APPENDIX G—ESA BIOLOGICAL ASSESSMENT—USFWS

U.S. Fish and Wildlife Service

Biological Assessment – Section 7

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ACRONYMS AND ABBREVIATIONS

%	percent
µPa	microPascal
4MP	Marine Mammal Monitoring and Mitigation Plan
ac	acre(s)
AAC	Alaska Administrative Code
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
dB	decibel
DPS	Distinct Population Segment
DWT	deadweight tonnage
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
ft	foot/feet
ft^3	cubic feet
gal	U.S. gallon
GPS	Global Positioning System
GOA	Gulf of Alaska
ha	hectare(s)
HDD	horizontal direct drilling
hr	hour
IMO	International Maritime Organization
in	inch(s)
ISO	International Organization for Standardization
kHz	kilohertz
km	kilometer(s)
km^2	square kilometer(s)

kt	knot(s)
L	liter
LNG	liquified natural gas
LOC	Letter of Concurrence
m	meter(s)
m^3	cubic meters
mg/L	milligrams per liter
MHW	mean high water
mi	statute mile(s)
mi^2	square statute mile(s)
MLLW	mean lower low water
nm	nautical miles
NMFS	National Marine Fisheries Service
Owl Ridge	Owl Ridge Natural Resource Consultants, Inc.
PCE	primary constituent elements
PFEIS	Preliminary Final Environmental Impact Statement
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	remotely operated vehicle
SPL	sound pressure level
TES	Threatened and Endangered Species
TSS	total suspended solids
TTS	temporary threshold shift
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
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 at 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 at 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:

- Structures and work in tidal waters below the mean-high water (MHW) of Cook Inlet:
  - Constructing the Diamond Point port causeway/marine jetty and access road (Iliamna Bay).
  - Dredging the shallow port site approach out to depth adequate for year-round barge access.
  - Installing one spread anchor mooring system at an offshore lightering station in Iniskin Bay.
  - 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 any of 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. Three species (northern sea otter, Steller's eider, and short-tailed albatross) under ESA jurisdiction of the U.S. Fish and Wildlife Service (USFWS) 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 distributions, feeding, reproduction, natural mortality, threats, acoustical ecology, designated critical habitats, and use of the Action Area, all of which are necessary to conduct the detailed effects analysis. Additional species under ESA jurisdiction of the National Marine Fisheries Service (NMFS) 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 activities	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). The port site 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 ft 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 to the port site would require dredging to create a navigation channel and a turning/mooring basin (71.4 ac [28.9 ha]) 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 of the 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 is 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 facility. 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-ft x 60-ft (36.6 m x 18.3 m) concrete caissons 58 ft (17.7 m) high and 60 ft (18.3 m) apart. 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 near 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 5). 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 sea floor. 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 ten 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 level 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. Numerous 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 (75 mi [120.7 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 (61.0 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 160 decibels (dB). 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.

Table 3. Pipeline trenching requirements and methodologies.

Range from Origin[1] mi (km)		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 (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 (27.66)	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

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.

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, anchor chain 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 chain sweep from proposed construction of a 27.3-mi (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 underwater noise exceeding the 160 dB threshold level for disturbance (Level B) of sea otters (Table 4). There are no noise level criteria for Steller's eiders or short-tailed albatrosses. However, only anchor handling produces underwater noise levels of significance. LGL/JASCO/Greeneridge (2014) measured large ocean-going tugboats handling anchors in the Chukchi Sea and estimated general source levels at 188 dB. USFWS (2019) recently used this value in authorizing harassment take of sea otters for the Alaska Gasline Development Project in Cook Inlet and it is conservative based on other values used in similar authorizations in Cook Inlet (NMFS 2018). This value, and the associated radius (243 ft [74 m]) to the 160-dB threshold, is used in this BA.

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 Disturbance Threshold (based on the practical spreading model)[1]	Source
Cutter suction dredge	175.0	33 ft (10 m)	Reine et al. (2012b, 2014a)
Cutter suction dredge	178.0	52 ft (16 m)	Greene (1987)
Cutter suction dredge	167.0	10 ft (3 m)	Greene (1987)
Trailing hopper suction dredge	171.0	16 ft (5 m)	Reine et al. (2014b)
Trailing hopper suction dredge	161.3	<1 ft (<1 m)	Reine et al. (2014b)
Trailing hopper suction dredge	161.2	<1 ft (<1 m)	Reine et al. (2014b)
Clamshell/bucket dredge (bottom strike)	179.4	66 ft (20 m)	Dickerson et al. (2001), Reine et al. (2012a, 2014a)
Clamshell/Bucket dredging (scoop)	146.0	0 ft (0 m)	Dickerson et al. (2001), Reine et al. (2012a, 2014a)
Winching in/out	149.0	0 ft (0 m)	Dickerson et al. (2001)
Barge loading	166.2	10 ft (3 m)	Reine et al. (2012a)
Emptying barge at placement site	158.7	0 ft (0 m)	Dickerson et al. (2001)
Tugboat anchor handling	170.0	16 ft (5 m)	NMFS (2018)
Tugboat anchor handling	188.0	243 ft (74 m)	LGL/JASCO/Greenridge (2014)

[1] Distance to the 160-dB disturbance threshold for sea otters using the 15 Log R practical spreading model.

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 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 tonnes) 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), <10 kt (18.5 km/hr) in sea otter foraging habitat	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 an 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., ISO tanks) 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 L) (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.

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 (1,361 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.
Sodium hydrogen sulfide (NaHS)	Copper depressant used in the copper-molybdenum	4,300 tons (3,900 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
	separation processes. Reducing agent used for precipitation of metal sulfides.					
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.	1,000 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.
Polymer (typically, a proprietary material selected through	Coagulation and settling of precipitated	100 tons (91 tonnes)	Solid (powder)	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
laboratory testing based on site-specific water quality).	solids in water treatment.					
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 parts 171–180 and other applicable regulations.

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.

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 locations 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 2.1.4) 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 includes the proposed mine and transportation corridor, a portion of lower Cook Inlet waters (Figure 14, Figure 15), and marine areas crossed by marine transport vessels. The latter includes the concentrate bulk carriers, traveling from Cook Inlet through Shelikof Strait and the Aleutian Islands, and marine line haul barges traveling between Cook Inlet to West Coast ports following either an offshore route through the GOA or a coastal route along 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 dredging) 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 2.4.2 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)
Acoustical Impact	
Dredging of navigation channel and basin (ensonified area at any given time)	70 ac (28.3 ha)
Initial dredging of navigation channel and basin (total ensonified area)	518 ac (210 ha)
Maintenance dredging of navigation channel and basin (total ensonified area)	492 ac (199 ha)
Diamond Point port marine components construction (total ensonified area)	175 ac (71 ha)
Natural gas pipeline construction anchor handling tugs (daily ensonified area)	302 ac (122 ha)
Natural gas pipeline construction anchor placement corridor (daily disturbance area)	9.1 mi^2 (23.6 km^2)
Fiber optic cable installation anchor handling tugs (daily ensonified area)	302 ac (122 ha)
Fiber optic cable installation anchor placement corridor (daily disturbance area)	9.1 mi^2 (23.6 km^2)
Mooring placement for the lightering station (total ensonified area)	47.3 ac (19.1 ha)
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 would 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 levels above the sea otter 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 dB to 111 dB and maximum levels from 115 dB to 120 dB, but those noise levels were not associated with the shot, as a signal was never detected during the study (ASRC 2014). Airborne noise from blasting is expected, but pressure levels or attenuation rates are unknown at this time.

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 acoustical impact zone for the dredging of the Diamond Point port approach is based on the area that may experience underwater noise associated with 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 (160 dB) ranging from 10 ft (3 m) to 52 ft (16 m) (Table 4). However, USFWS assumes that sea otter harassment take from dredging operations can occur out to 984 ft (300 m) (USACE Sea Otter Programmatic Consultation 2015; Consultation #2013-0016). Based on a 984-ft (300 m) radius, the area of acoustical impact at a given time is 70 ac (28.3 ha), while the total area that could be acoustically impacted during the initial dredging is 518 ac (210 ha) (Table 7). The total area that could be acoustically impacted during maintenance dredging (repeated approximately every 5 years) is 492 ac (199 ha).

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. The Diamond Point port components would fill or cover an area of 6.2 ac (2.5 ha) of intertidal and subtidal waters of Iliamna Bay (Table 7).

Dickerson et al. (2001) measured emptying a barge at a fill placement site and found that underwater noise levels did not exceed the 160-dB threshold for sea otter (Table 4). 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 determined 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). Based on the 984-ft (300 m) impact radius, the marine portion of the ensonified area (construction footprint plus 984-ft [300 m] buffer) would be 175 ac (71 ha) (Table 7).

