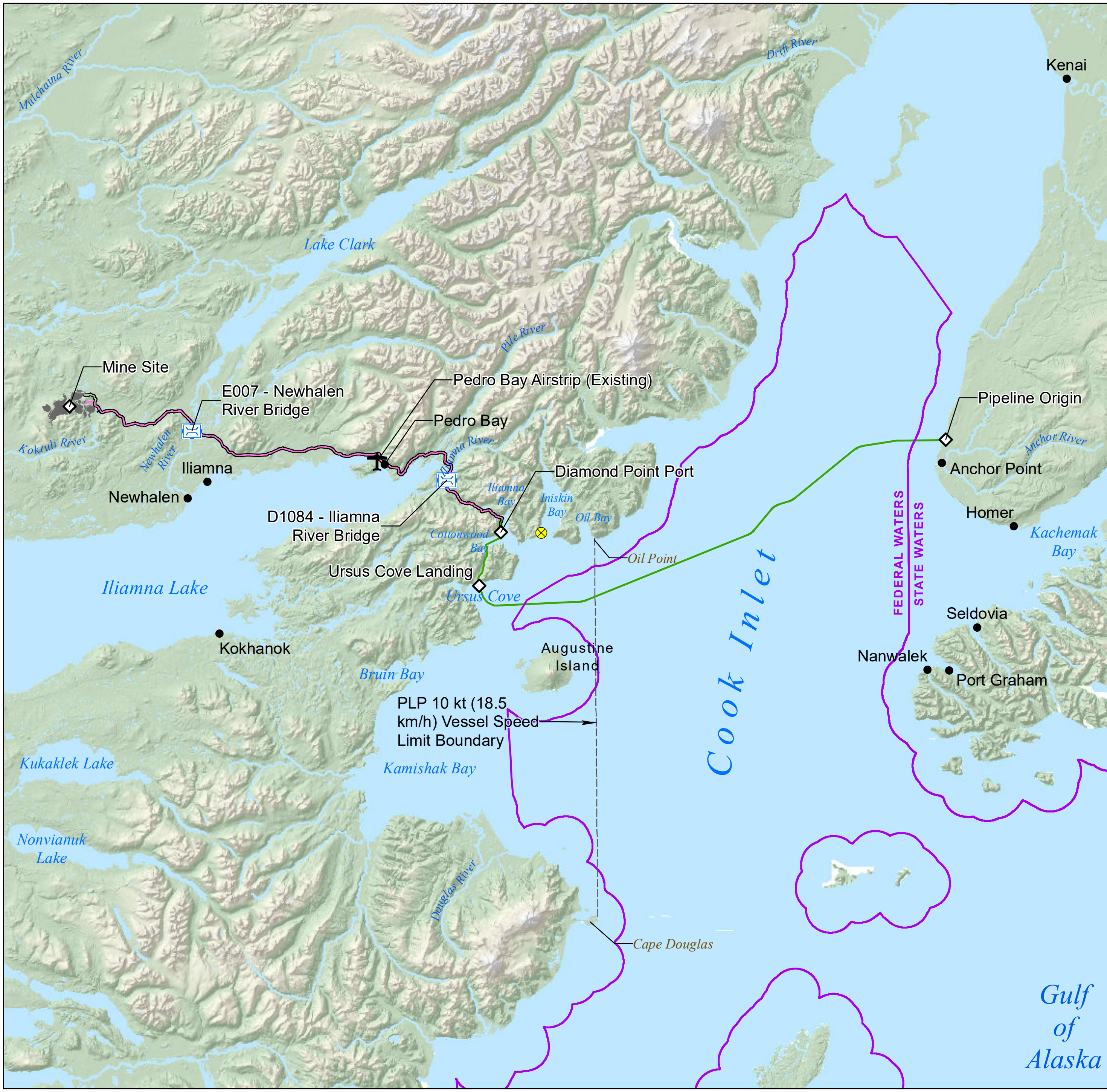
FIGURES



THE pebble PARTNERSHIP

Project Feature

Lightering Station

Bridge

Access Road

Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)

NGP, FOC, Concentrate Pipeline, and Return Water Pipeline

State Seaward Boundary

Mine Site

Pedro Bay Airstrip (Existing)

Miles

0 10 20 30

Scale 1:1,300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 1

PROJECT COMPONENTS

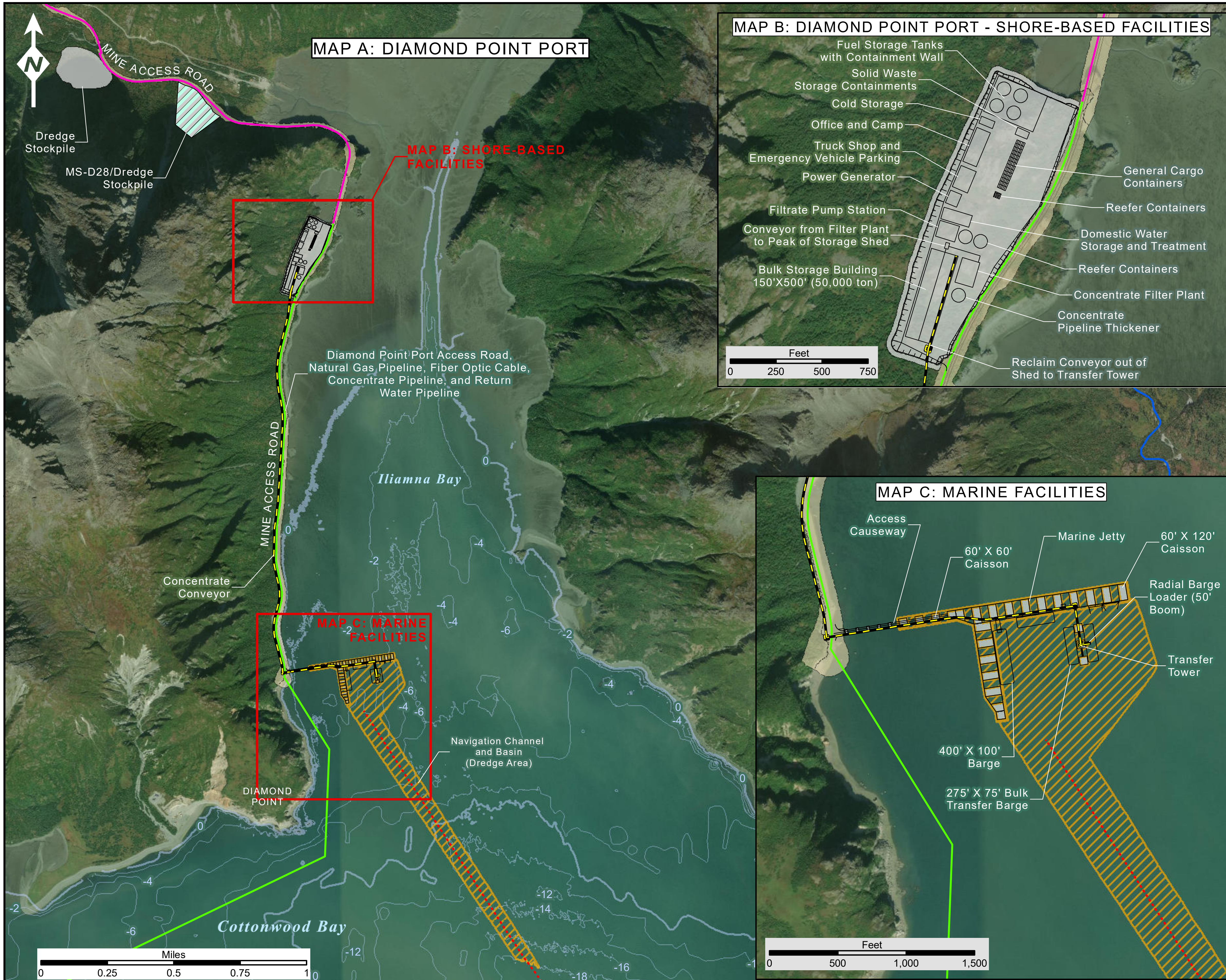
NMFS Biological Assessment

File: PLPNMFS_014

Date: 5/13/2020

Revision: 03

Author: ORNRC



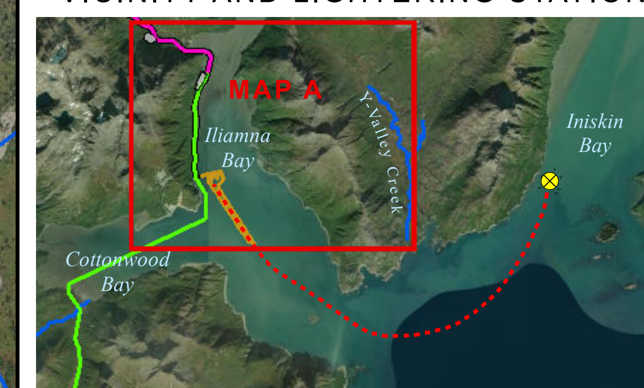
THE pebble PARTNERSHIP

- Lightering Station
- Lightering Route
- Concentrate Conveyor
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- Access Road
- Material Site and Dredge Stockpile
- Diamond Point Port
- Navigation Channel and Basin (Dredge Area)
- Anadromous Streams

Bathymetric Contours (2 feet - MLLW)

- Index Contour
- Intermediate Contour

VICINITY AND LIGHTERING STATION



Miles
0 2 4 6

Scale 1:23,500

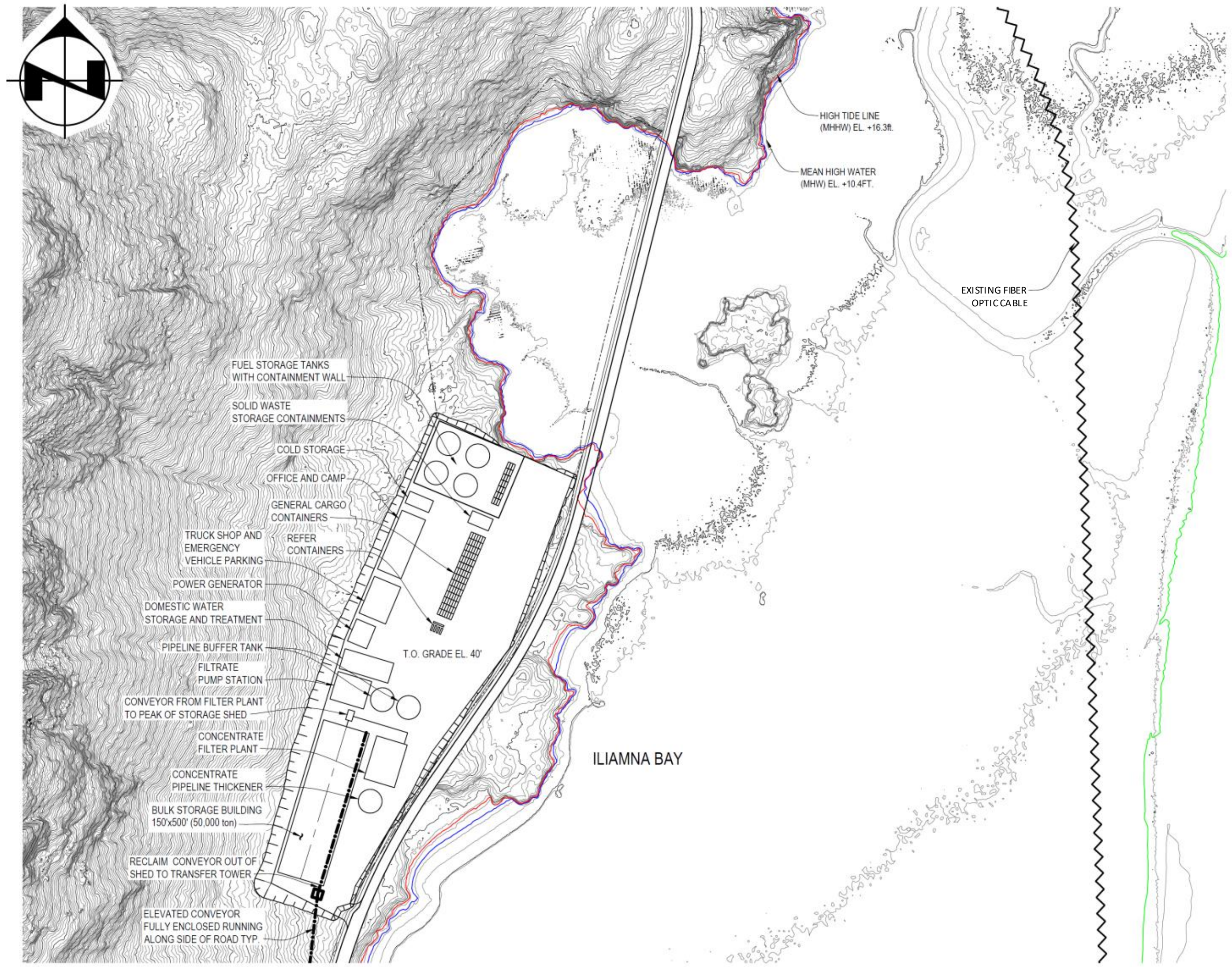
NAD 1983 StatePlane Alaska 5 FIPS 5005 Seward Meridian