2.4.4. Natural Gas Pipeline Construction

During pipeline placement, the primary source of impact to sea otters is the noise generated by tugboats while handling anchors tethered to the pipelay barge. Based on a conservative source of 188 dB (LGL/JASCO/Greeneridge 2014), the radius to the 160-dB harassment threshold is 243 ft (74 m). Thus, the area ensonified to above threshold levels during any given anchor-pulling event is 4.2 ac (1.7 ha) for a single tugboat. Given that during each movement the two tugs would handle up to 12 anchors, and an average of 6 moves would occur daily, the total daily ensonified area is 302 ac (122 ha) (Table 7). However, as both tugboats would operate at the boundary of the anchor spread, it is assumed that the area between the tugboats, that includes the operating lay barge and other attending vessels, is a zone of visual disturbance. Thus, the total area potentially affected includes the width of the anchor spread (which varies by water depth but averages 1 mi [1.6 km]) multiplied by the daily progress (assumed to be 2 mi [3.2 km] on average based on 35 days of construction over 75 mi [120.7 km] of subsea pipeline) surrounded by a 243-ft (74 m) buffer to account for tug noise extending outside the corridor. This results in a 9.1 mi^2 (23.6 km^2) daily disturbance (acoustic and visual) area (Table 7).

Pipeline construction across Cottonwood Bay would occur during low tide when the route is exposed (and placed using mats). There would not be any in-water sound of consequence from placing this section of the pipeline. Total physical footprint for installation of the natural gas pipeline and fiber optic cable across Cottonwood Bay is 19.6 ac (7.9 ha) (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 daily ensonified area is the same as for the pipe lay, or 302 ac (122 ha), and the daily disturbance area, accounting for all disturbance (acoustic and visual) within the construction corridor, is 9.1 mi^2 (23.6 km^2) (Table 7).

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 5) 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 each anchor 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 similar to noise during anchor pulling, with the noise levels exceeding the 160-dB harassment threshold ranging out to 243 ft (74 m), with an area affected of 4.2 ac (1.7 ha). With 10 mooring anchors to be placed, the total ensonified area would be 47.3 ac (19.1 ha) (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 extends 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 and 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 liquified 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

[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

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.

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). The 1.2 nm (1.4 mi, 2.2 km) ensonification area was calculated based on potential effects to marine mammals under the jurisdiction of NMFS. This value is highly conservative with respect to listed species addressed in this BA but was used for here for consistency. Outside the approaches to the port and lightering station, none of the vessel travel corridors cross sea otter foraging or critical habitat, or Steller’s eider foraging habitat, but portions do cross offshore habitats where short-tailed albatrosses forage.

3. SPECIES POTENTIALLY AFFECTED

Three species of wildlife currently listed under the ESA and under the jurisdiction of USFWS, occur seasonally or year-round within the Action Area (Table 8). Northern sea otters are found along both the eastern and western shores of lower Cook Inlet, but only the population occurring along the western shore (Southwest Alaska Distinct Population Segment [DPS]) are listed. Steller's eiders from Russian and Alaskan breeding populations winter along both shores of lower Cook Inlet. Only a small fraction (1 to 2 percent) of the wintering birds, from the Alaskan breeding population, are ESA-listed (USFWS 2001). Short-tailed albatrosses are included because of their occurrence in the Gulf of Alaska, although there is no evidence that they occur in Cook Inlet (Piatt et al. 2006).

Table 8. USFWS-listed species occurring within the Cook Inlet Action Area.[1]

Common Name	Latin Name	ESA Status	Population	Critical Habitat
Northern Sea Otter	*Enhydra lutris kenyoni*	Threatened	Southwest Alaska DPS	Yes
Steller's Eider	*Polysticta stelleri*	Threatened	Alaska Breeding	No
Short-tailed Albatross	*Phoebastria albatrus*	Endangered	Worldwide	No

1. Obtained from the USFWS Information Planning and Consultation System website [https://ecos.fws.gov/ipac/] on May 21, 2020.

4. STATUS OF LISTED SPECIES

Three ESA-listed species under the jurisdiction of the USFWS have been identified as potentially 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. Northern Sea Otter (*Enhydra lutris kenyoni*)

4.1.1. ESA Status

The Southwest Alaska DPS of the northern sea otter was listed as threatened in 2005 after the population declined an estimated 50 percent since the 1980s. This population stretches from the western shoreline of lower Cook Inlet to the western end of the Aleutian Islands. The entire range of this DPS was designated as critical habitat in 2009 and a recovery plan was finalized in 2013 (USFWS 2013). Figure 14 and Figure 15 show the location of northern sea otter critical habitat and the Project Action Area.

4.1.1.1. Designated Critical Habitat

As stated above, the entire range of this DPS has been designated as critical habitat. USFWS has based the critical habitat designation on four primary constituent elements (PCEs):

- PCE #1 - Shallow (<6.6 ft [2 m] deep), rocky areas where marine predators are less likely to forage.
- PCE #2 - Nearshore (within 328.1 ft [100 m] of the high-water mark) waters that might provide protection or escape from marine predators.
- PCE #3 - Kelp forests that provide protection from marine predators (waters < 65.6 ft [20 m] deep).
- PCE #4 - Prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

These PCEs are addressed in this BA with respect to their presence and the potential impact the Project might have on these elements.

4.1.2. Biological Status

4.1.2.1. Abundance and Trends

Recovery of the worldwide sea otter population began at the cessation of commercial harvest in 1911. Sea otter populations in the western Aleutian Islands began reaching pre-exploitation levels in the 1940s (Kenyon 1969) and remained at about equilibrium to late in the twentieth century (Estes 1990). However, while otter populations elsewhere continued to increase and reoccupy historical habitat, populations in the Aleutian Islands began to rapidly decline (Estes et al. 1998, Doroff et al. 2003, Burn and Doroff 2005), resulting in the 2005 listing under ESA. The Southwest Alaska DPS is divided into six management units: the Kodiak, Kamishak, Alaska Peninsula, and the South Alaska Peninsula management units, and small portions of the Eastern Aleutian and Bristol Bay management units. The South Alaska Peninsula, Eastern Aleutian, and Bristol Bay management units have all experienced significant population declines since the mid-1980s and early 1990s (-74 percent, -56 percent, and -39 percent respectively), while the Kodiak, Kamishak, and Alaska Peninsula management units have remained stable or increased (Bodkin et al. 2003, Doroff et al. 2003, Burn and Doroff 2005, Estes et al. 2005, USFWS unpublished data). Overall, the Southwest Alaska DPS, including the Western Aleutian management unit, declined between 43 percent and 58 percent from between approximately 94,050 and 128,650 animals in 1979 to the most recent estimate of 53,674 (USFWS 2013).

4.1.2.2. Distribution and Habitat Use

Sea otters once occurred in a near continuous distribution from central Baja California north to Alaska, along the Aleutian Islands to the Commander Islands and Kamchatka Peninsula then south to northern Japan (Kenyon 1969). By 1911, when otters were protected under the International Fur Seal Treaty, the world population had been reduced to a few remnant populations, most in Alaska. Sea otters have since recovered nearly all their former range in Alaska. Sea otter habitat includes nearshore waters inside the 328-ft (100 m) isobath, with about 80 percent use in waters less than 131 ft (40 m) deep (Bodkin and Udevitz 1999). Nearly all their foraging strategy requires diving to the seafloor, and Bodkin et al. (2004) found that 84 percent of foraging occurs in waters less than 98 ft (30 m) deep. Northern sea otters feed over both rocky and soft-sediment ocean floors. Distributions in Bristol Bay and Cook Inlet may be limited by the extent of annual sea ice events (Schneider and Faro 1975), although Larned (2006) thought that sea otter populations on the west side of Cook Inlet (i.e., Kamishak Bay) remained in place despite sea ice presence.

4.1.2.3. Feeding and Prey Selection

Northern sea otters feed on a wide variety of prey (Estes and Bodkin 2002), although their diet is dominated by mollusks, crustaceans, and echinoderms (USFWS 2013). In soft-sediment substrates otters feed largely on infaunal clam species, though when feeding at rocky substrates they prey more on urchins and mussels. Crabs, snails, and sea cucumbers are also important prey items, but can quickly be overharvested. The diet diversity generally increases over time as abundant prey are consumed and otters are forced to feed on less preferred prey (Estes et al. 1981, Estes and Bodkin 2002), although Green and Brueggeman (1991) found male sea otters inhabiting the north side of the Alaska Peninsula subsisting on nearly a pure diet of 1- to 2-year-old mussels, indicative of an overexploitation of all food resources. There is little or no data on diet for Iniskin/Iliamna Bay otters; however, otters at Kachemak Bay, across Cook Inlet from Iniskin/Iliamna Bay, ate primarily mussels, crabs, and clams (Doroff et al. 2012).

4.1.2.4. Population Biology

Male sea otters become sexually mature at age 3, but generally cannot successfully compete for mating until age 5 or older (Garshelis 1983). Females are sexually mature earlier at 2 or 3 years of age (Bodkin et al. 1993). Copulation and pupping can occur at any time of the year, although there is seasonal synchronicity at some locations (Bodkin and Monson 2002). Gestation, including delayed implantation, is about 6 months, and females usually give birth to a single pup (USFWS 2013). Reproductive rates are relatively high ranging between 80 percent and 98 percent (USFWS 2013).

Pups are dependent on their mothers for their first 6 months (USFWS 2013). Pups are born with highly buoyant natal pelage that allows them to float passively on the surface while their mothers are foraging but, coupled with a high lung volume to body size ratio, prevents them from diving (Payne and Jameson

1984). After their first molt at 3 months they have a limited ability to dive that increases with subsequent molts and muscle development (Thometz et al. 2015). Sea otters are considered juveniles after weaning (at approximately age 6 months) and adults at age 1.5 years (Thometz et al. 2015).

4.1.2.5. Natural Mortality

Natural mortality in sea otter populations has been difficult to quantify (USFWS 2013). Primary causes of mortality in Alaska include severe winter weather, especially when coupled with low seasonal food supply (Kenyon 1969). Sea ice events on the north side of the Alaska Peninsula have resulted in overland movements of large numbers of otters where they become susceptible to terrestrial predators (Schneider and Faro 1975). Bald eagles (*Haliaeetus leucocephalus*) are a regular predator of pups (USFWS 2013) and killer whale (*Orcinus orca*) predation was a leading cause of sea otter decline in the Aleutians in the 1990s (Estes et al. 1998). Infectious diseases are major sources of mortality in California (Thomas and Cole 1996, Kreuder et al. 2003). Sea otter mortality is variable in the first year of life, but the annual survival rate is generally high (90 percent) after that (USFWS 2013). Maximum ages in the wild are 22 years for females and 15 years for males (USFWS 2013).

Identified threats to recovery of this DPS include killer whale predation, infectious disease, biotoxins, contaminants, oil spills, food limitation, disturbance, bycatch in fisheries, subsistence harvest, loss of habitat, and illegal take (USFWS 2013).

4.1.3. Species Use of the Action Area

As mentioned above, this BA addresses potential Project impacts to the listed population of sea otters occurring within the Action Area. The lower Cook Inlet population may have originated from a remnant population at Augustine Island that survived the commercial harvest that ceased in 1911 (Calkins and Curatolo 1979). This population gradually grew to relatively high numbers by the 1960s but may have gone through some population fluctuations due to emigration to the southwest, sea ice formation, and oil related mortality (Calkins and Curatolo 1979, Mulherin et al. 2001). The 1970s population was estimated at between 1,000 and 2,000 animals (Calkins and Curatolo 1979).

Bodkin et al. (2003) surveyed western lower Cook Inlet in summer 2002 and estimated the population at 6,918 otters. Larned (2006) conducted monthly (January to April) aerial surveys for Steller's eiders and other marine wildlife along the coastal waters of lower Cook Inlet during 2004 and 2005 and found sea otters to be well distributed in western lower Cook inlet from Oil Bay to Cape Douglas (Figure 1) and as far offshore as the survey lines ran (to the 65.6-ft [20 m] depth contour located up to 7.5 mi [12 km] from shore). Monthly counts ranged from 1,874 to 4,000 otters. These surveys did not include the waters around Augustine Island where otters are also known to occur and did not account for otters missed by observers (often because they dove ahead of the aircraft) as did the Bodkin et al. (2003) survey. The most recent estimate for western lower Cook Inlet is a much larger 10,737 animals based on a May 2017 survey (Garlich-Miller et al. 2018), representing a 55 percent population increase in 15 years (2002 to 2017).

Several marine mammal surveys have been conducted in the west side of lower Cook Inlet that incidentally or directly recorded sea otters including: marine mammal aerial surveys (targeting beluga whales) conducted by NMFS from 1993 to 2016 (Figure 16); marine mammals surveys conducted in

2006 to 2012 by ABR (2015) within Cottonwood, Iliamna, Iniskin bays and Ursus Cove area specifically for this Project (Figure 17); incidental surveys by ABR in March through July 2018 (ABR 2018a-e) during a PLP-sponsored fish study along a previously proposed pipeline route in Kamishak Bay (Figure 18); recent sea otter surveys conducted by ABR in 2019 during March (Figure 19), May (Figure 20), June (Figure 21), early October (Figure 22), and late October (Figure 23) in Kamishak Bay (including Ursus Cove) (ABR 2019); and the May 2017 sea otter survey conducted by Garlich-Miller et al. (2018) mentioned above (Figure 24). A sea otter density heatmap from the Garlich-Miller et al. (2018) survey is shown in Figure 25.

ABR (2015) helicopter surveys from 2006 to 2012 noted seasonal fluctuation in otter distribution in Cottonwood Bay, Iliamna Bay, Iniskin Bay and Ursus Cove (Figure 17) and three notable congregations or haulout areas: White Gull Island, Iniskin Island, and Pomeroy Island (Figure 17). A fourth lesser used congregation area, Big Rock, was used primarily during winter/spring (Figure 17). Table 9 includes total sea otter counts within a 500-ft (152 m) from these islands across all survey years. During summer (not surveyed before 2009), individual otters were scattered throughout the survey area and overall mean count was only 1.78 otters (f = 54, range = 14). The highest summer count occurred around Iniskin Island (12 otters). In fall, otters began to move into Cottonwood, Iliamna, and Iniskin bays to overwinter with a mean count of 1.82 otters (f = 466, range = 42) in the survey area. Otter concentrations increased at White Gull Island (214 otters) and Pomeroy Island (94 otters). The influx of otters continued to into mid-winter (mean count of 7.40 otters [f = 1402, range = 439]), moving further into Iliamna and Iniskin bays with the highest number at Pomeroy Island (3,135 otters). Late-winter/spring otters remained in the survey area but began moving to the outer coasts and offshore waters (mean count of 6.36 otters [f = 952, range = 300]). The highest numbers of otters were at Pomeroy Island (1,010), with small congregations on the other three haulout areas. Winter/spring concentrations of otters were also noted in central Iniskin Bay. These surveys show concentrations of otters inhabit the Action Area of the Diamond Point port and lightering station at Iliamna and Iniskin bays throughout the year but are most abundant in winter and spring.

Table 9. Total northern sea otter counts by season at congregation/haulout areas between 2006 and 2012 (ABR 2015).[1]

Area	Summer (Jun-Jul)	Fall (Aug–Oct)	Mid-Winter (Nov-Feb)	Late-Winter/Spring (Mar-May)	Total
White Gull Island	4	214	311	133	662
Iniskin Island	12	16	50	237	315
Pomeroy Island	7	94	3,135	1,010	4,246
Big Rock	-	-	29	214	243
Total	23	324	3,525	1,594	5,466

[1] Counts include sightings that occurred within a 500-foot (152 m) from each island.

During the five aerial surveys of Kamishak Bay, conducted by ABR in 2019 an average of 749 sea otters (range: 563 to 923) were recorded along 15 tracklines spaced 2 mi (3.2 km) apart (ABR 2019). Mother-pup pairs were observed during all five surveys but were most numerous in June. Sea otters were least numerous along the three most southern tracklines but aggregated on the intertidal reefs near the mouth of Amakdedori Creek during low tides. In general, sea otter use of Kamishak Bay had shifted northward in October towards the Action Area with large numbers found between Augustine Island and the mainland (where the island may provide protection from fall weather). These surveys documented three sea otter haulouts during Mach (Figure 26). These surveys did not extend into Cottonwood Bay, Iliamna Bay, Iniskin Bay and Ursus Cove.

Based on benthic surveys of Iliamna and Cottonwood bays and around White Gull Island conducted by Stutes et al. (2018), only patches of understory kelp (e.g., *Alaria* spp*., Saccharina* spp., *Desmarestia* spp.) in reefs (Figure 27) occur in the portions of the Action Area that overlap sea otter critical habitat, and no understory kelp was found in Ursus Cove. No canopy-forming kelps (e.g., forest kelps such as *Eularia fistulosa*) were identified in the Action Area.

These data clearly indicate that large numbers of sea otters inhabit Cottonwood Bay, Iliamna Bay, Iniskin Bay, and Ursus Cove year-round and range several miles offshore, and particularly use the Action Area as shelter during winter.

Northern sea otter critical habitat (described in Section 4.1.1.1) also encompasses the nearshore waters of Kodiak Island, the Alaska Peninsula, and the Aleutian Islands. 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) would not pass inside the 66-ft (20 m) depth contour delimiting the extent of this habitat (Figure 15).

4.2. Steller's Eider (*Polysticta stelleri*)

4.2.1. ESA Status

Steller's eider is a small, bottom-foraging diving duck with breeding populations in Russia and the U.S. Because of significant population declines, the U.S. breeding population was listed as threatened in 1997 (USFWS 1997), and critical habitat was designated in 2001 (USFWS 2001). A recovery plan was finalized in 2002 (USFWS 2002).

4.2.1.1. Designated Critical Habitat

Steller's eider critical habitat has been designated in breeding areas on the Yukon-Kuskokwim Delta, staging area in the Kuskokwim Shoals, and molting areas in waters associated with the Seal Islands, Nelson Lagoon, and Izembek Lagoon in Southwestern Alaska. The vessel traffic corridor through Unimak Pass is about 80 mi (129 km) southwest of the Izembek Lagoon molting area on the Alaska Peninsula. No critical habitat occurs within the Action Area.