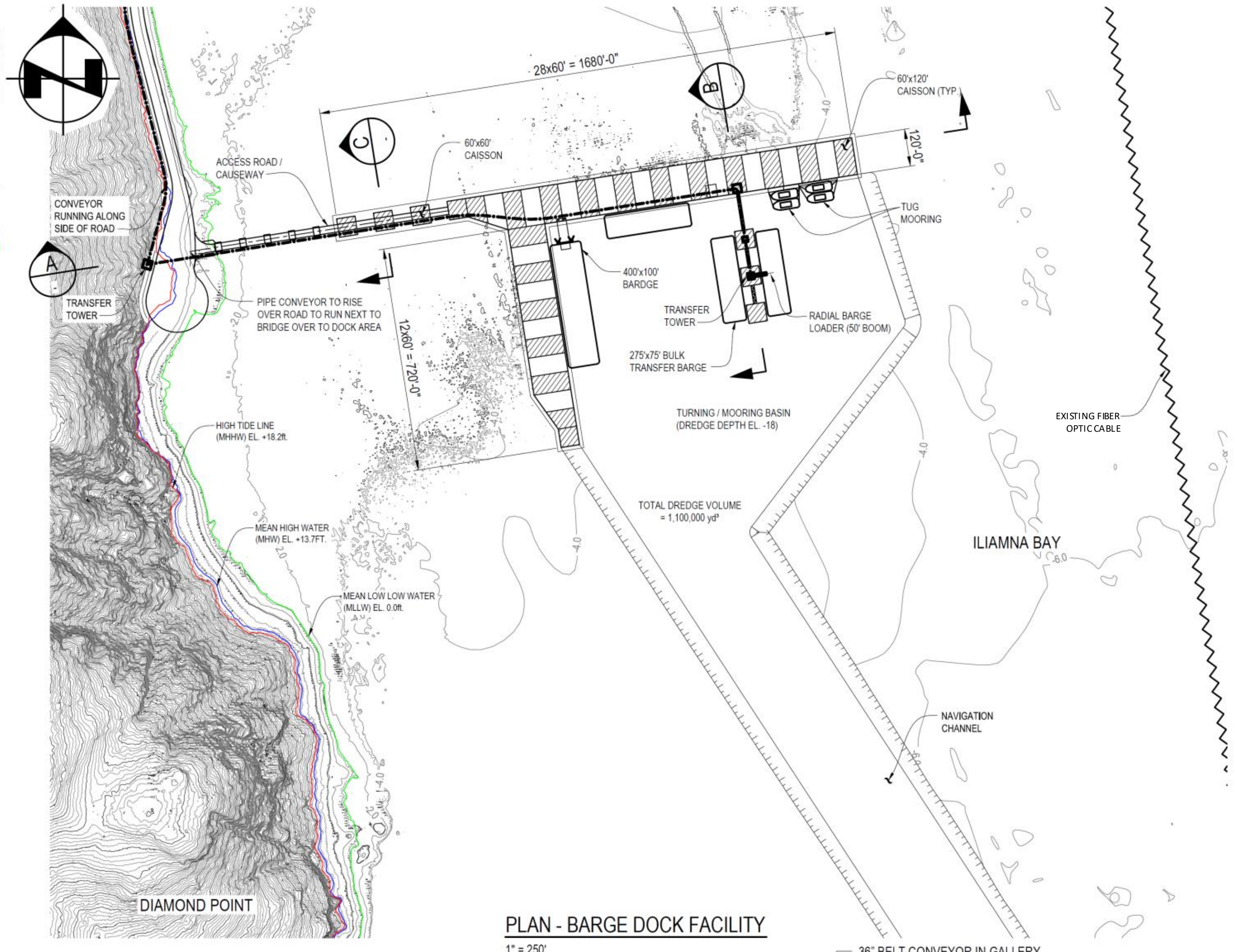
Figure: **2**

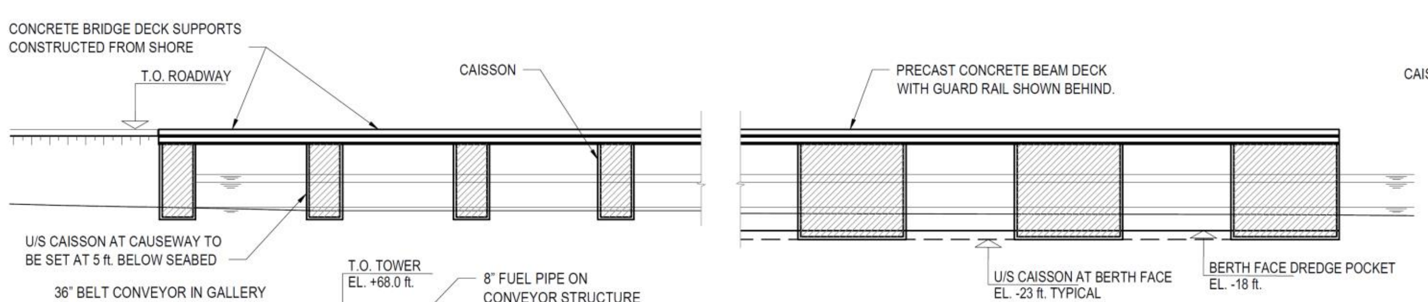
DIAMOND POINT PORT AND LIGHTERING STATION

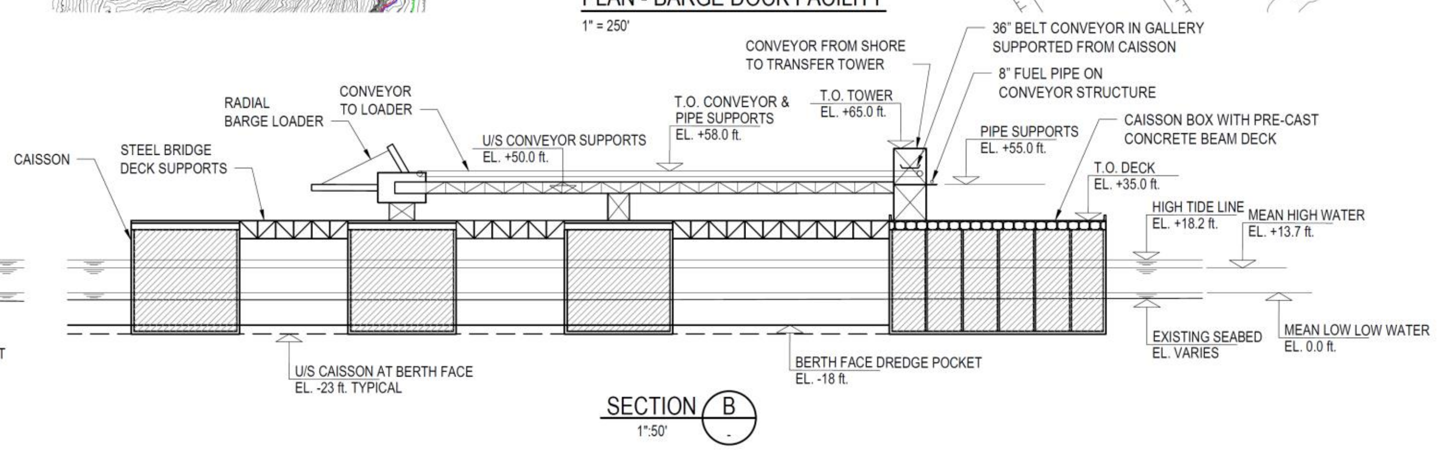
NMFS Biological Assessment

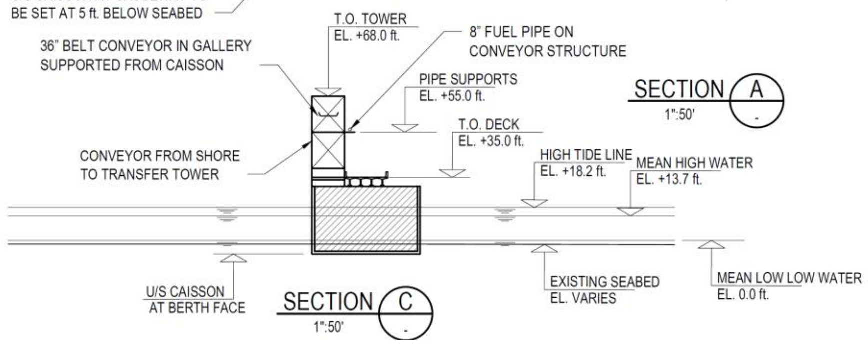
File: PLPNMFS_030	Date: 5/22/2020
Revision: 03	Author: ORNRC











NOTES:
1. DIMENSIONS AND DEPTHS ARE IN FEET, UNLESS NOTED OTHER
2. HORIZONTAL DATUM TO UTM NAD83, ALASKA STATE PLANE ZON

50' 0 50' 100' 150'
SCALE: 1"=50'

250' 0 250' 500' 750'
SCALE: 1"=250'

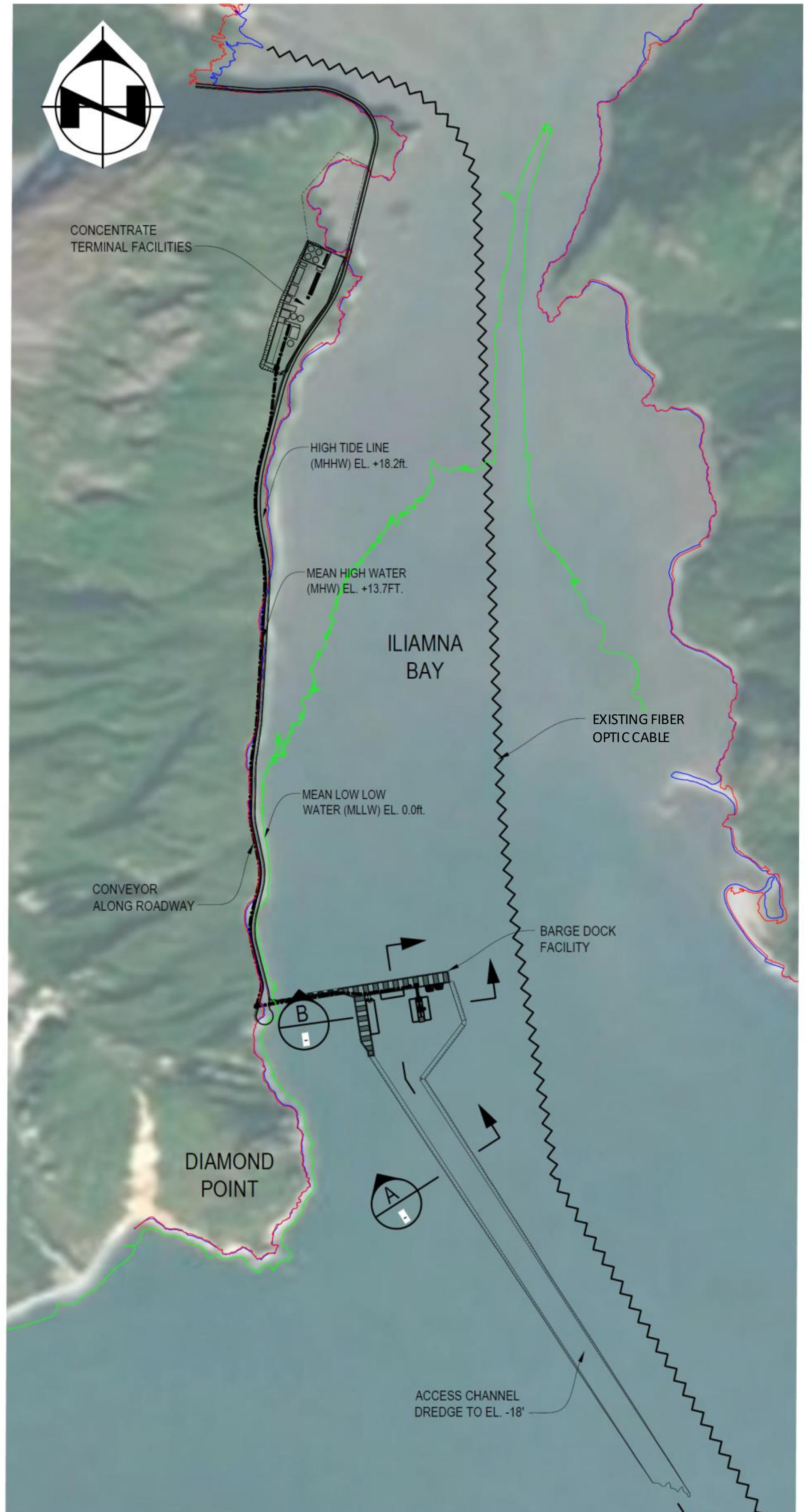
THE pebble PARTNERSHIP

FIGURE 3

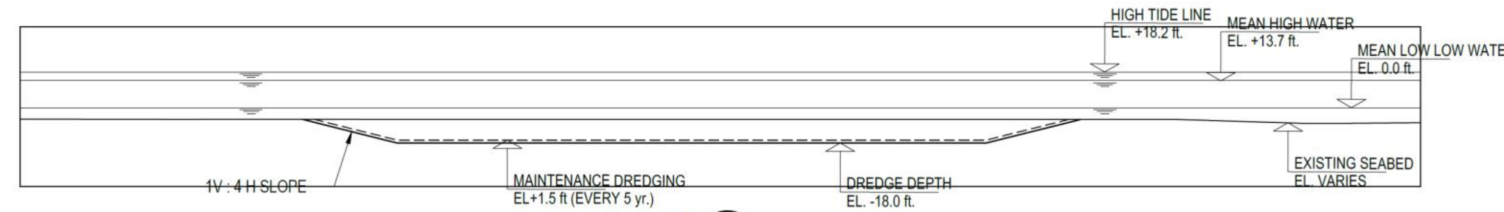
DIAMOND POINT PORT PLAN AND CROSS SECTION VIEW

NMFS Biological Assessment

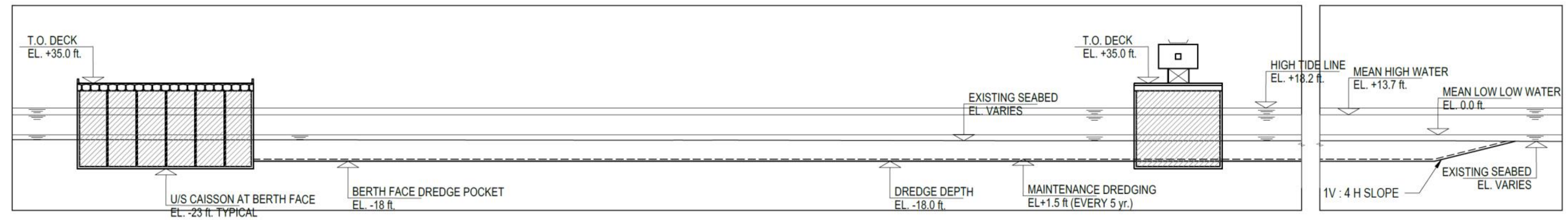
File: PLPNMFS_032	Date: 5/8/2020
Revision: 02	Author: ORNRC



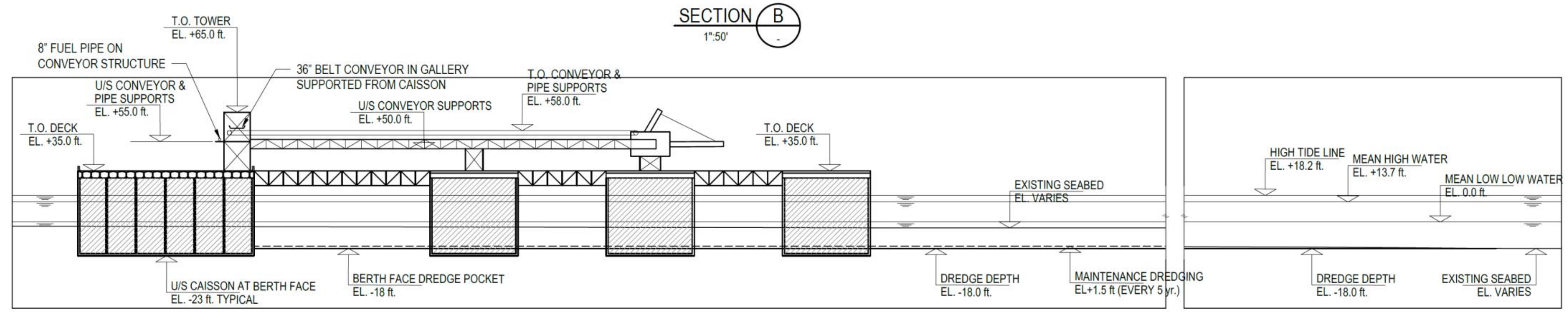
PLAN
1" = 1500'



SECTION A
1":50'



SECTION B
1":50'



SECTION C
1":50'

NOTES:
1. DIMENSIONS AND DEPTHS ARE IN FEET, UNLESS NOTED OTHERWISE.
2. HORIZONTAL DATUM TO UTM NAD83, ALASKA STATE PLANE ZONE 5, US SURVEY FEET.

50' 0 50' 100' 150' 200'
SCALE: 1"=50'

1000' 0 1000' 2000' 3000' 4000' 5000' 6000'
SCALE: 1"=1500'