4.2.2. Biological Status

4.2.2.1. Abundance and Trend

There are three main Steller's eider breeding populations, with the majority breeding in Arctic Russia, and a much smaller Alaska-based breeding population (USFWS 2014). The Russian Atlantic population is believed to contain 30,000 to 50,000 individuals, and the Russian Pacific population likely numbers between 50,000 to 100,000 (USFWS 2014). The U.S. breeding population most recent estimate is 577 individuals (USFWS 2017). The Alaska breeding population experienced a significant decline in the late twentieth century (Quakenbush et al. 2002); low breeding density and great interannual variation in breeding locations make it difficult to determine whether the population is beginning to stabilize or increase. Larned (2006) estimated the number of wintering birds (January 2005 high count) on the western side of lower Cook Inlet was 4,284 birds and the eastern side was 1,247 eiders, the great majority of which originated from Russia. Wintering Steller's eiders also concentrate at Izembek and Nelson lagoons, as well as other areas along the Alaska Peninsula (Petersen 1981, USFWS 2002).

4.2.2.2. Distribution and Habitat Use

Steller's eiders arrive on their Siberian and Alaskan breeding grounds in late May and early June. In Alaska, breeding occurs sparsely across the Arctic Plain, with few concentrations near Barrow (Quakenbush et al. 2002). Eiders once nested on the Yukon-Kuskokwim Delta, but no significant breeding activity has been observed there for several decades (Kertell 1991, Flint and Herzog 1999). Steller's eiders do not nest within the vicinity of the Action Area. Males begin leaving the breeding grounds in early July, arriving at Southwest Alaska molting areas. Females remain on breeding grounds until broods have fledged, then migrate to molting areas or directly to wintering grounds farther south. Most Pacific populations of eiders molt within lagoons along the Alaska Peninsula, particularly Nelson and Izembek lagoons (Petersen 1981), although small numbers molt along the nearshore waters throughout Bristol Bay, including northern Kuskokwim Bay where about 5,000 birds have been found (Larned and Tiplady 1996, Wilson et al. 2012). Kamishak Bay was recently documented as a molting area by Rosenberg et al. (2014). They found, using telemetry studies and associated aerial surveys, that approximately 2,500 Steller's eiders molted in Kamishak Bay, primarily at Douglas Reef, in late summer of 2005 and 2006 (but none of the tagged birds moved north of Kamishak Bay into the Action Area). Satellite-tagging results indicate eiders began arriving at Kamishak Bay from mid-August to early September. Many of the birds appear to leave Kamishak Bay in the fall and winter as overwinter estimates by Larned (2006) were lower at approximately 1,700. Presumably, many of these birds move north into the Action Area where Iniskin and Iliamna bays provide storm protection.

During the fall, U.S. Steller's eider populations are joined by thousands of unlisted Russian Steller's eiders along the north side of the Alaska Peninsula, where they undergo several weeks of molt (Jones 1965, Ward and Stehn 1989, Laubhan and Metzner 1999). In late November, they begin moving to overwintering areas in the Aleutian Islands, the south side of the Alaska Peninsula, Kodiak Archipelago, and Cook Inlet (Petersen 1981, USFWS 2002). During April and May, nearly the entire population wintering in Alaska concentrates in Bristol and Kuskokwim bays as they wait for the sea ice to retreat and breeding ponds to thaw (USFWS 2001), although eiders have been observed in Iniskin Bay (n = 28) in April 2004 (Figure 31) and as far north as Tuxedni Bay (n=1) (Figure 36) in April 2005 (Larned 2006).

4.2.2.3. Feeding and Prey Selection

Steller's eiders are reported to consume a diverse diet of invertebrates, suggesting they are nonselective foragers (Petersen 1980, 1981; Metzner 1993; Bustnes and Systad 2001); their main diet consists of bivalves, gastropods, and crustaceans such as crabs, shrimp, and amphipods (Vang Hirsh 1980, Goudie and Ankney 1986, Metzner 1993, Ouellet et al. 2013). Goudie and Ankney (1986) suggested that small ducks wintering in northern latitudes, such as Steller's eiders, do so at the edge of their energetic limits. Foraging habitat is considered waters less than 33 ft (10 m) deep (USFWS 2001).

4.2.2.4. Reproduction

Steller's eiders nest on the edges of tundra ponds in Russia (Siberia) and the North Slope of Alaska (and formerly the Yukon-Kuskokwim Delta). Steller's eiders begin courtship and pairing in April often while still on the spring staging grounds (Fredrickson 2001). Nest-building begins within days of arriving on the nesting grounds, with egg-laying occurring mid-June (Quakenbush and Cochrane 1993). Clutches average about 6 eggs, which hatch 26 to 27 days after the laying of the first egg (Fredrickson 2001). There are no re-nesting opportunities in the short Arctic summer. In Russia, successful females and fledglings leave the nesting grounds in late August to mid-September (Solovieva 1997). Nesting success is highly variable in Alaska, and appears related to the number of lemmings, an alternative prey for local nest predators (Quakenbush and Suydam 1999).

4.2.2.5. Natural Mortality

Maximum longevity is more than 20 years, and there is little information on major causes of Steller's eider adult mortality (Fredrickson 2001), although in Alaska, jaegers and common ravens have been identified as egg predators (Quakenbush and Suydam 1999). Presumably, red foxes (*Vulpes vulpes*) and arctic foxes (*V. lagopus*) are potential predators of both nests and nesting adults. Other identified threats include hunting, ingestion of lead shot in wetlands, changes in the marine environment that could affect their food resources, exposure to oil, and exposure to contaminants from fish processing facilities (USFWS 2002).

4.2.3. Species Use of the Action Area

Steller's eiders overwinter along the shoreline of both sides of lower Cook Inlet. During aerial surveys conducted by Larned (2001, 2006) in 2001, 2004, and 2005, substantial numbers of eiders were found at:

- Anchor Point north to Ninilchik
- Homer Spit to Anchor Point
- Kamishak Bay from Douglas River to Bruin Bay (especially Douglas River Shoals)
- Mouth of Iniskin Bay

Both Anchor Point and Iniskin Bay fall within the Action Area. Most construction activities at Anchor Point associated with the natural gas pipeline would occur during the summer months when Steller's eiders are not seasonally present. Potentially significant numbers of eiders are expected to occur in Kamishak Bay (just south of the Action Area) from mid-August through April (USFWS 2001, Rosenberg et al. 2014). Surveys conducted by Larned (2001, 2006) found wintering eiders in the mouth of Iniskin Bay, in the vicinity of the proposed lightering station and Ursus Cove near the proposed pipeline landing site. Larned (2006) observation locations for the 2004-2005 survey can be found in Figures 27-34.

Surveys conducted by ABR (2015) from 2006 through 2012 regularly recorded Steller's eiders in Iniskin and Iliamna bays during winter and early spring (Figure 37). In December 2012, two flocks totaling 2,462 eiders were documented along Fortification Bluff (just south of Ursus Cove). Steller's eiders were found primarily in offshore waters in the middle portions of Iniskin and Iliamna bays, and occasionally in nearshore waters. Most birds occurred around a shallow shoal in the lower part of Iniskin Bay, and in the middle of the channel between Cottonwood and Iliamna bays. Generally, several hundred Steller's eiders were present in these bays from late November to early December, and through the end of March to early April. ABR (2015) reports in 2006, the highest count was 300 Steller's eiders in early December; numbers increased to 676 Steller's eiders during the surveys in early March 2007. In 2008, the highest number recorded in Iliamna and Iniskin bays was in early March (n = 275), increasing (n = 350) by early February 2009. Birds departed by late April 2009, returning in late November (n = 110) and December (n = 170). Fewer than 200 eiders were present during any month between January and early March 2010, and birds did not return to the area until January 2011 (n=11). Even fewer birds were recorded in 2011 with a peak (n=112) occurring in late February. Similar to 2010, birds left the area in late March 2011 and did not return until January 2012 (n=260). Notably, in 2012, no eiders were recorded from early February through early March, but 125 eiders were documented in late March. Eiders were not documented again in 2012. The fluctuations in Steller's eiders numbers during winter is likely related to the location and presence of sea and shorefast ice, in addition to severity and timing of fall storms, which push eiders from southern locations into more northern protected bays. Therefore, surveys conducted by Larned (2001, 2006), and ABR (2015) indicate that Iniskin and Iliamna bays provide overwintering habitat for several hundred Steller's eiders.

Steller's eiders were also targeted during ABR's Kachemak Bay aerial surveys conducted in March 23, May 24, June 20-21, October 3, and October 30, 2019, which is included as a portion of the Action Area, including Ursus Cove and Cook Inlet waters north of Augustine Island (ABR 2019). The only Steller's eiders observed were outside of the Action Area and consisted of a single flock of 20 males observed on October 30, 2019 near the southern shore of Augustine Island.

Steller's eiders molt at wintering grounds on the Alaskan Peninsula where critical habitat has been designated in Izembek and Nelson Lagoons. The nearest Project component to this critical habitat, the vessel traffic corridor that passes through Unimak Pass, is approximately 80 miles (129 km) away.

4.3. Short-tailed Albatross (*Phoebastria albatrus*)

4.3.1. ESA Status

The short-tailed albatross was listed as endangered throughout its range in 2000. Prior to the turn of the 20th century, millions of these birds had been harvested for their feathers, bringing the species to near extinction by the mid-20th century (USFWS 2008). Just one island, Torishima, supported at least 300,000 breeding pairs prior to exploitation. By 1949 there were no breeding pairs remaining on any of the 14 islands off Japan and Taiwan where they previously nested, and the species was thought to have gone extinct (Austin 1949). However, soon after this declaration, a few birds that presumably had been wandering the North Pacific during the final years of slaughter began returning to Torishima Island where eventually they formed two breeding colonies. Breeding pairs began appearing at Minami Kojima Island in the Senkaku Islands group in the early 1970s (USFWS 2008).