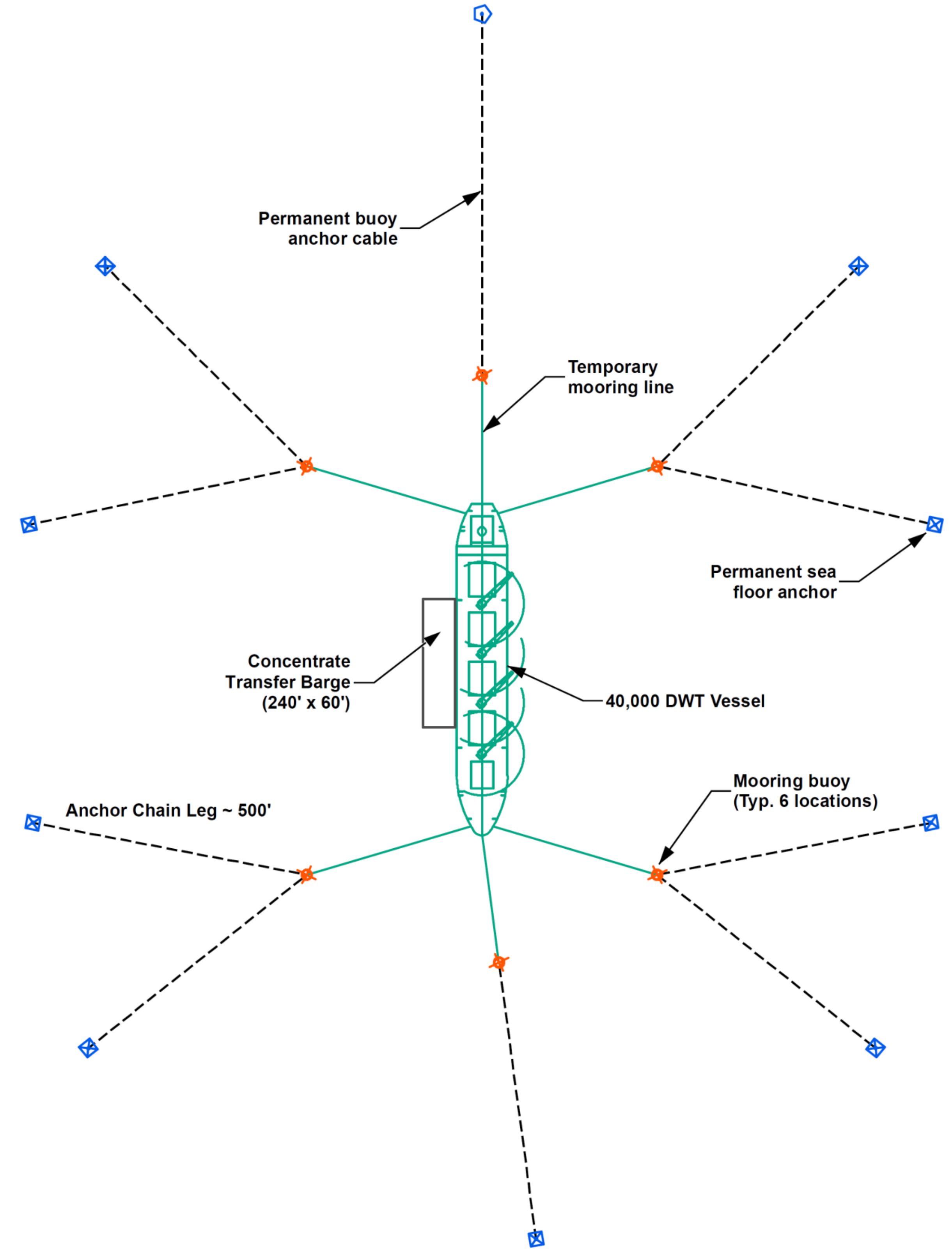
THE pebble PARTNERSHIP

FIGURE 4

NAVIGATION CHANNEL AND BASIN PLAN AND CROSS SECTION VIEW

NMFS Biological Assessment

File: PLPNMFS_031	Date: 5/8/2020
Revision: 02	Author: ORNRC



LIGHTERING SPREAD MOORING SYSTEM ARRANGEMENT

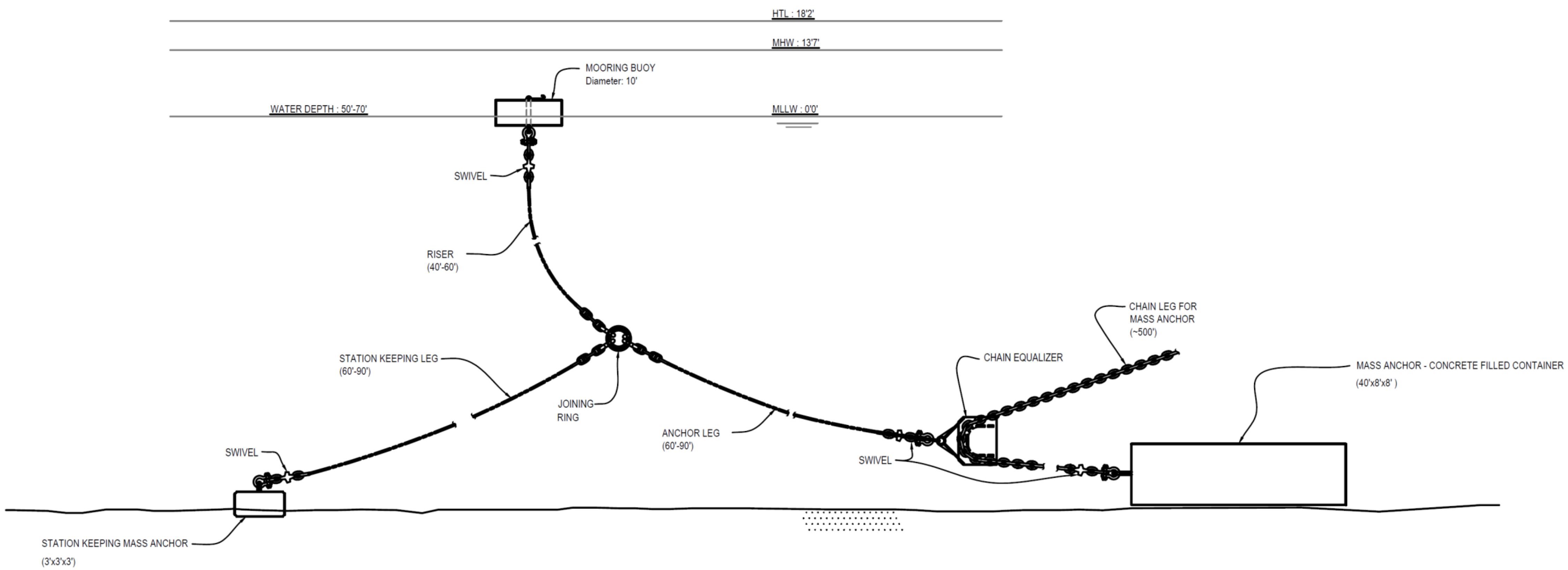
THE pebble PARTNERSHIP

FIGURE 5

SPREAD ANCHOR
MOORING SYSTEM

NMFS Biological Assessment

File: PLPNMFS_018	Date: 5/7/2020
Revision: 01	Author: ORNRC



TYPICAL ANCHOR DESIGN

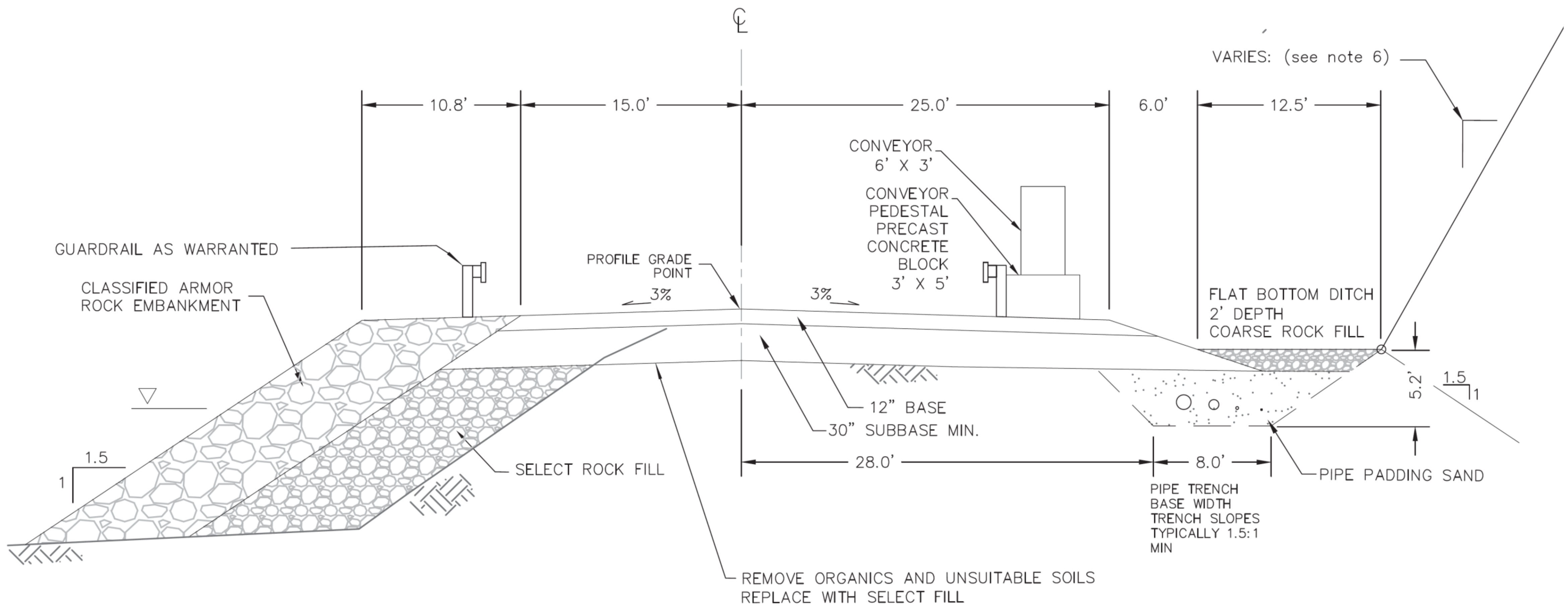
THE pebble PARTNERSHIP

FIGURE **6**

TYPICAL ANCHOR ARRANGMENT

NMFS Biological Assessment

File: PLPNMFS_019	Date: 5/7/2020
Revision: 01	Author: ORNRC



NOTES:

1. CLEARING LIMITS MIN. TO TOP OF CUT OR TOE OF FILL.
2. BASE TO CONSIST OF 2 inch MINUS, DURABLE, WELL GRADED, CRUSHED ROCK WITH 6 TO 10% PASSING THE 200 SIEVE. 12" MIN DEPTH.
3. SUBBASE TO CONSIST OF CLEAN DURABLE COARSE ROCK OR GRAVEL. NON-FROST-SUSCEPTIBLE. 30" MIN DEPTH.
4. SELECT ROCK FILL MATERIAL; TO CONSIST OF DURABLE COARSE FREE DRAINING ROCK OR GRAVEL, AS APPROVED BY ENGINEER.
5. DEPTH OF EMBANKMENT STRUCTURAL FILL WILL VARY DEPENDING ON SOIL TYPE AND CONDITION. 3.5 ft TOTAL EMBANKMENT DEPTH WILL TYPICALLY BE THE MINIMUM.
6. BACKSLOPES WILL VARY DEPENDENT UPON SOIL OR ROCK TYPE AND CHARACTER
   TYPICAL: 2:1 FOR GLACIAL MORAINE SOILS
   1.5:1 FOR COARSE ROCK OR GRAVEL
   0.25:1 TO 1:1 FOR ROCK
7. ARMOR ROCK TO BE PER SPEC FOR CLASS II ARMOR ROCK
8. ACCOMMODATE EXCESS EXCAVATION AND WASTE DISPOSAL BY FLATTENING AND/OR EXTENDING INSLOPE AT SELECT LOCATIONS AS APPROVED BY ENGINEER.
9. INSTALL GUARDRAIL PER PLAN AND AS WARRANTED.

TYPICAL SECTION APPLIES OT FOLLOWING INTERVALS:
STA. 32+40 TO 82+26 (MP 0.61 TO MP 1.60)

1" = 10'

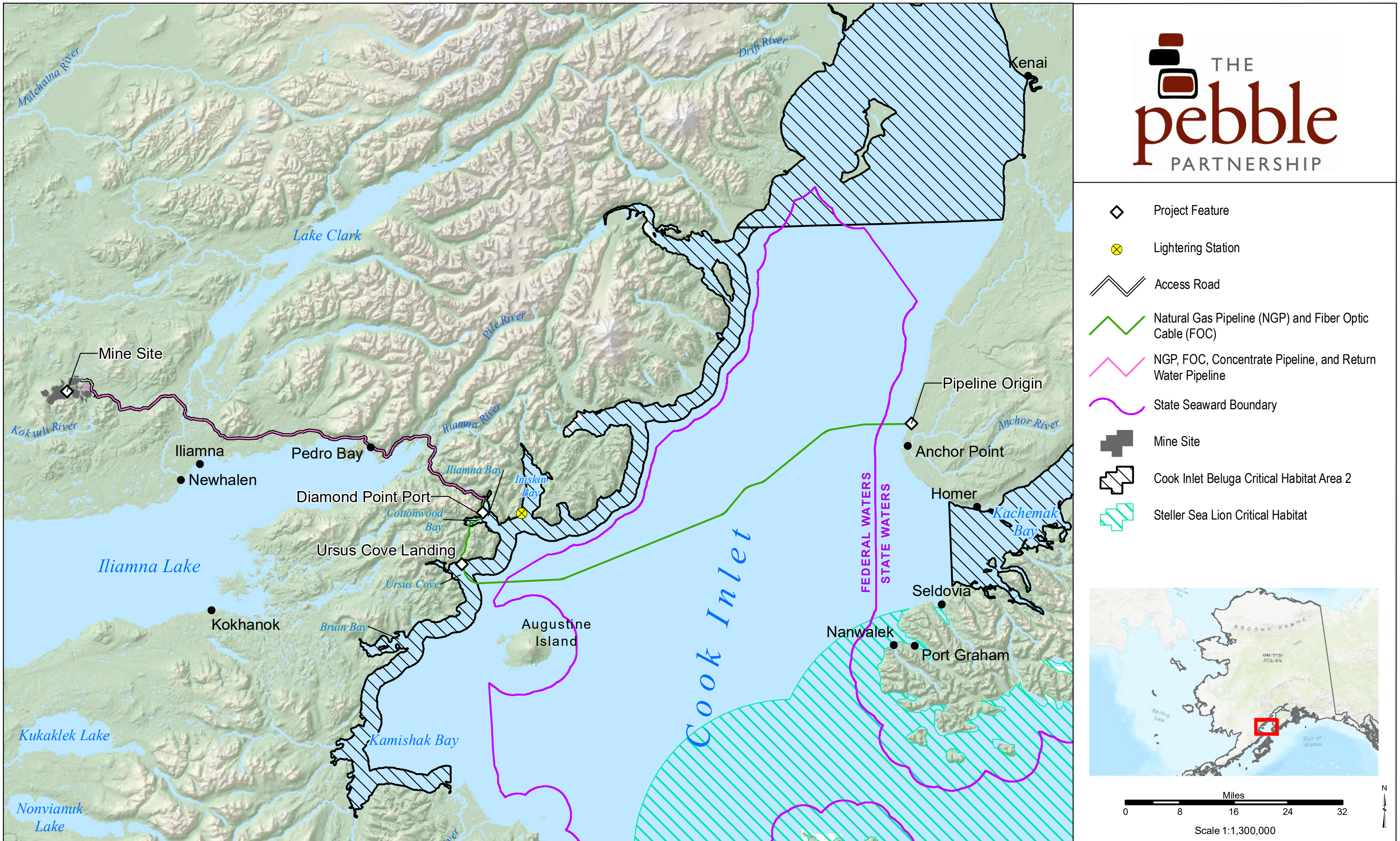
THE pebble PARTNERSHIP

FIGURE 7

ROAD TYPICAL SECTION FOR EMBANKMENT IN INTERTIDAL AREAS

NMFS Biological Assessment

File: PLPNMFS_024	Date: 5/5/2020
Revision: 01	Author: ORNRC



THE pebble PARTNERSHIP

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

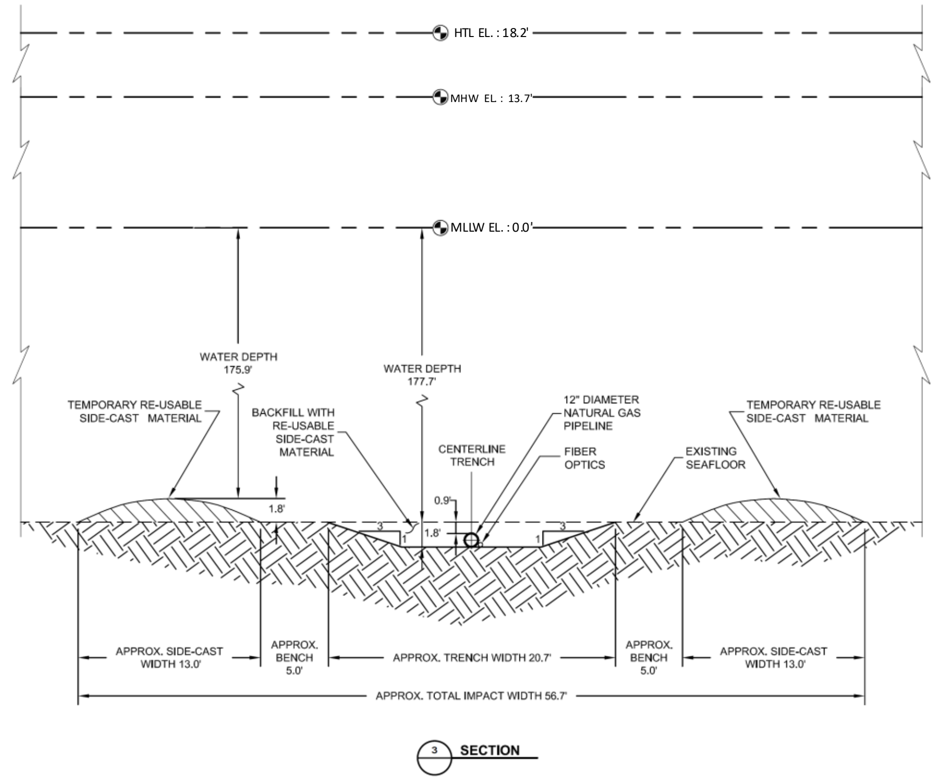
Figure: 8

NATURAL GAS PIPELINE AND FIBER OPTIC CABLE LOCATION

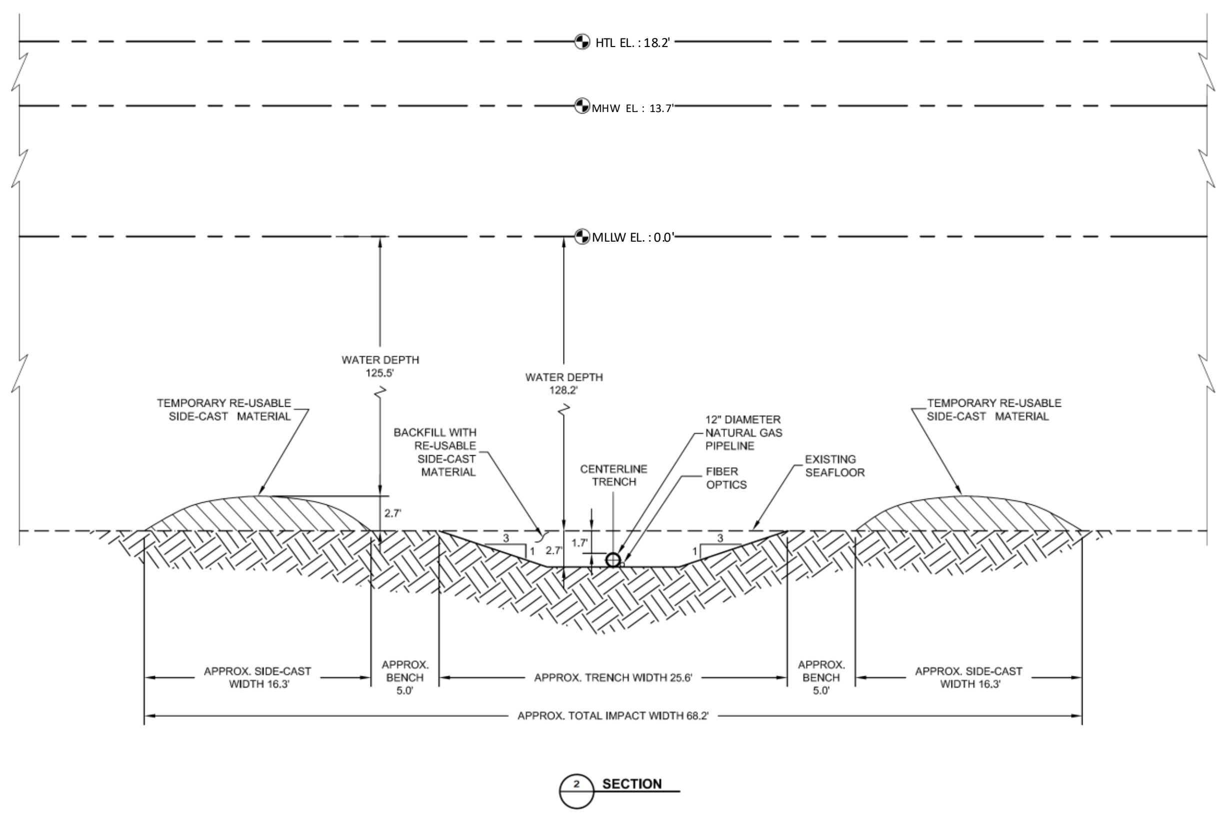
NMFS Biological Assessment

File: PLPNMFS_015	Date: 5/13/2020
Revision: 02	Author: ORNRC

56.7 FT TOTAL IMPACT WIDTH



68.2 FT TOTAL IMPACT WIDTH



THE pebble PARTNERSHIP

FIGURE **9**

NATURAL GAS PIPELINE AND FIBER OPTIC CABLE SEABED TYPICALS (56.7 FT AND 68.2 FT IMPACT WIDTH)

(See Table 3 and Figure 12)

NMFS Biological Assessment

File: PLPNMFS_016	Date: 5/5/2020
Revision: 02	Author: ORNRC

THE pebble PARTNERSHIP

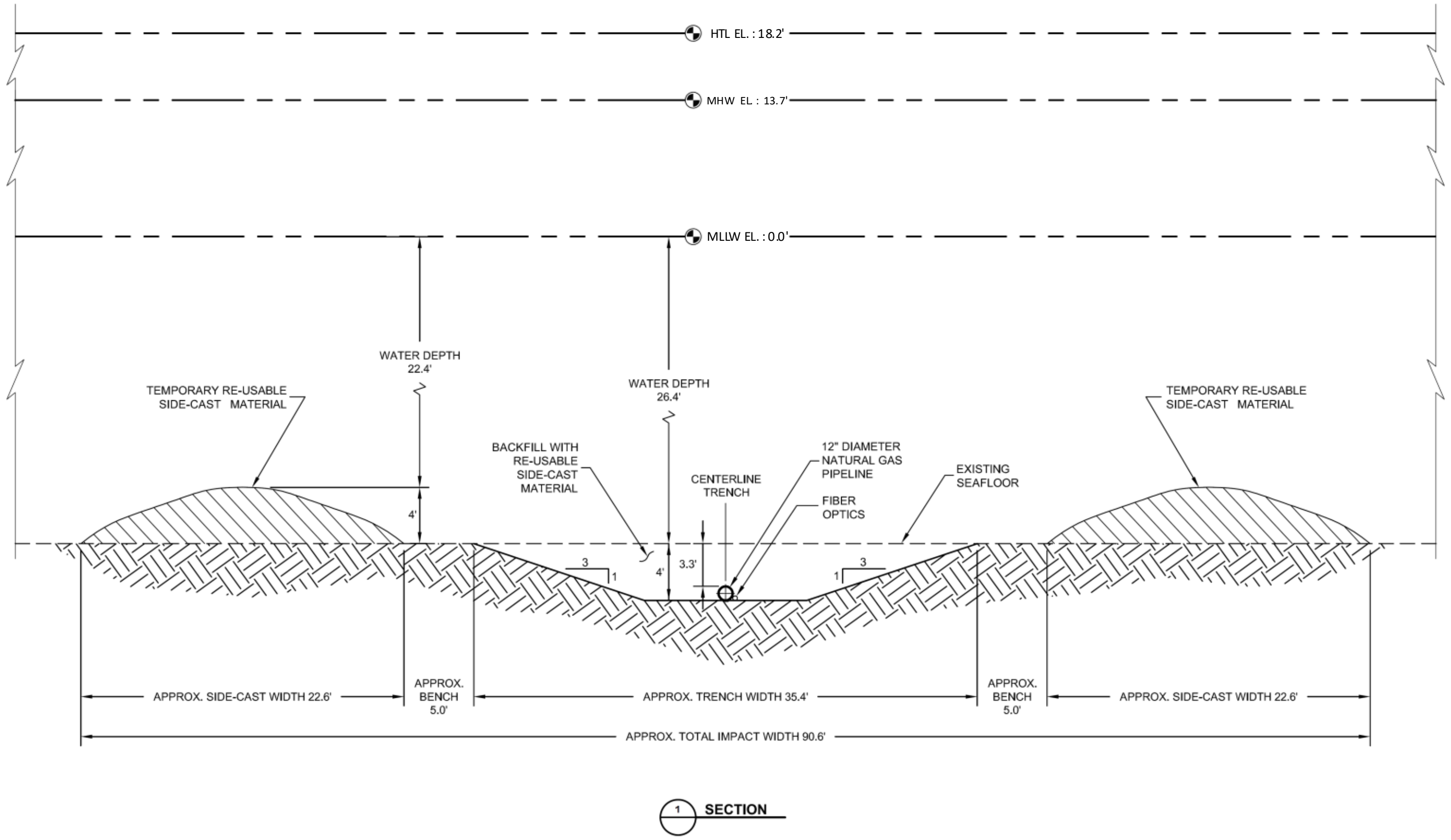
FIGURE **10**

NATURAL GAS PIPELINE AND FIBER OPTIC CABLE SEABED TYPICALS (90.6 FT AND 101.7 FT IMPACT WIDTH)

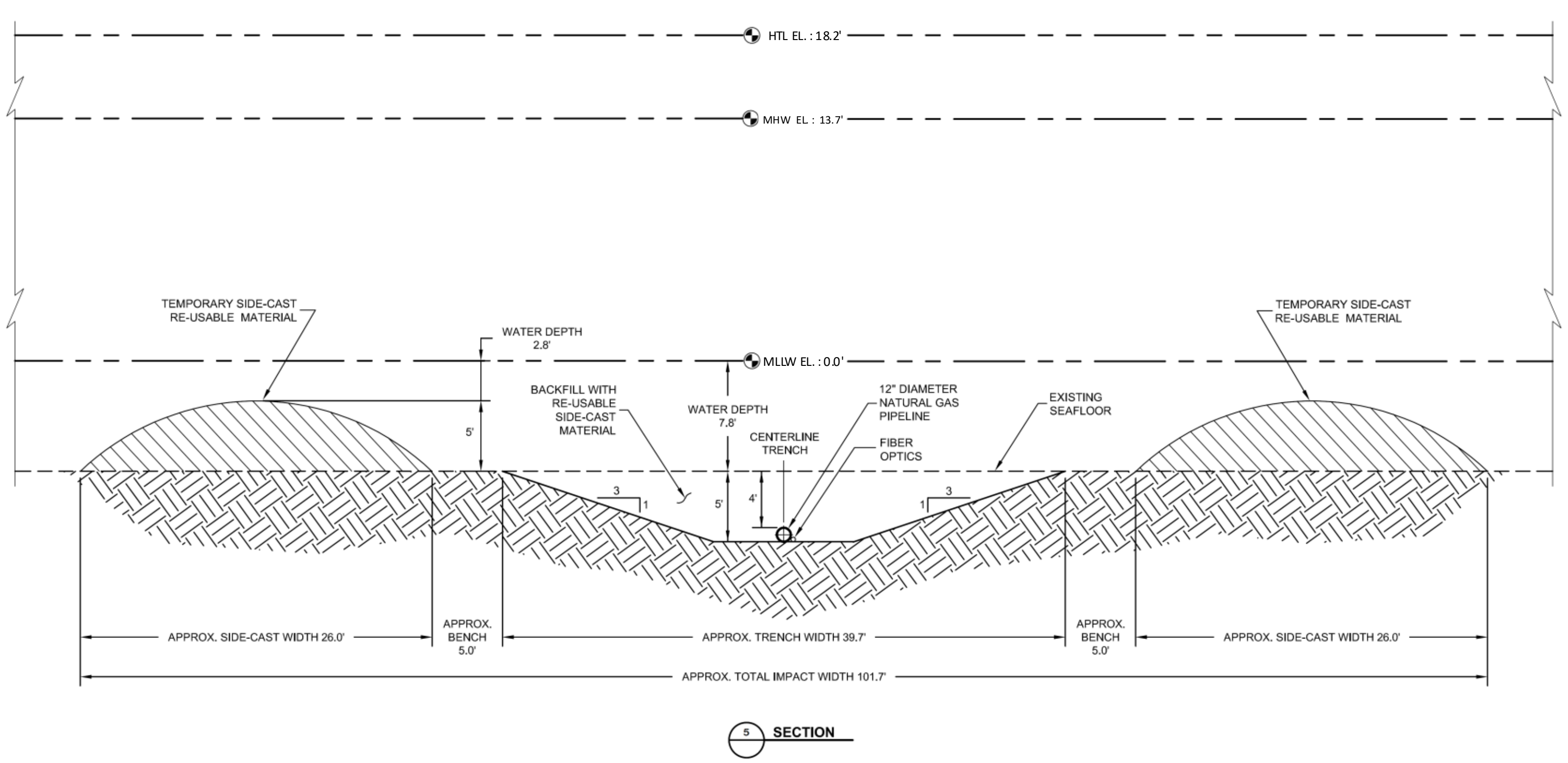
(See Table 3 and Figure 12)

NMFS Biological Assessment

90.6 FT TOTAL IMPACT WIDTH



101.7 FT TOTAL IMPACT WIDTH



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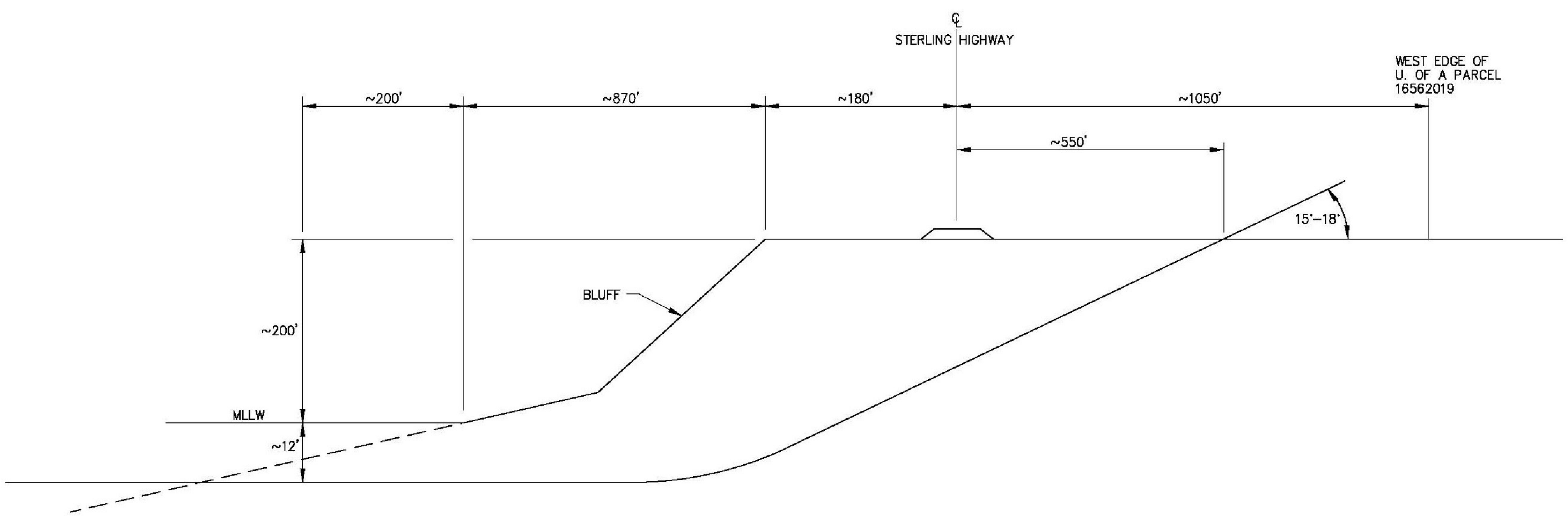


CONCEPTUAL PEBBLE NATURAL GAS PIPELINE HDD

SCALE: NTS

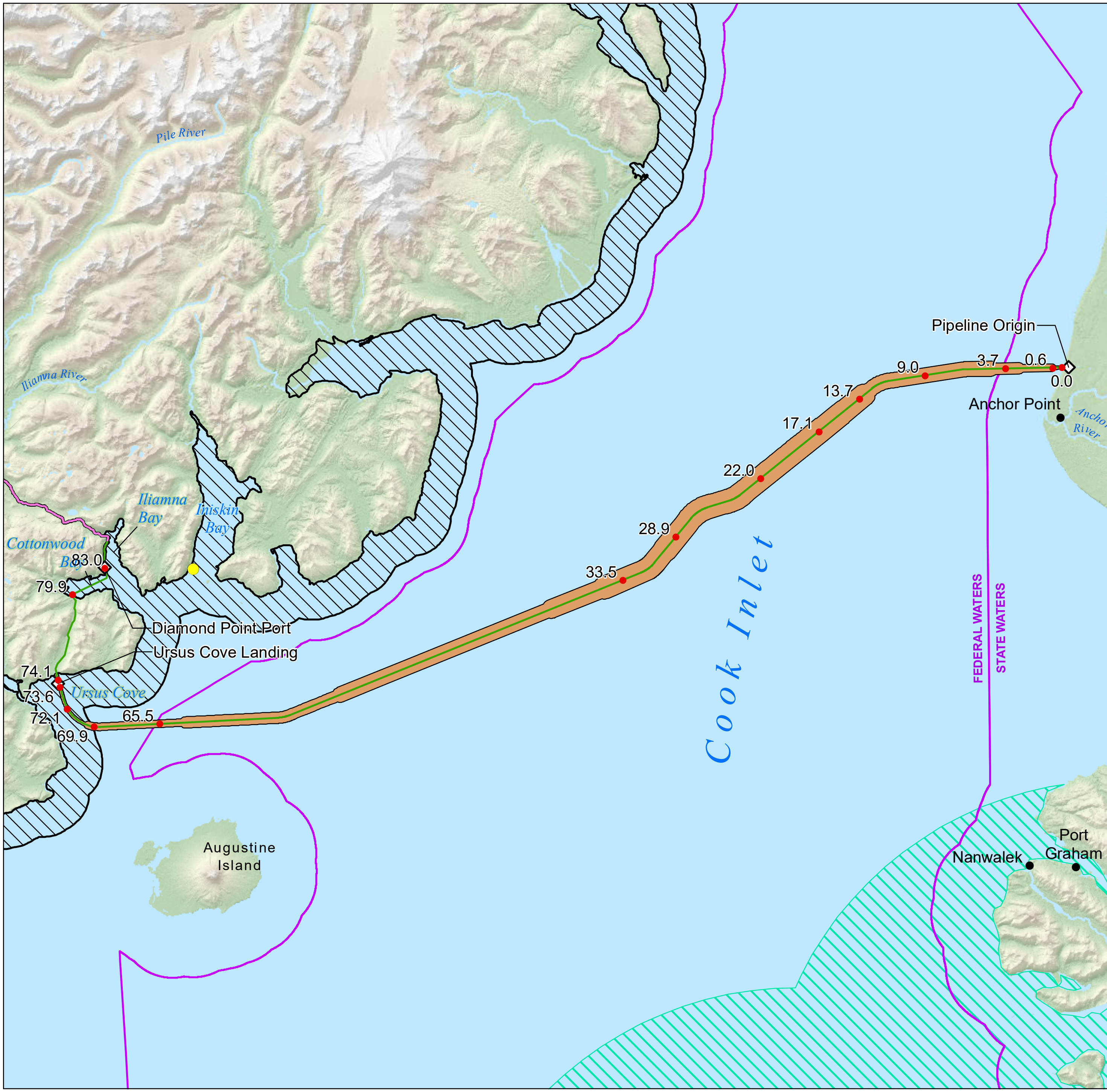
THE pebble PARTNERSHIP

FIGURE 11

NATURAL GAS PIPELINE ANCHOR POINT BLUFF HDD TYPICAL SECTION

NMFS Biological Assessment

File: PLPNMFS_017	Date: 5/7/2020
Revision: 01	Author: ORNRC



THE pebble PARTNERSHIP

- Project Feature
- Lightering Station
- Trench Burial Mode Limits (miles) (See Table 3 and Figures 9-10)
- Access Road
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- State Seaward Boundary
- Sea Anchor Placement Corridor
- Cook Inlet Beluga Critical Habitat Area 2
- Steller Sea Lion Critical Habitat Area