4.3.1.1. Designated Critical Habitat

Critical habitat has not been designated for this species largely because it is not prudent given their pelagic distribution and lack of nesting in the U.S.

4.3.2. Biological Status

4.3.2.1. Abundance and Trends

The worldwide short-tailed albatross population has grown steadily since reestablishing breeding in the early 1950s. The 2007–2008 estimated population for breeding birds was 1,114, and the subadult population estimated at 1,292, or 2,406 (USFWS 2008). More than 82 percent of the population originated from Torishima, where the colony has been growing at an annual rate of 6.5 to 8.0 percent (USFWS 2008).

4.3.2.2. Distribution and Habitat Use

Currently short-tailed albatrosses only nest on the Japanese-managed island of Torishima, and Minami Kojima Island located about 110 mi (177 km) northeast of Taiwan, where its ownership is under dispute by Taiwan, China, and Japan (USFWS 2008). Efforts are ongoing to establish colonies elsewhere. During the 4-month non-breeding season, male adult short-tailed albatrosses largely travel to feeding waters in the Bering Sea and waters off the Aleutian Islands, while females are more likely to feed in Japanese and Russian waters (Suryan et al. 2007b). Juveniles and subadults, however, range a far wider area of the North Pacific, including down the U.S. west coast, before returning to their breeding colony of origin at 5 to 6 years of age.

Foraging short-tailed albatrosses spend most of their time in shelf waters less than 3,281 ft (1,000 m) deep, and rarely in waters deeper than 9,843 ft (3,000 m) outside Japan (Suryan et al. 2007a, USFWS 2008). These birds concentrate in upwelling areas off Japan, along the shelf breaks of the Aleutian Islands and the Gulf of Alaska, and along the edge of the Bering Sea shelf (Suryan et al. 2006, Piatt et al. 2006). Juveniles and subadults off the U.S. west coast also spend most of their time near the continental shelf edge, while birds that have been satellite-tracked in deeper pelagic waters appear to be transiting between foraging areas (Suryan et al. 2007a).

These birds were once thought to be coastal because of their prevalence in Native midden sites from southern California to St. Lawrence Island (Murie 1959, Piatt et al. 2006). However, Piatt et al. (2006) has shown that these birds concentrate at the shelf edge and over submarine canyons, and aboriginal hunting would likely have occurred as the birds moved through the Aleutian passes and where "hotspot" upwelling sites are close enough to the coast to have been reached by boat-based Native hunters.

4.3.2.3. Feeding and Prey Selection

Short-tailed albatrosses are adapted for soaring just above the water surface feeding largely on squid, shrimp, and schooling fish (Hasegawa and DeGange 1982), and fish offal discarded from fishing vessels (Melvin et al. 2001). These birds feed on squid more than other species of albatrosses (USFWS 2008). Piatt et al. (2006) found that in Alaska, short-tailed albatrosses are concentrated along the shelf edges from the Gulf of Alaska through the Aleutians, and particularly along the edge of the Bering Sea shelf where upwelling brings squid to the surface, making them available to the shallow-diving albatross.

4.3.2.4. Reproduction

Short-tailed albatrosses currently nest only on Torishima and Minami Kojima Islands. They are slow reproducing birds that can live to 40 years of age (USFWS 2011). They begin breeding at about age 5 or 6 and lay a single egg. Slow-growing chicks are dependent on their parents until fledging at about 5 months. In all, the breeding season lasts about 8 months.

4.3.2.5. Natural Mortality

Apparently crows (*Corvus macrorhynchos*) preyed heavily on albatross chicks at Torishima prior to 1949 (Austin 1949) but are not present on the island today (USFWS 2008). Sharks and Steller's sea eagles (*Haliaeetus pelagicus*) may occasionally take fledglings, but adult short-tailed albatrosses have few natural threats to survival. Monsoon rains have destroyed nesting habitat leading to chick mortality, and because Torishima is an active volcano, an eruption could have a catastrophic impact to the world population (USFWS 2008).

4.3.3. Species Use of the Action Area

More than 1,400 sighting records from Alaskan waters clearly show that short-tailed albatrosses concentrate along the Aleutian Islands, Bering Sea, and Gulf of Alaska, with highest concentrations along the continental shelf breaks and slope regions (Piatt et al. 2006; Figure 38), and with the Aleutians especially important during the molt (USFWS 2015). None of these sightings occurred in Cook Inlet. The short-tailed albatross is pelagic in distribution and does not inhabit Cook Inlet or frequent near-shore waters. However, this bird might be encountered by offshore vessel traffic associated with the Project.

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 northern sea otters (and its critical habitat), Steller's eiders, or short-tailed albatrosses 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, disturbance from maintenance operations for the natural gas pipeline and fiber optic cable, and general disturbance from vessel traffic. Disturbance includes alteration of seafloor habitat and acoustical disturbance due to excessive underwater noise.
- Vessel strike of sea otters, especially pups and ill adults, eider collision with vessels and structures, and short-tailed albatross collision with vessels.
- 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 construction of the Diamond Point port, lightering station, port access road, natural gas pipeline and fiber optic cable.

Table 10 provides a summary of Project components and activities potential effects, and results of the two-part test. These potential effects– disturbance, vessel strike/structure collisions, incidental spill, accidental spill, foraging habitat loss – are discussed below.

Table 10. Summary of Project proposed actions, 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/structure collision	Yes	Yes
	Loss of foraging habitat and loss of prey	Yes	Yes
Dredging of Diamond Point port approach	Disturbance	Yes	Yes
	Vessel strike/structure collision	Yes	Yes
	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/structure collision	Yes	Yes
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/structure collision	Yes	Yes
Maritime transport	Disturbance	Yes	Yes
	Vessel strike/structure collision	Yes	Yes
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/structure collision	Yes	Yes
Maritime transport (barges)	Disturbance	Yes	Yes
	Vessel strike/structure collision	Yes	Yes
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/structure collision	Yes	Yes
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/structure collision	Yes	Yes
Maintenance and repair operations of the natural gas pipeline and fiber optic cable (subsea) (or pipeline decommissioning)	Disturbance	Yes	Yes
	Vessel Strike	Yes	Yes
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

Disturbance concerns include auditory and visual disturbance from construction activities and vessel traffic at important sea otter, Steller's eider, or short-tailed albatross concentration areas (e.g., sea otter rafting locations, eider molting areas, or short-tailed albatross foraging areas near the edges of the continental shelf).

Apart from any potential for damaging marine mammal hearing, loud noises can disrupt normal behaviors of otters or eiders both through auditory and visual harassment. Disturbed otters or eiders may quit feeding, move away from feeding areas, display overt reactions (such as abandoning pups), or display other behaviors that expend undue energy potentially culminating in lowered fitness.

Underwater hearing ability of sea otters is significantly less than that of other marine mammals (Ghoul and Reichmuth 2014). Their ear structure suggests that there has been little change since their terrestrial origin. Unlike other marine mammals, the sea otter ear canal remains fully open and not closed as in cetaceans or reduced as in pinnipeds. Their one adaption appears to be an earflap that closes over the ear canal during diving, trapping air inside. While this mechanism would protect the inner ear, an ear canal filled with air can cause an impedance mismatch reducing sound conduction to the middle and inner ears (Wartzok and Ketten 1999). Ghoul and Reichmuth (2014) found sea otters have poor hearing sensitivity below 1 kilohertz (kHz), and best sensitivity between 2 kHz and 26 kHz, but the lowest threshold (69 dB re 1 µPa) at between 8 kHz and 16 kHz was much higher than pinnipeds. Davis et al. (1988) did conduct playback sound experiments on otters and could elicit a startle response depending on intensity and frequency, but disturbance effects were limited to 328–656 ft (100–200 m) from source. In sum, sea otters do not appear to be particularly adapted to hearing underwater, except for extreme underwater sounds, which is supported by the lack of evidence of underwater communication (Ghoul and Reichmuth 2012). Sea otters do communicate above water, especially with loud screams between separated mothers and pups (McShane et al. 1995). Ghoul and Reichmuth (2012) measured these vocalizations and found that the intensity of these calls ranged between 50 and 113 dB with sound pressure level (SPL) re 20 µPa (dB SPL re 20 µPa) and were loud enough that they can be heard by humans at distances exceeding 0.62 mi (1 km) (McShane et al. 1995). Aerial hearing in sea otters is similar to terrestrial carnivores with best sensitivity between 1.2 kHz and 27 kHz (Ghoul and Reichmuth 2014).

Although in-air hearing has been measured in the common eider (*Somateria mollisma*) (Crowell et al. 2015), there are no studies on the underwater hearing ability of eiders. Joint research is currently being conducted by researchers at the University of Delaware and the Patuxent Wildlife Research Center on the underwater hearing of long-tailed ducks (*Clangula hyemalis*), surf scoters (*Melanitta perspicillata*), lesser scaup (*Athya affinis*), and harlequin ducks (*Histrionicus histrionicus*), but published results are not yet available. Preliminary results indicate that while long-tailed ducks can hear underwater at frequencies between 0.5 kHz and 2.86 kHz (Therrien 2014), they have less sensitive underwater hearing than marine mammals (McGrew et al. 2017).