Miles
0 2.5 5 7.5 10 12.5
Scale 1:600,000

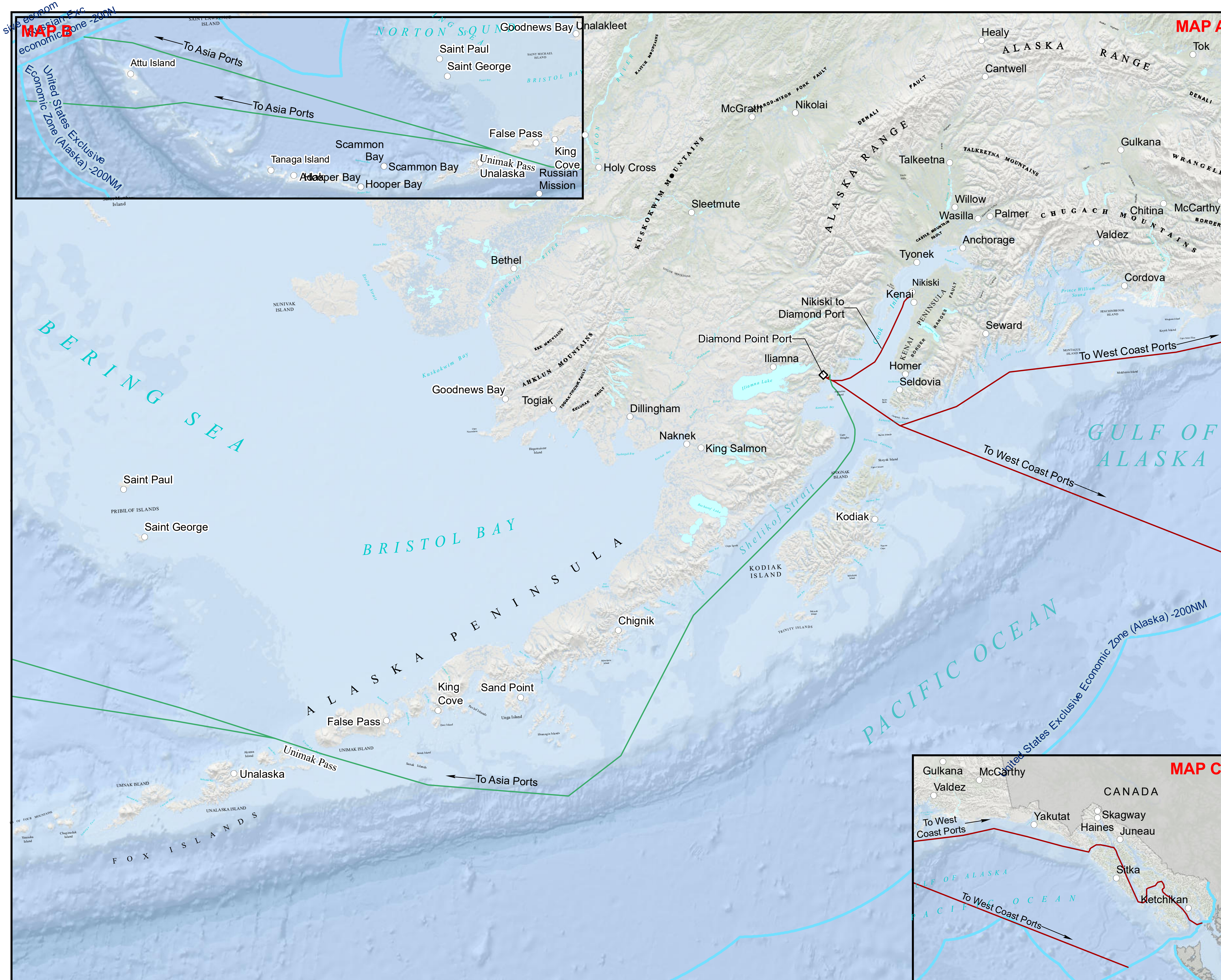
N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **12**

NATURAL GAS PIPELINE AND FIBER OPTIC CABLE ANCHOR PLACEMENT CORRIDOR

NMFS Biological Assessment

File: PLPNMFS_001	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

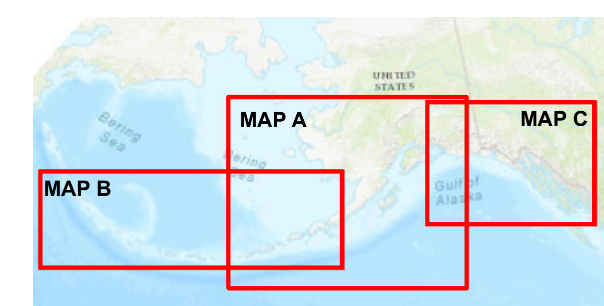
◇ Project Feature

Exclusive Economic Zone Boundary (EEZ)

Maritime Travel Routes

Concentrate Bulk Vessels

Supply Barges



Miles

0 50 100 150 200

Scale 1:5,500,000

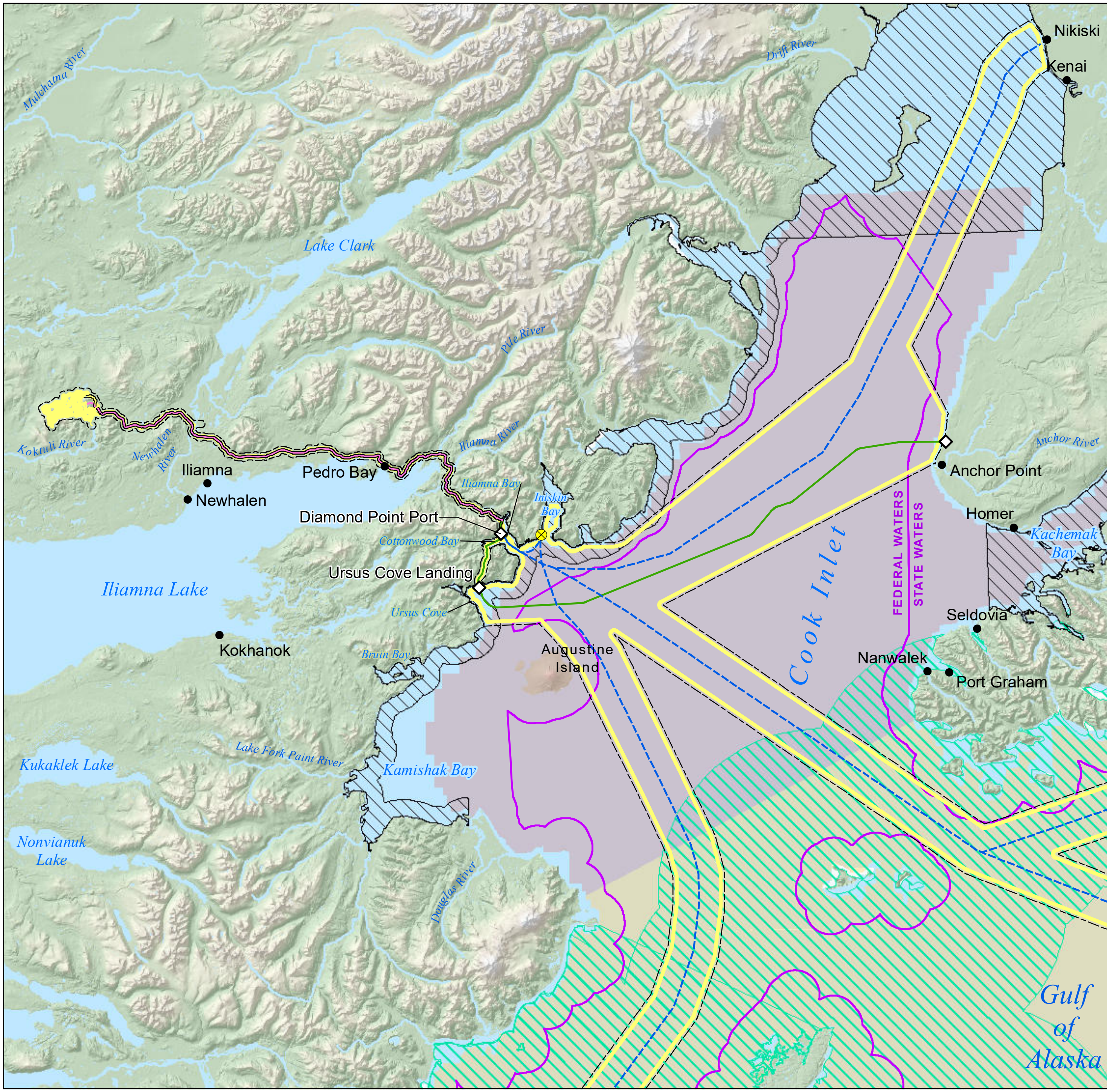
NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

Figure:
13

SUPPLY BARGES AND CONCENTRATE BULK VESSEL TRAVEL ROUTES - COOK INLET, GULF OF ALASKA, ALEUTIANS, PACIFIC OCEAN AND BERING SEA

NMFS Biological Assessment

File: PLPNMFS_027	Date: 5/11/2020
Revision: 02	Author: ORNRC



THE pebble PARTNERSHIP

- Project Feature
- Lightering Station
- Maritime Traffic
- Access Road
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- State Seaward Boundary
- Action Area

Critical Habitat Area

- Steller Sea Lion
- Cook Inlet Beluga Whale Area 2
- Humpback Whale - Unit 5 (Proposed)
- Humpback Whale - Unit 6 (Proposed)

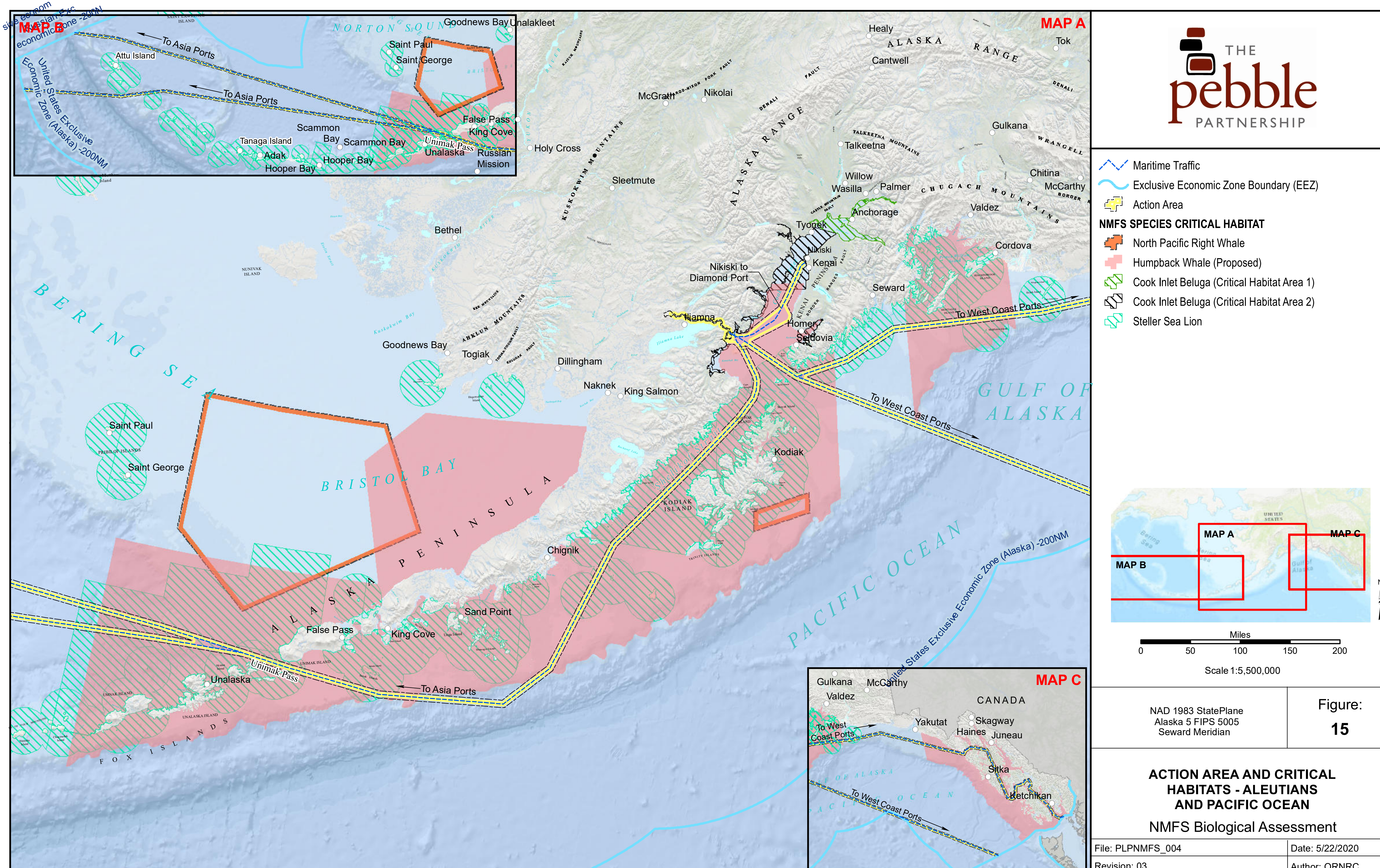
Miles
0 5 10 15 20 25
Scale 1:1,300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **14**

ACTION AREA AND CRITICAL HABITATS - COOK INLET

NMFS Biological Assessment

File: PLPNMFS_003	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

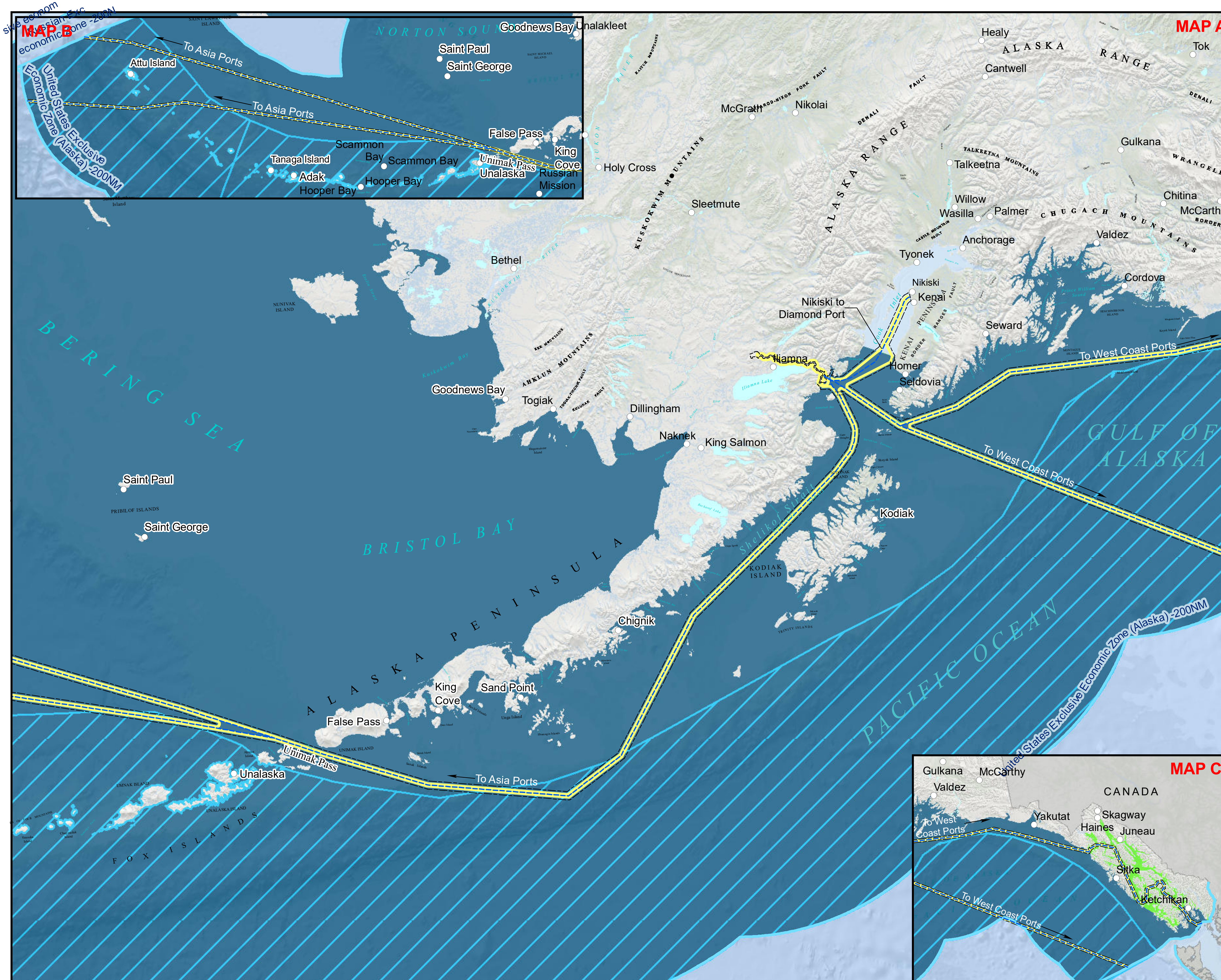
Figure: 15

ACTION AREA AND CRITICAL HABITATS - ALEUTIANS AND PACIFIC OCEAN

NMFS Biological Assessment

File: PLPNMFS_004 | Date: 5/22/2020
Revision: 03 | Author: ORNRC

Document Path: G:\Pebble\ARC_Proj\MXD\PLPNMFS\PLPNMFS_004.mxd



THE pebble PARTNERSHIP

Maritime Traffic

Exclusive Economic Zone Boundary (EEZ)

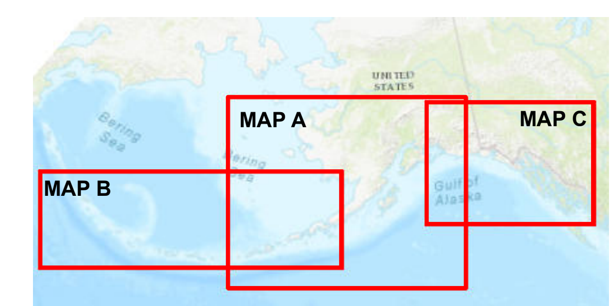
Action Area

NMFS SPECIES

Blue Whale

Fin Whale and Humpback Whale

Humpback Whale (Ketchikan)



Miles

0 50 100 150 200

Scale 1:5,500,000

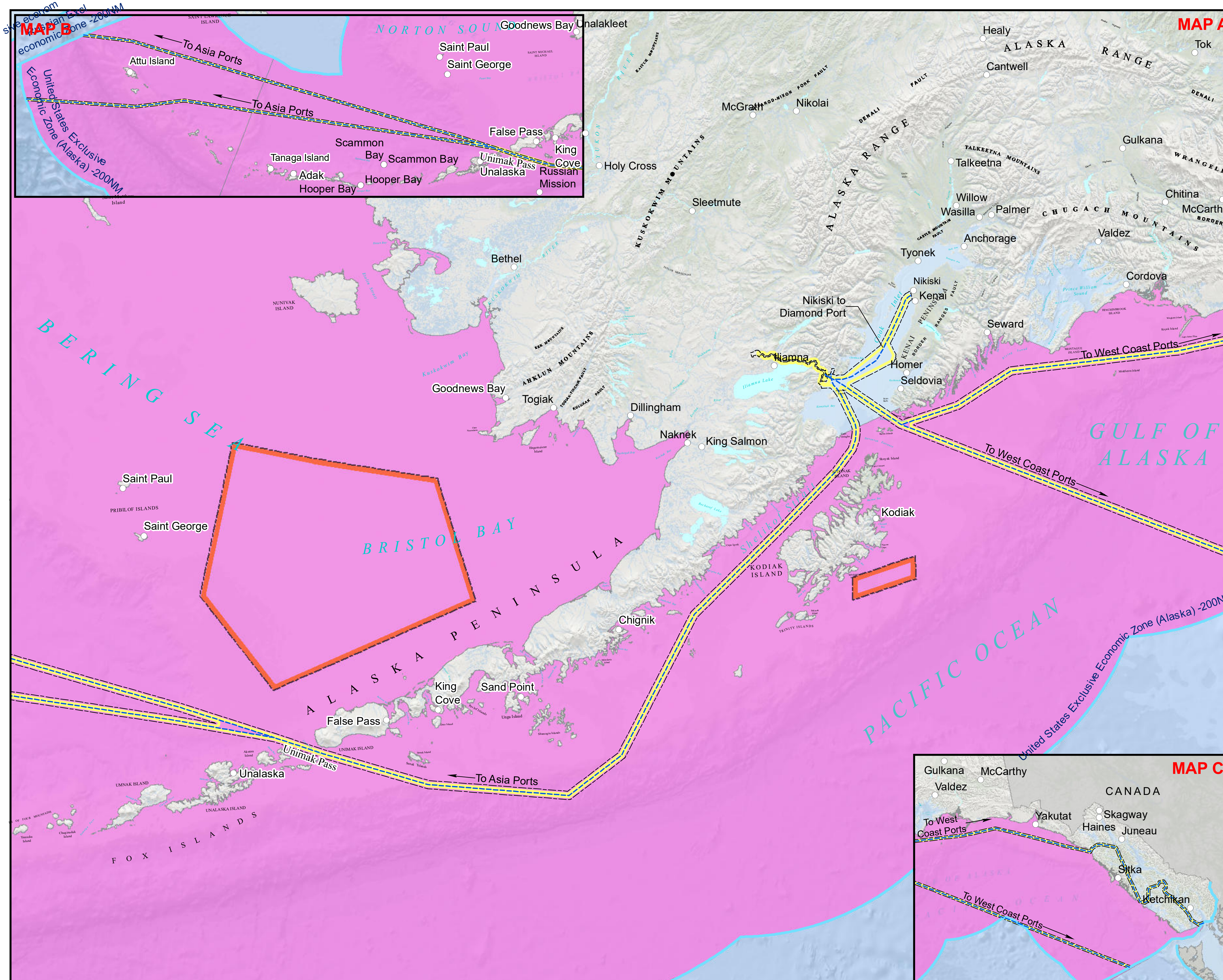
NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

Figure:
16

ACTION AREA BLUE WHALE, FIN WHALE, AND HUMPBACK WHALE DISTRIBUTION - ALEUTIANS AND PACIFIC OCEAN

NMFS Biological Assessment

File: PLPNMFS_005	Date: 5/13/2020
Revision: 02	Author: ORNRC



THE pebble PARTNERSHIP

Maritime Traffic

Exclusive Economic Zone Boundary (EEZ)

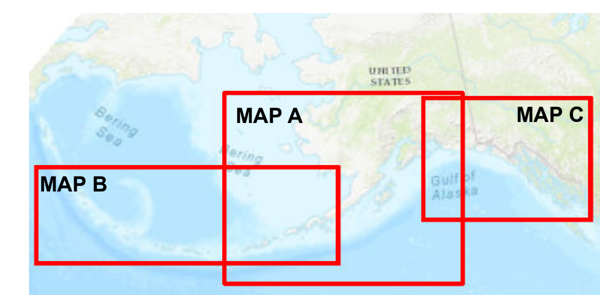
Action Area

NMFS SPECIES

North Pacific Right Whale

NMFS SPECIES CRITICAL HABITAT

North Pacific Right Whale



Miles

0 50 100 150 200

Scale 1:5,500,000

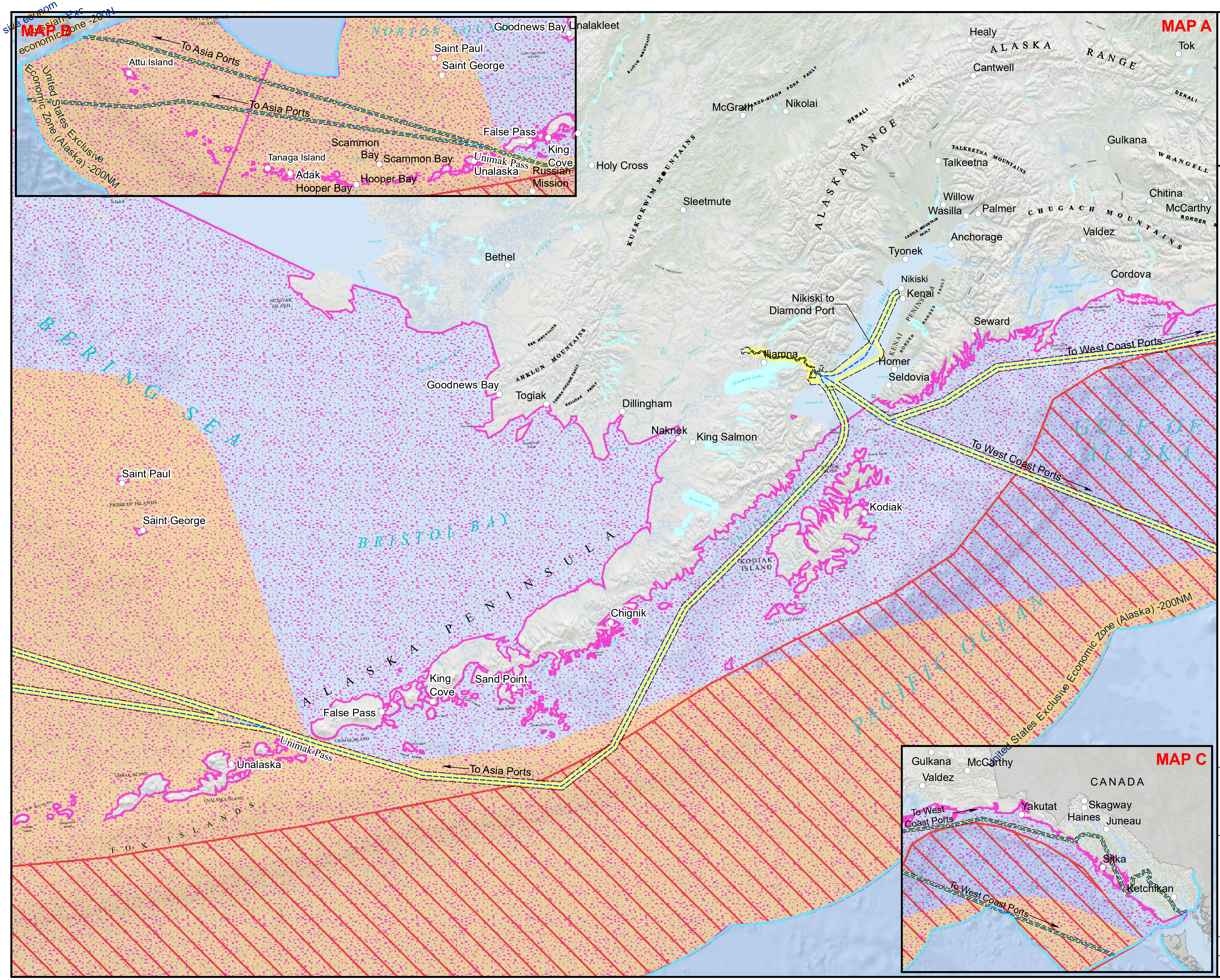
NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

Figure:
17

ACTION AREA NORTH PACIFIC RIGHT WHALE DISTRIBUTION - ALEUTIANS AND PACIFIC OCEAN

NMFS Biological Assessment

File: PLPNMFS_025	Date: 5/13/2020
Revision: 02	Author: ORNRC



Document Path: G:\Pebble\ARC_Proj\MXD\PLPNMFS\PLPNMFS_023.mxd

THE pebble PARTNERSHIP

- Maritime Traffic
- Exclusive Economic Zone Boundary (EEZ)
- Action Area

NMFS SPECIES

- Sei Whale
- Sperm Whale
- Western N. Pacific Gray Whale

Miles: 0 50 100 150 200

Scale 1:5,500,000

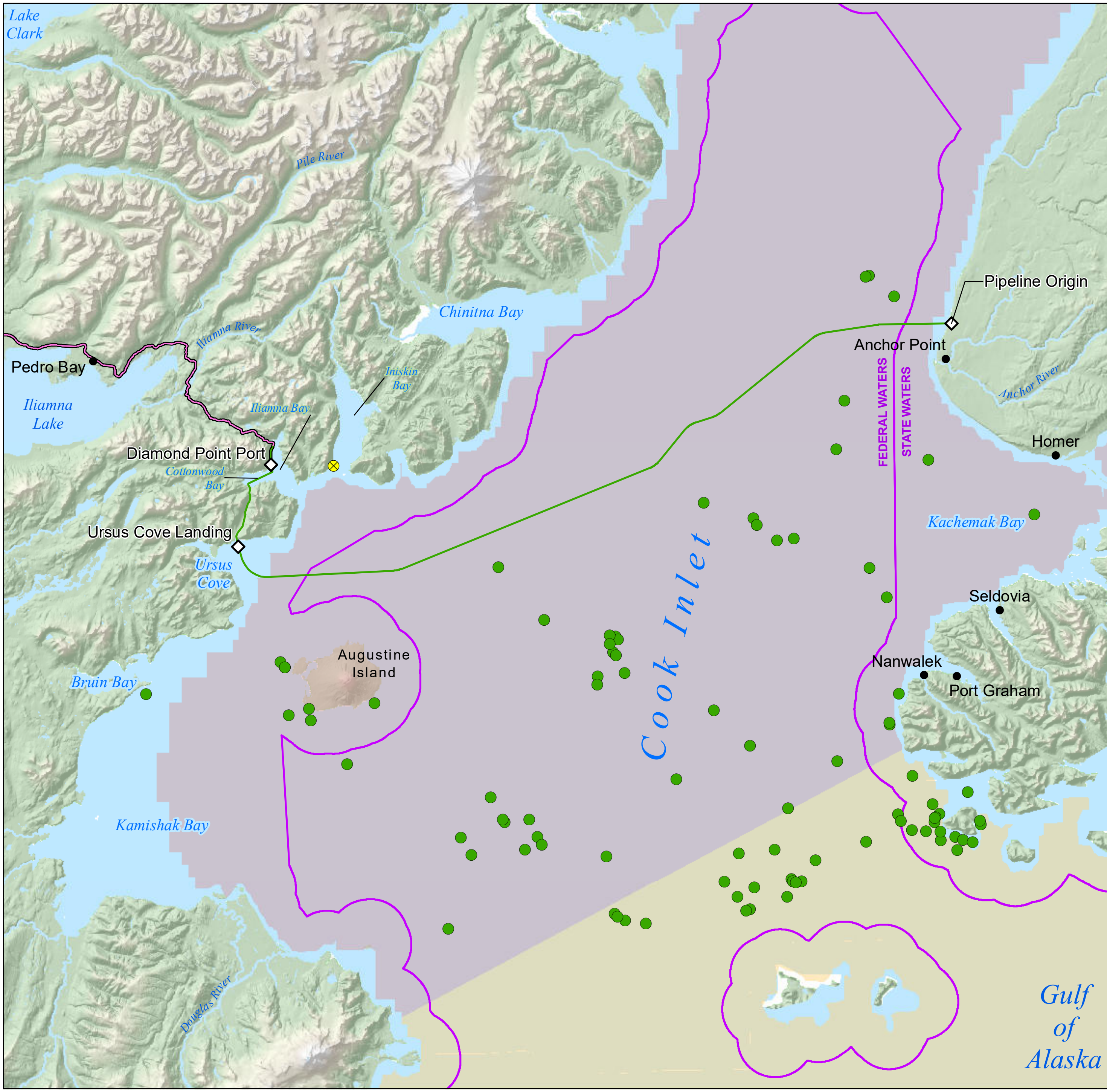
NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

Figure: 18

ACTION AREA SEI WHALE, SPERM WHALE, AND GRAY WHALE DISTRIBUTION - ALEUTIANS AND PACIFIC OCEAN

NMFS Biological Assessment

File: PLPNMFS_023	Date: 5/13/2020
Revision: 02	Author: ORNRC



THE pebble PARTNERSHIP

- Humpback Whale
- Project Feature
- Lightering Station
- Access Road
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- State Seaward Boundary
- Humpback Whale - Unit 5 (Proposed)
- Humpback Whale - Unit 6 (Proposed)