Short-tailed albatrosses have not been found in the Cook Inlet waters where construction activity could result in potential disturbance but these birds could be encountered by project vessels traveling within their shelf-edge foraging grounds in the GOA or the Bering Sea (Piatt et al. 2006). There are no studies relevant to visual or auditory disturbance to short-tailed albatrosses on their foraging grounds. However short-tailed albatrosses are known to interact with trawls when seabirds fly behind vessels or float in offal plumes that trail behind the vessels (USFWS 2008). Therefore, vessels (specially fishing vessels) may be a more important source of attraction rather than disturbance. Human disturbance is not currently considered to be a significant threat to short-tailed albatrosses outside of their nesting colonies, of which none are found in the U.S. (USFWS 2008). Therefore, albatross disturbance is not specifically addressed in this section.

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 in an effort 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, as the hair cells have some ability to recover between and after the intermittent sound pulses. 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.

Anthropogenic sources of underwater impulsive noises that could lead to TTS in sea otters include seismic surveys, pile driving, and blasting, but with elimination of the option of a pile-supported causeway and marine jetty, there are no impulsive underwater sound activities (such as impact pile driving) planned for the Project during any phase.

The primary underwater noise associated with construction is the continuous noise generated during the material fill of the caissons, dredging activities, and continuous underwater noise emanating from anchor-handling vessels while operating dynamic positioning thrusters (cavitation noise) during laying of the gas pipeline.

The USFWS considers underwater noise associated with fill to behaviorally effect sea otters out to 984 ft (300 m) (USACE Sea Otter Programmatic Consultation 2015; Consultation # 2013-0016), although it is unclear how much noise would be radiated from fill directly placed into an open-air caisson, rather than directly into the ocean.

Continuous sounds for small vessels (including tugs) have been measured at up to 171 dB re 1 μPa (rms) at a 1-m source (broadband), and they are emitted at dominant frequencies of less than 5 kHz, and generally less than 1 kHz (Miles et al. 1987, Richardson et al. 1995, Simmonds et al. 2004). Cavitation noise, such as occurs during anchor handling, is louder (e.g., 188 dB re 1 μPa [rms] from

LGL/JASCO/Greeneridge 2014) and is a potential source for PTS depending on the received noise level (a function of the distance the animal is to the vessel) and duration (dependent on the period animal and vessel are in proximity). There is some overlap between the hearing in sea otters and cavitation noise, as the best underwater hearing sensitivity for sea otters is between 2 kHz and 26 kHz (Ghoul and Reichmuth 2014). However, peak cavitation frequencies (<100 Hz) do not overlap with peak hearing sensitivities (>1 kHz) thereby reducing PTS risk. More importantly, sea otter exposure to continuous tug noise is limited to the dive duration. The average dive time of a northern sea otter has been measured at from 85 seconds (Bodkin et al. 2004) to 149 seconds (Wolt et al. 2012), far too short a period for the onset of PTS.

No data currently exist on the physiological effect of anthropogenic noise on sea ducks and, like sea otters, the exposure duration (limited to the short dive period) from the moving vessels is far too short to induce PTS regardless. (The USFWS has adopted impulsive underwater noise injury criteria for marbled murrelets, but no criteria have been developed for continuous noise).

Airborne noise from blasting (road construction) is likely to be heard by any sea otters inhabiting Iliamna Bay at the time, and may trigger a startle response, but otters are expected to recover quickly. There is no airborne criterion for sea otter disturbance. Steller's eiders are not expected to be present during the summer blasting period.

5.1.2. Masking

Masking occurs when louder noises interfere with marine mammal vocalizations or their ability to hear natural sounds in their environment (Richardson et al. 1995), which limits their ability to communicate or avoid predation or other natural hazards. In particular, masking can prevent marine animals from hearing approaching predators. However, predation is probably not a primary mortality factor of sea otters inhabiting Cook Inlet, although killer whales have been implicated as a mortality factor of Aleutian otters. Also, underwater noise would not contribute to increased sea otter mortality from an aerial predator such as a bald eagle, although it might for an underwater predator such as a killer whale. Still, sea otters spend the great majority of their time with their head out of the water and are likely to use visual cues more than auditory to detect approaching killer whales.

Research by Therrien (2014) suggests that sea ducks hear best underwater at low frequencies between 0.5 kHz and 2.86 kHz, or at frequencies similar to cavitation noise and, therefore, might be susceptible to masking. However, dive durations for eiders are generally a minute or less (Heath et al. 2007, Evers et al. 2010) with longer rest periods between dives. Noise exposure is limited to when a dive event coincides with the short time a travel vessel is in effective hearing range. Also, fill operations would extend over only the period it would take to fill a single caisson before operations would cease to allow repositioning over the next caisson, thereby limited the period of continuous exposure for eiders or otters.

5.1.3. Chronic Disturbance

Continued exposure to low levels of noise and disturbance can lead to chronic stress, potentially 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, such as underwater fill placement, but does not apply to a passing construction 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 sea otter or Steller's eider contributing to a general distress and deleterious effects. Additional vessel passes would contribute further to the stress load.

The construction of the Project would have some additive effect to the overall anthropogenic noise budget, especially since there is little anthropogenic noise within the western side of lower Cook Inlet. Construction of the Diamond Point port marine components and dredging of the navigational channel are expected to take place over one summer between the months of May and September. Construction of the marine portion of the gas pipeline would occur over a 90-day period from June through August also in a single summer. Anchor placement and construction of the lightering station would take place over a 10- to 12-day period in a single summer. After the initial dredging of the navigational channel, maintenance dredging of the Diamond Point port navigation channel would take place approximately every 5 years, lasting approximately 1 to 2 weeks during the summer. Thus, noise levels associated with construction would be short-term, especially for Steller's eiders, which would not be present during most of the summer construction period. Disturbance during operations would largely be limited to increased vessel traffic with the highest contribution from the concentrate barges traveling between the port and lightering station.

Stress in sea ducks and other waterfowl is difficult to evaluate and is usually determined by measuring levels of corticosterone, a stress hormone, which requires capture and handing of individuals. A few studies to date (e.g., Perfito et al. 2002, Taylor et al. 2014) have shown a relationship between corticosterone levels and fitness in ducks, especially in the winter when environmental hardships already contribute to stress levels (see Wingfield et al. 1997 for an overview of the chronic effects of elevated corticosterone on birds).

5.1.4. Other Disturbance

Besides noise disturbance, both construction and operational activities could visually disturb listed species and their habitats. 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 sea otters and Steller's eiders from using the affected area or bury benthic resources. For example, re-suspension 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. 2004, 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 re-suspension 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 re-suspension 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 as a result 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

5.1.5.1. Northern Sea Otter

Activities that could acoustically or visually disturb sea otters include placement of fill for construction of the Diamond Point port access road (including blasting), Diamond Point port, lightering station, dredging of the navigation channel, trenching activities and vessel thruster use for the installation of the lightering station, natural gas pipeline and fiber optic cable placement, and a general increase in vessel traffic associated with port and pipeline/cable construction and operations.

The Project's construction activities and vessel movements would contribute to existing vessel traffic noise in lower Cook Inlet and would be the dominant noise sources in Cottonwood Bay, Iniskin Bay, and Ursus Cove, and in Iliamna Bay during certain times of the year. Marine traffic in Iliamna Bay is not uncommon between April and October due to existing marine traffic at Williamsport (Section 2.4.7), but the project would result in increased vessel traffic in the bay, including year-round operations. At times, the noise from these activities may temporarily disturb marine wildlife, resulting in acute stress levels and adding to the animal's overall stress budget.

Noise harassment of sea otters due to thruster use and anchor pulling during pipeline and fiber optic cable placement is limited to 243 ft (74 m). Most otters are likely to remain outside this zone during construction, although any otters occurring within the construction corridor might be visually disturbed as well.

Installation of mooring structures at the lightering station could disturb otters by the presence of vessels and barges, but no significant underwater noise is expected to be generated and any effects would be short-term. Similar short-term acoustical harassment is expected from placement of fill during causeway and marine jetty construction. Fill activities would be monitored by Protected Species Observers (PSOs).

All noise associated with the project would be from continuous sources and none would reach levels considered harmful to either otters or eiders (harassing levels only). None of the noise sources would result in Level A harassment or injury of sea otters.

Sediment re-suspension from activities that disturb the sea bottom, such as fill or dredging activities for construction of the access road, Diamond Point port marine facilities, dredging of the navigation channel and basin, and installation of the natural gas pipeline and fiber optic cabler is expected to occur. The effects of increased sediment in water would be localized near the construction activity and could persist from hours to one or two days after cessation of the construction activity. Increased sediment concentrations would not be larger than maximum concentrations that occur in Cook Inlet under natural processes (section 4.16.4.6 in USACE 2020).

Finally, increased vessel traffic (supply barging and concentrate shipping) during port operations has the potential to disturb sea otters, especially breaking up rafts or separating mother/pup pairs that might occur within the travel lanes leading to the port or between the port and lightering station.