Miles: 0, 5, 10, 15, 20

Scale 1:850,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

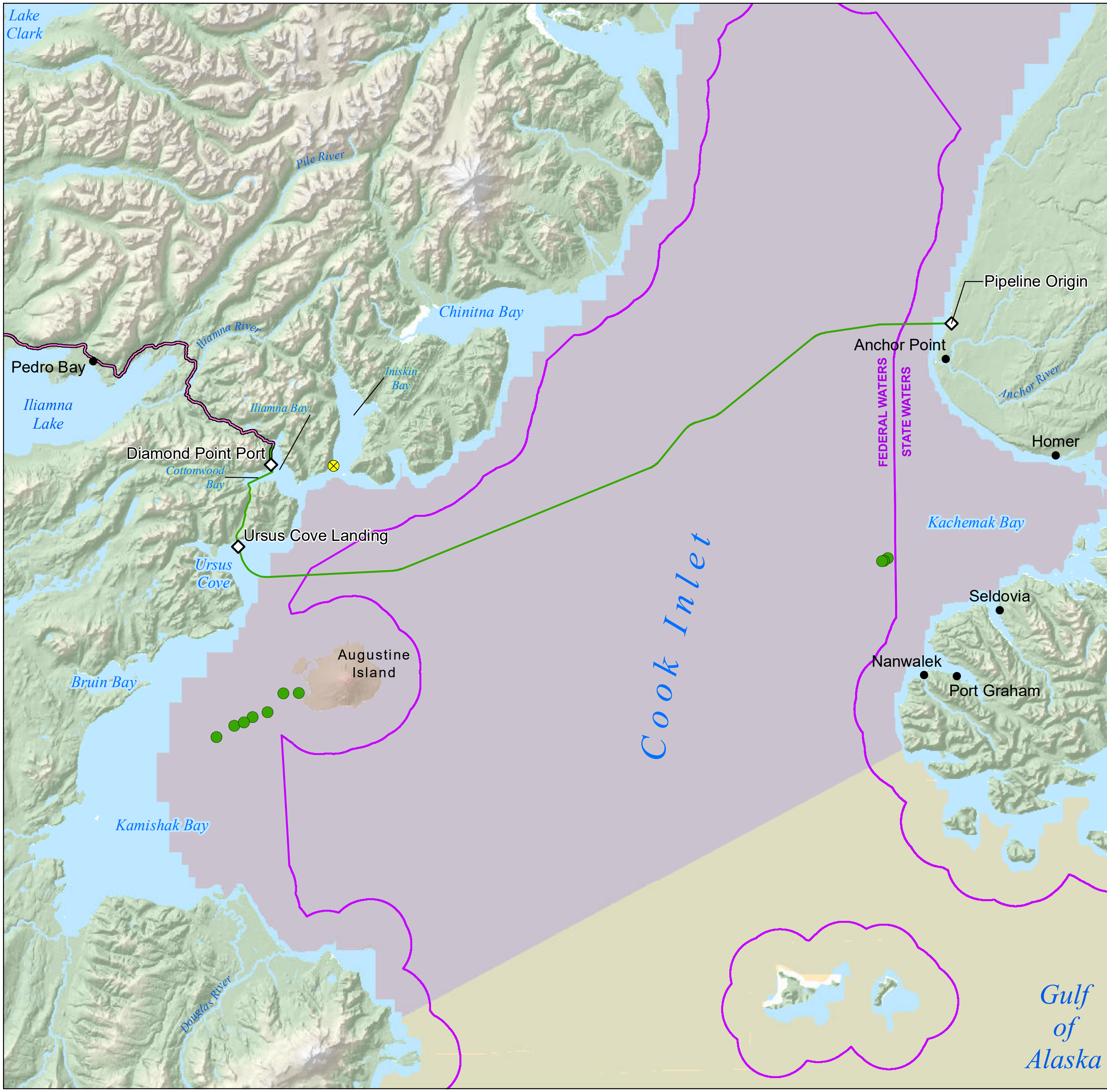
Figure: 19

HUMPBACK WHALE LOCATIONS FROM NMFS SURVEYS 1993-2016

NMFS Biological Assessment

File: PLPNMFS_006 | Date: 5/22/2020

Revision: 04 | Author: ORNRC



THE pebble PARTNERSHIP

- Humpback Whale
- Project Feature
- Lightering Station
- Access Road
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- State Seaward Boundary
- Humpback Whale - Unit 5 (Proposed)
- Humpback Whale - Unit 6 (Proposed)

Miles
0 5 10 15 20
Scale 1:850,000

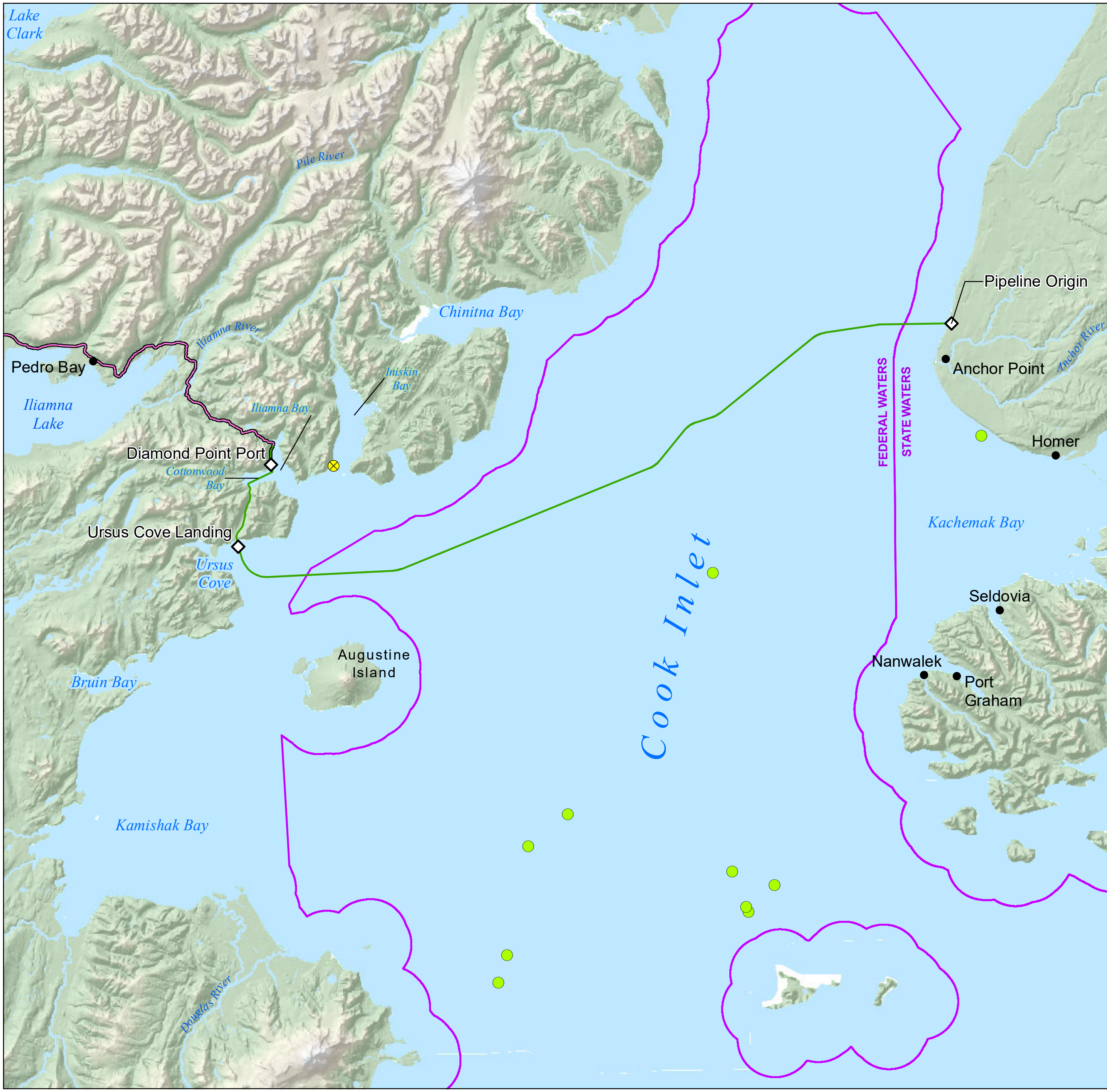
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 20

HUMPBACK WHALE LOCATIONS FROM ABR SURVEYS 2018

NMFS Biological Assessment

File: PLPNMFS_007	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

- Fin Whale
- Project Feature
- Lightering Station
- Access Road
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- State Seaward Boundary

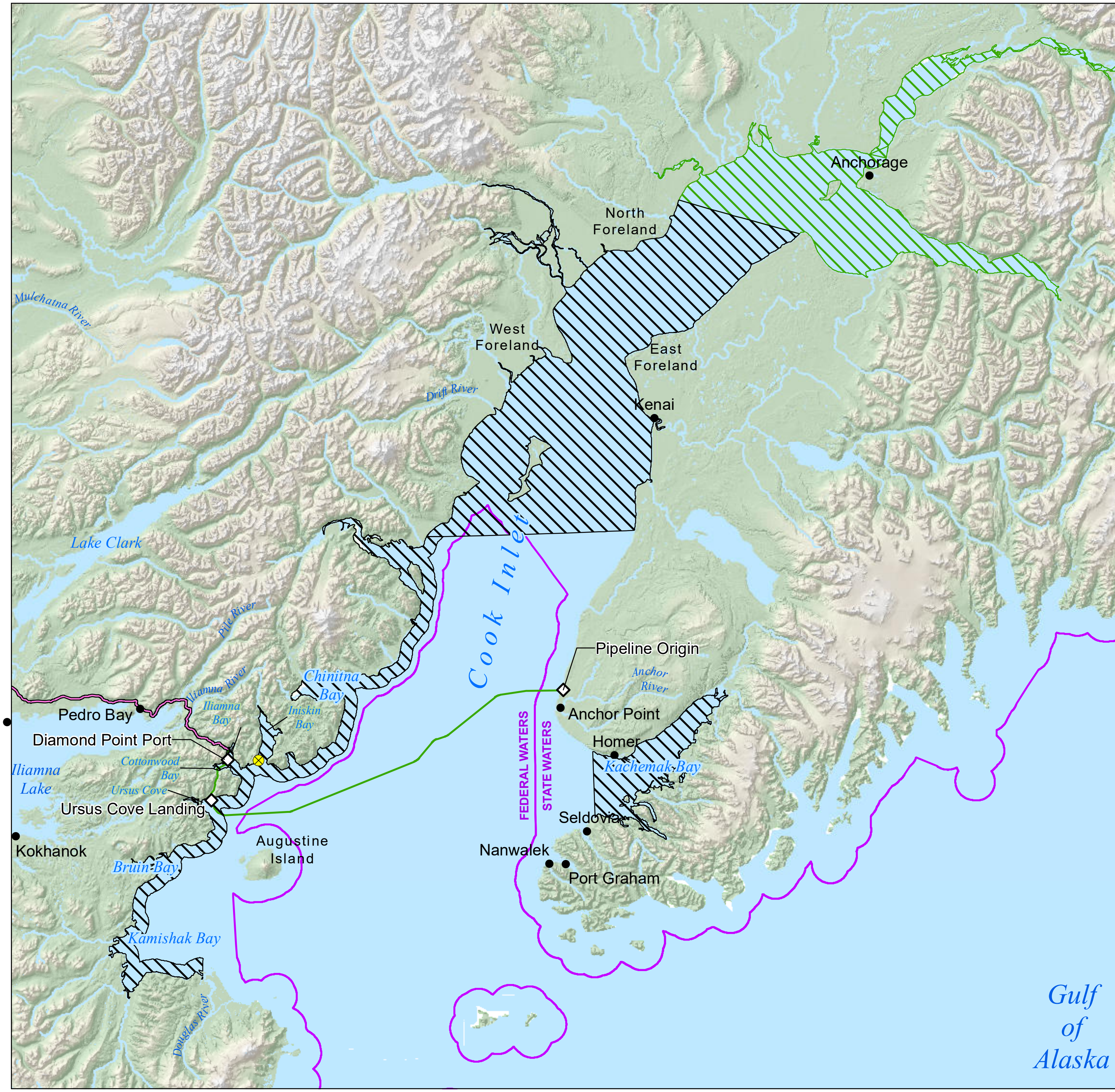
Miles
0 5 10 15 20
Scale 1:850,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **21**

FIN WHALE LOCATIONS FROM NMFS SURVEYS 1993-2016

NMFS Biological Assessment

File: PLPNMFS_008	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

Project Feature

Lightering Station

Access Road

Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)

NGP, FOC, Concentrate Pipeline, and Return Water Pipeline

Cook Inlet Beluga Whale Critical Habitat

Area 1

Area 2

Miles

0 10 20 30 40

Scale 1:1,725,000

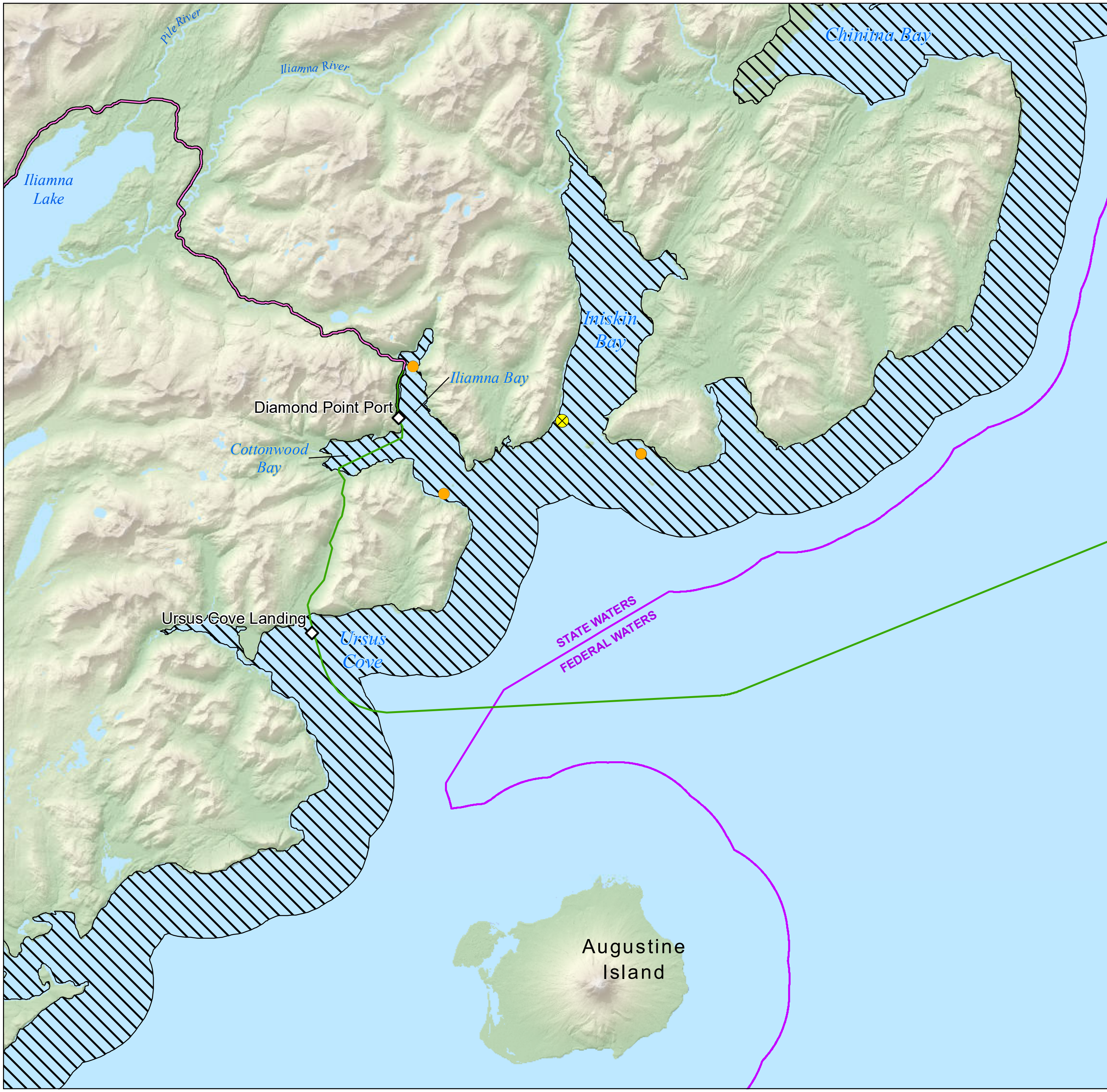
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **22**

COOK INLET BELUGA WHALE CRITICAL HABITAT

NMFS Biological Assessment

File: PLPNMFS_009	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

- Beluga Whale
- Project Feature
- Lightering Station
- Access Road
- Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
- NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
- State Seaward Boundary
- Cook Inlet Beluga Critical Habitat Area 2