5.1.5.2. Steller's Eider

Steller's eiders begin arriving to lower Cook Inlet to molt in mid-August after most of the summer construction activities (i.e., port construction, pipeline/fiber optic cable placement, and lightering station placement), would have been completed. Any construction activity that occurs from mid-August to September could potentially disturb molting eiders.

Project activities that could potentially disturb molting eiders during construction and operations are the same as for sea otters; with the exception that there are no underwater noise threshold criteria for eiders. Thus, there are no impact radii for fill placement or thruster use for eiders. Further, use of the immediate vicinity of the construction activities by molting eiders is unknown. Rosenberg et al. (2014) found that most of the Steller's eiders found in Kamishak Bay during the molt period were concentrated in the southern margin of the bay. None of the satellite tagged eiders followed by Rosenberg et al. (2014) molted north of Kamishak Bay.

In contrast, ABR (2015) noted Steller's eiders arriving to Cottonwood Bay, Iliamna Bay, Iniskin Bay and Ursus Cove in late-November (after the fall molt), overwintering in the area, and departing by early-April. The helicopter surveys between 2006 and 2012 were conducted throughout the year, however eiders were only observed in winter/early-spring. Though fluctuations did occur, mean numbers generally increased from November to early-March when the highest counts were observed (mean of 229 birds). Numbers decreased rapidly between early-March and early April when the last birds leave the area. ABR (2015) confirmed the rapid decline to be a real response to extreme cold ambient and marine temperatures that occur at that time of year (not an artifact of sampling). Steller's eiders were found primarily in offshore waters in the middle portions of Iniskin and Iliamna bays, and occasionally in nearshore waters. Lightering activities and port construction/operation may disturb wintering eiders as most birds occurred around a shallow shoal in the lower part of Iniskin Bay, and in the middle of the channel between Cottonwood and Iliamna bays (Figure 37).

5.2. Vessel Strike and Structure Collision

Vessel strike concerns are usually associated with large cetaceans, such as humpback whales (*Megaptera novaeangliae*) and fin whales (*Balaenoptera physalus*), that frequent shipping lanes and are too ponderous to effectively maneuver away from fast-approaching large vessels (Laist et al. 2001, Jensen and Silber 2004). There is very little evidence of ship strike for the more agile smaller whales, dolphins, and pinnipeds. The same is true for adult sea otters, which are vigilant at the surface and can quickly dive to a safe depth at approach of a vessel. This has been particularly evident by the great difficulty in capturing agile adults using powerboats and hoop nets (Kenyon 1969). However, sea otter pups are incapable of diving their first 3 months of life (pre-first molt of natal pelage) and do not reach adult diving ability until age 1.5 years (Kenyon 1969, Payne and Jameson 1984, Thometz et al. 2014). Due to their large lungs relative to body size and highly insulative natal pelage, sea otter pups (age 0–3 months) have high positive buoyancy and simply float at the surface when unattended by their mother (Payne and Jameson 1984). Pups are incapable of maneuvering away from an approaching vessel. In addition, panicked mothers can unintentionally drown pups by taking them underwater with them in an escape dive (Snow 1897). Finally, sea otters pup year-round (Kenyon 1969), so there is no season where small pups are not present (although pupping does peak in the summer months). ABR (2019) found mother-pup pairs during all five surveys conducted in Kamishak Bay between May and late October.

Research to date has shown that while vessel strike is a recurring mortality factor across all Alaskan sea otter populations (Muto et al. 2018), it does not appear to be a significant factor. Even in California, where vessel activity is relatively high, mortality due to vessel collision is considered rare (Ames et al. 1983). Mortality data collected by the Marine Wildlife Veterinary Care and Research Center in California (https://www.wildlife.ca.gov/OSPR/Science/MWVCRC/Sea-Otter-Necropsy-Program) indicate that direct anthropogenic mortality, including vessel strike, represents only a small (approximately 5 percent) portion of the total annual mortality with disease and shark bite the primary causes. However, the USFWS recently stated "In Alaska, the annual rate of documented mortality from boat strike was similar to that reported for California: 2.7 otters per year (USFWS unpublished data). However, compared to otters in California, Alaska otters belong to much larger and more dispersed populations where carcass recovery is lower. Instances of vessel collision are likely to be underreported, and the probability of collision is unknown." (USFWS 2019).

Birds often collide with man-made structures and suffer mortality or severe injuries including concussions, internal hemorrhaging, and broken bones (Manville 2004). Birds are particularly at risk during inclement weather (Weir 1976, Russell 2005). Seabirds and sea ducks are also at increased risk as they fly at low altitudes where encounters with offshore oil platforms or large ships are possible (Anderson and Murphy 1988). Studies of Alaskan eiders indicate that most of these birds fly at high speeds at altitudes less than 33 ft (10 m) Johnson and Richardson 1982; Day et al. 2004, 2005).

Seabirds attracted to offal, such as the short-tailed albatross, could strike wires or cables on the vessels as they fly about, presumably in search of offal (USFWS 2008). Such incidents have been documented for seabirds, other than short-tailed albatrosses, in trawling vessels with large cables that connect the trawl net to the vessel (USFWS 2008).

5.2.1. Project Components Contributing to the Stressor

5.2.1.1. Northern Sea Otter

Vessel traffic in Cottonwood Bay, Iliamna Bay, Iniskin Bay, Ursus Cove, and between these bays and Anchor Point during construction of the port and pipeline is expected and would include a variety of tugs and barges with drafts less than 15 ft (4.6 m). The exact number of vessels and types are not yet known pending additional construction planning. All vessels, including those arriving and departing the construction areas, would travel within sea otter foraging habitat (waters less than 66 ft [20 m] deep) at speeds less than 10 knots (kt) (<18.5 km/hr). During actual construction, vessel traffic would be limited to barge maneuvering and anchor-handling in the immediate vicinity of the port, lightering station, and pipeline/fiber optic cable construction corridor. While all age classes of otters are susceptible to high-speed vessels, only pups not yet able to dive (<3 months old) or ill adults are probably susceptible to collision from slow moving (<10 kt [18.5 km/hr]) barges and construction support vessels. Pup collision risk is dependent on pup density and mother attendance. Dependent pups would be most vulnerable to vessel strike when the mother is below the surface foraging. However, Laidre and Jameson (2006) found that otter dive durations during feeding bouts averaged only 55 seconds. Still, USFWS considers a separation of a mother and pup due to a passing vessel a form of take.

Doroff and Badajos (2010) estimated that 2 percent of the otter population in Kachemak Bay die annually from vessel strike (speeds unknown), which would relate to about 120 otters per year, and that many of the otters likely to be struck are already ill or moribund from disease or injury. Thus, while pups at the surface are vulnerable, and would represent a portion of the potential otter mortality or harm due to vessel strike or if separated from its mother, ill adults of all ages appear to be the group most susceptible to vessel strike. These animals represent otters that may be approaching death. Still, fast moving vessels operating in poor visibility conditions (perhaps relying on radar) represent a risk to resting otters. But again, for the Project, the risk is very small given construction and shipping vessels would be operating at slow (<10 kt [18.5 km/hr]) speeds within waters less than 66 ft (<20 m) approaching and leaving the port and lightering station.

5.2.1.2. Steller's Eider

Over-water structures pose a collision hazard for Steller's eiders during periods of low visibility (fog, rain, falling light) because of the bird's natural propensity of flying rapidly at low altitudes (Day et al. 2004). Project structures posing risk include construction cranes, light stanchions, vessel infrastructure, the communications tower, and the port marine components including the access causeway, marine jetty, and concentrate bulk loader. Lights on structures can simultaneously pose a hazard via attraction and a safety measure alerting flying birds of its presence in time to avoid the structure. Day et al. (2005) evaluated the effect of placing anti-collision lights on an artificial oil production island in the Beaufort Sea on migrating eiders and concluded that the lights did cause avoidance, "but the response was inconsistent and not dramatic" and some non-eider species may have been attracted to the island by the lights. Day et al. (2005) also found collision mortality at the island was often associated with moon phase. Migrating eiders, using the full moon to orient, may have confused lighting with the moon causing disorientation and leading to collision. Because Cottonwood Bay, Iliamna Bay, and Iniskin Bay are destinations for wintering eiders, rather than a major migration pathway, the moon phase factor might not be as relevant once birds arrive.

Based on research by Day et al. (2005) and others (Verheijen 1985, Jones and Francis 2003, Marquenie 2007), the Bureau of Ocean Energy and Management (BOEM) stipulated (Lease Stipulation No. 7, Oil and Gas Lease Sale 193 Chukchi Sea) mitigation measures for offshore oil and gas activities in the Chukchi Sea specifically to avoid eider collision. These measures included orienting lighting downward and inward, avoiding high-intensity lighting when not needed, reducing lighting to levels as needed for safe working conditions (extinguishing unnecessary lighting), painting select surfaces with dark or non-reflective colors to decrease light reflectivity, and evaluating lighting wave-lengths (color) for those that might be less attractive (Marquenie 2007).

To reduce collision risk to Steller's eider, PLP would ensure that no extended structures, such as cranes or light stanchions used during construction, remain extended and in place outside the initial construction period. The communications tower would use a monopole tower arrangement that does not require cables to avoid potential impacts to eiders from use of supporting cables. Also, PLP would examine lighting options for the port that are not greatly attractive (such as orienting the lighting downward) but still provide enough light for safe operational activities and to warn approaching birds. Special lighting for anchored bulk carriers would also be examined.