Miles
0 2 4 6 8
Scale 1:325,000

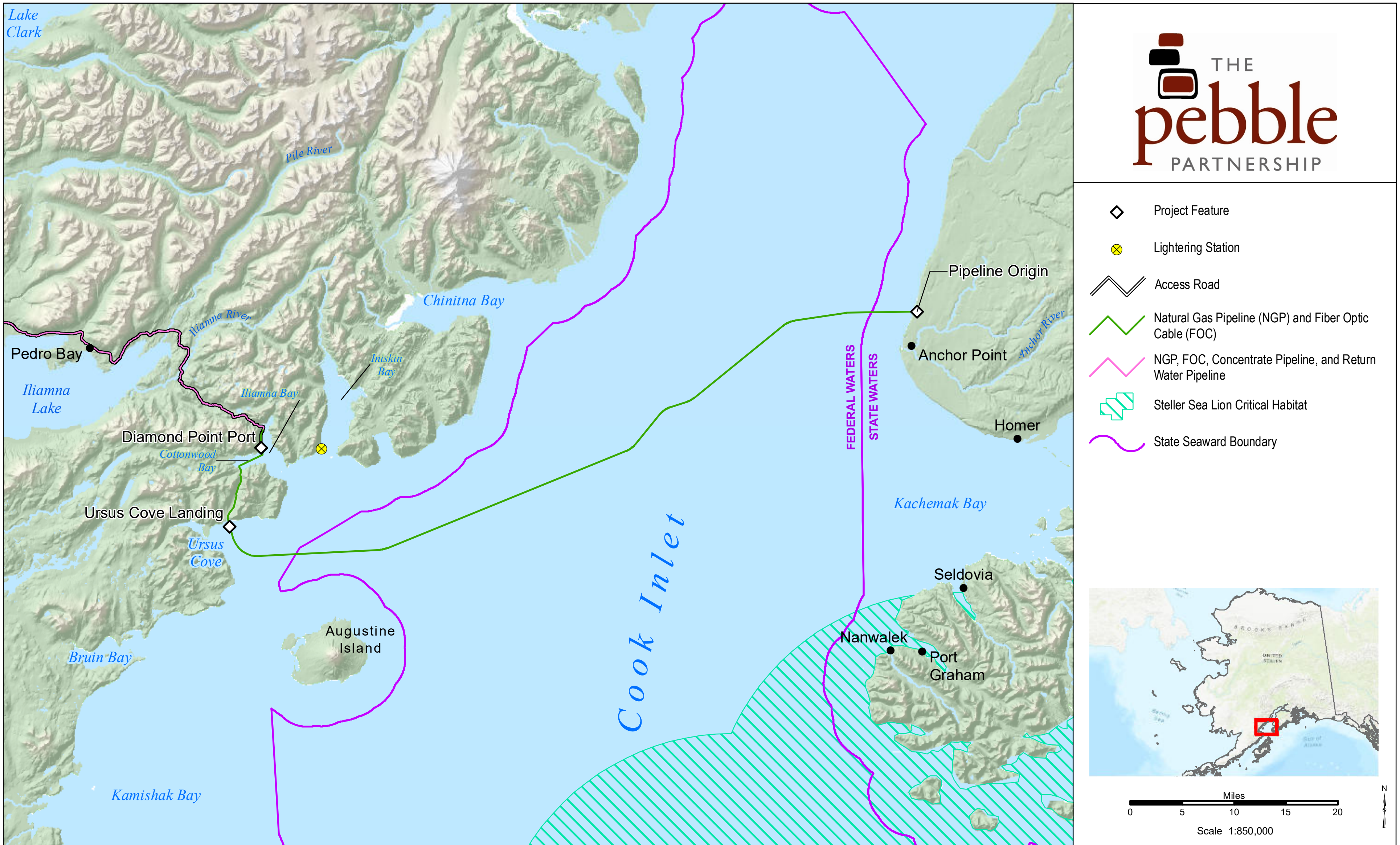
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 23

BELUGA WHALE LOCATIONS FROM ABR SURVEY 2015

NMFS Biological Assessment

File: PLPNMFS_010	Date: 5/22/2020
Revision: 04	Author: ORNRC



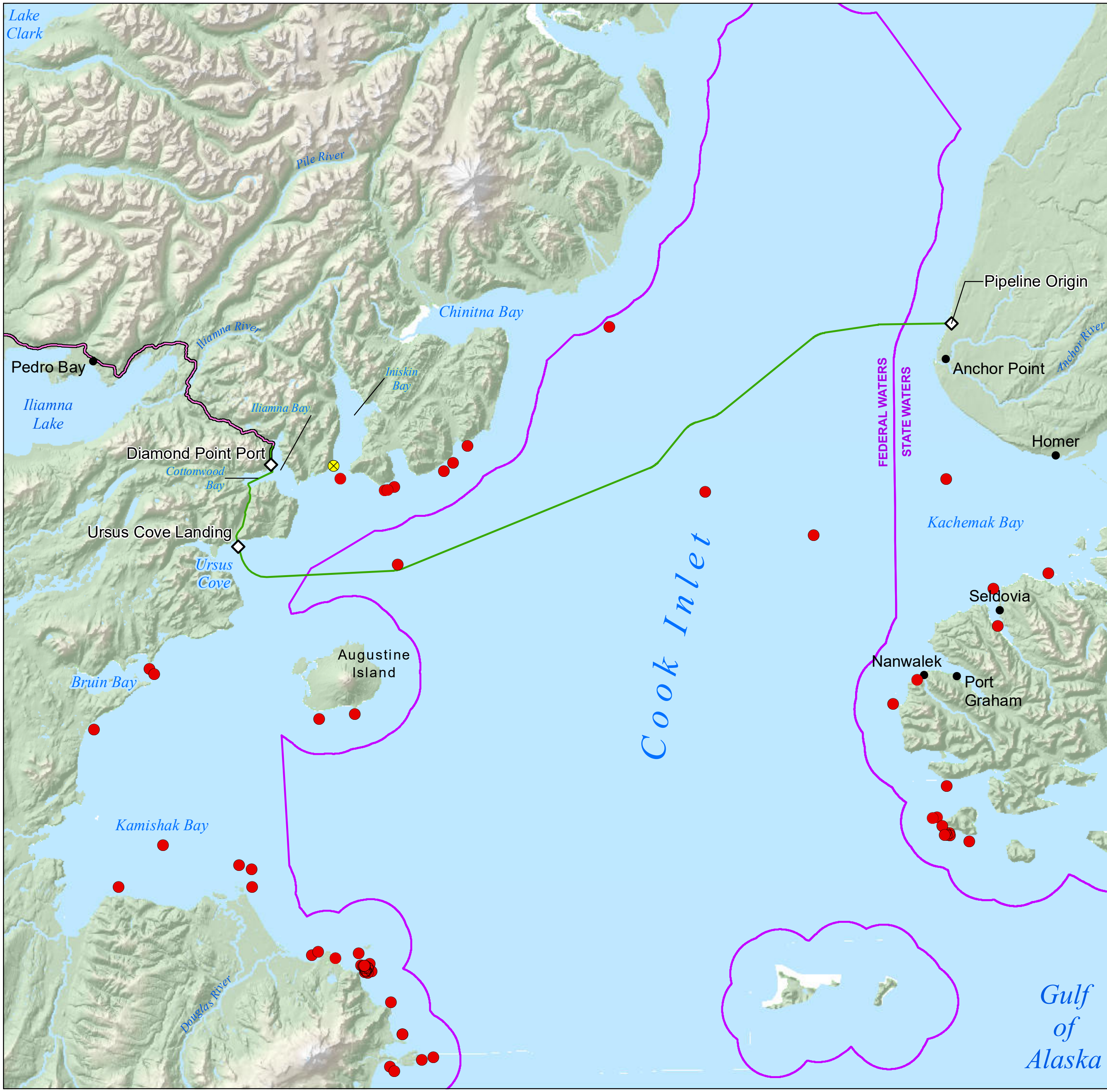
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 24

STELLER SEA LION CRITICAL HABITAT

NMFS Biological Assessment

File: PLPNMFS_011	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

Steller Sea Lion
Project Feature
Lightering Station
Access Road
Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
State Seaward Boundary

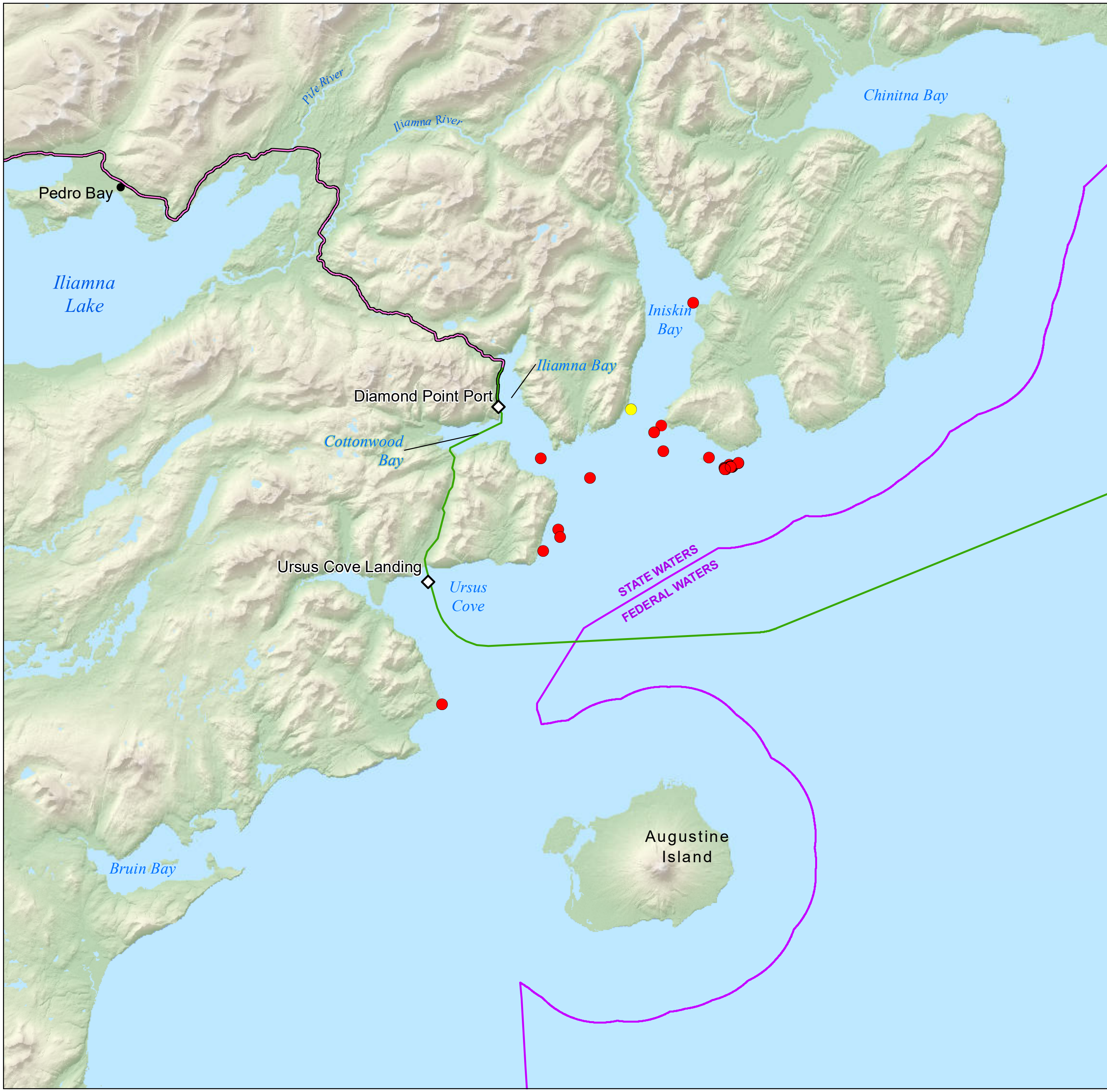
Miles
0 5 10 15 20
N
Scale 1:850,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **25**

STELLER SEA LION LOCATIONS FROM NMFS SURVEYS 1993-2016

NMFS Biological Assessment

File: PLPNMFS_012	Date: 5/22/2020
Revision: 04	Author: ORNRC



THE pebble PARTNERSHIP

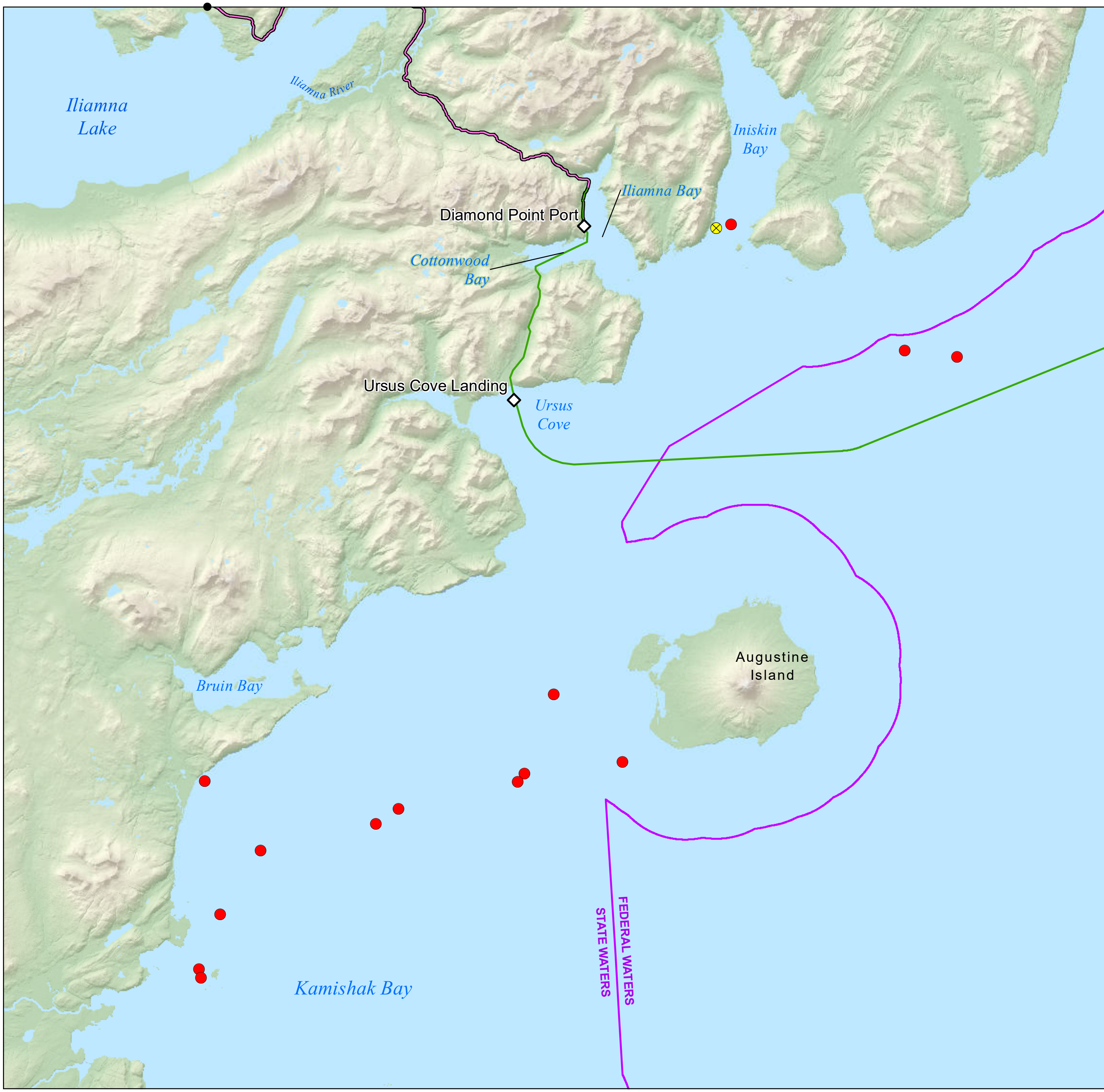
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 26

STELLER SEA LION LOCATIONS FROM ABR HELICOPTER SURVEYS 2006-2012

NMFS Biological Assessment

File: PLPNMFS_021
Date: 5/22/2020
Revision: 04
Author: ORNRC



THE pebble PARTNERSHIP

Steller Sea Lion
Project Feature
Lightering Station
Access Road
Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
NGP, FOC, Concentrate Pipeline, and Return Water Pipeline
State Seaward Boundary

Miles
0 2.5 5 7.5 10
Scale 1:400,000

N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: 27

STELLER SEA LION LOCATIONS FROM ABR SURVEYS 2018

NMFS Biological Assessment

File: PLPNMFS_013	Date: 5/22/2020
Revision: 04	Author: ORNRC