5.2.1.3. Short-Tailed Albatross

Short-tailed albatrosses do not typically occur in the Action Area within Cook Inlet waters where construction activities would occur, therefore eliminating any risk for potential strike or collision with project structures. Supply barges and concentrate bulk vessels could encounter short-tailed albatrosses outside of Cook Inlet waters. Although these vessels could attract the attention of traveling short-tailed albatrosses, these are not fishing vessels and do not release offal or fish discards that would result in a persistent attractant. Furthermore, these vessels are not equipped with large wires or cables over the water that present a hazard to birds examining the surrounds of the vessel.

5.3. 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 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.

5.3.1. Project Components Contributing to the Stressor

5.3.1.1. Northern Sea Otter

The primary issue with incidental spills is the chronic impairment of water quality, which has a likelihood of occurrence only during port operations over several years (although, as mentioned above, PLP will comply with all laws and regulations [40 Code CFR part 110, 18 AAC 75, 33 CFR part 144] to prevent water quality impairment). If such were the case, oil entrained on the bottom sediment could allow oil to get on the fur of an otter feeding on the bottom. Sea otters are especially susceptible to oil fouling their fur and reducing the animal's ability to thermoregulate (Kenyon 1969, Geraci and Williams 1990); pups are most vulnerable. Cimberg and Costa (1985) found that even lightly oiled animals spent an inordinate amount of time and energy grooming to remove the oil, and for the most part only spread it into clean areas and deeper into the fur. Geraci and Williams (1990) described the consequences as such:

> "A more extensive coating of oil would likely have tipped the balance and delivered the otters…in a tightening metabolic spiral: oil fouls the fur, reduces its insulative properties, and increases heat loss; the animal compensates by increasing its metabolic rate which, in turn, it must fuel by consuming more food; but eating gives way to vigorous grooming,

> and that energy squandered on spreading the oil, is not restored; body mass decreases and more heat is lost."

Sea otters can ingest oil when attempted to clean fouled fur, and inhale volatile oils leading to injured lungs and damage to liver and kidneys (USFWS 2019). Intoxication from oil exposure was the major contributing factor to sea otter mortality during the *Exxon Valdez* spill (Geraci and Williams 1990). However, those otters were heavily covered in fresh crude oil. A diesel spill of less than 10 gal (38 L) emanating from an active port is likely to quickly evaporate or dissipate into concentrations too low to intoxicate individual otters. Diesel spills of this magnitude are unlikely to affect sea otters (USFWS 2019).

Incidental spills could occur at the port, lightering facilities, or along the transportation routes, but as mentioned above incidental spill is an issue largely limited to port operations but even here chronic impairment of water quality would be ameliorated by compliance with all relevant laws and regulations (40 Code CFR part 110, 33 CFR part 144). Finally, incidental spill issues would be limited to the immediate vicinity of the port, which is unlikely to be an otter concentration area due to high levels of human activity. Any effects would be to individuals and not the population level.

5.3.1.2. Steller's Eider and Short-tailed Albatross

As with sea otters, incidental fuel spills could affect Steller's eider or short-tailed albatross through direct contact (thermoregulation reduction and ingestion during preening) or consumption of contaminated prey. O'Hara and Morandin (2010) studied the effects of petroleum sheens on pelagic seabirds and found that even very small quantities of oil can change the microstructure of feathers leading to lethal thermoregulation problems in seabirds. However, also as with otters, any chronic impairment of water quality would be confined to the immediate vicinity of the port where eiders are less likely to concentrate due to human activity. Short-tailed albatrosses would not be present at the Diamond Point port or Cook Inlet waters but could come in contacts with small amounts of oil and lubricants that may have been released by a supply barge or concentrated bulk carrier vessel. Any effects would be at the individual level, not the population level.

5.4. 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, 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 L) 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 L). 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, and the ADEC. The USCG requires Vessel Response Plans (VRP) that comply with 33 CFR 155 subparts D, F, G, and I.

5.4.1. 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 in lower Cook Inlet 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, (e.g., 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 11).

Table 11. 50th and 95th percentile spill risk by vessel type (Owl Ridge 2018).

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

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 (7,57 1- to 1.1 million L) range were estimated with a potential occurrence in the thousands of years. These results are consistent with similar studies by the BOEM (2016) that estimated the annual probability of a 300,000-gal (1.1 million L) fuel barge transportation spill to 1.5 x 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 small spills in the 10-gal to 1,000-gal (38 to 3,785 L) range 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

[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.

measures are expected to be effective at reducing the risk of spills in the Aleutian Islands Archipelago from a vessel running aground. PLP vessel routes through the Aleutians Islands Archipelago conform with the IMO measures.

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 feathers and 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 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. Marine birds and sea otters are so dependent on the insulative value of their feathers and fur that even a small amount of fouling can lead to death (Levy 1980, Burger and Fry 1993, O'Hara and Morandin 2010). It is generally accepted that feather fouling is the primary cause of mortality to seabirds in an oil spill event (Leighton 1991), and the *Exxon Valdez* spill in 1989 was thought to have killed nearly 4,000 sea otters in Prince William Sound (DeGange et al. 1994).

5.4.1.1. 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 7.4). 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 Steller's eider or sea otter 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.

5.4.2. 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.

5.4.3. 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 is 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 Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) spill records revealed that releases of hazardous or very hazardous substances besides 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. 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.

5.4.4. 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 poses some level of risk. However, as mentioned in Section 5.4.1, spills >1,000 gal (3,785 L) are not reasonably likely to occur and, therefore, the risk is de minimis. Spills of between 10 and 1,000 gal (38 and 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.

5.4.4.1. Northern Sea Otter

Sea otters are found throughout nearshore habitats of the Action Area and could encounter diesel should an accidental spill occur.

A diesel spill originating at Augustine Rocks could, for the most part, be transported away from areas of more concentrated sea otter use within the bay, but modeling suggests that currents would transport the spill to otters outside the bay, such as those inhabiting the nearshore waters of Shuyak and Afognak islands.

However, a diesel spill located in Iliamna, Cottonwood or Iniskin bays would likely result in a higher risk for sea otters to come in contact with oil, because the more confined nature of these bays would likely limit diesel dispersion (as compared to the Augustine Rocks scenario), and the distance the oil would travel before encountering sea otters would be shorter.

Lethality of either spill scenario is dependent on the concentration of the fuel at the time of animal encounter, which in turn is dependent on the location, time, weather, and cleanup efforts initiated. Neither of the scenarios discussed above consider spill containment and clean up actions. In the event of an accidental diesel spill, Project personnel would initiate containment and cleanup effort to minimize the potential environmental effects. Individual otters could be harmed or killed, but population level effects are unlikely given the ultimately small amount of spill involved.

5.4.4.2. Steller's Eider

Based on SLR Consulting modeling, oil from a spill originating from Augustine Rocks is most likely to transport away from nearshore and southern Kamishak Bay areas where molting and wintering Steller's eiders concentrate. It has been estimated that approximately 2,500 Steller's eiders molt within Kamishak Bay, with most found at Douglas Shoals (Rosenberg et al. 2014), and about 1,700 of these birds winter within the bay, again most in the southern end of the bay (Larned 2006). However, a spill originating between mid-August and May in Iliamna, Cottonwood or Iniskin bays would likely result in a higher risk for Steller's eiders to come in contact with oil. Peak counts in these areas for a given calendar year reported 676 birds (ABR 2015).

Oil may harm individual birds by fouling feathers leading to thermoregulation problems, especially in the winter. However, given the amount of fuel involved in a 1,000-gal (3,785 L) spill, and the spill containment and cleanup efforts, such a spill is unlikely to result in population level impacts to Steller's eiders.

5.4.4.3. Short-tailed Albatross

Oil spills can occur in many parts of the short-tailed albatrosses' marine range outside of Cook Inlet. The Project development would introduce the risk of local marine pollution from spills transfer and transportation of petroleum, oils, and lubricants. Flocks have occasionally been observed at sea numbering in the dozens to low hundreds (USFWS 2008). The birds' habit of feeding at the water's surface makes them vulnerable to oil contamination (USFWS 2008). An oil spill in an area where large numbers of short-tailed albatrosses are rafting could negatively affect the population significantly, however groups of such size are rarely documented in Alaskan waters.

5.5. Effects to Foraging Habitat and Prey

Both northern sea otters and Steller's eiders are primarily benthic feeders. Sessile bivalves are a major component of the otter's diet, although both also feed on crustaceans. In addition, otters feed on urchins where available. The abundance and quality of benthic prey could be affected by the loss of habitat, the introduction of contaminants, or physical forces (i.e., sound).

The Diamond Point port would be at the intersection of Iliamna and Cottonwood bays. Both bays are relatively shallow (mostly less than 40 ft [12.2 m] in depth), with rocky substrates (intertidal reefs and subtidal rocky substrate) along a substantial portion of the shorelines and on many offshore reefs and islets (Stutes et al. 2018). Rock is the dominant substrate into the intertidal zone. Mud or other unconsolidated sediments composing beaches extend from the toe of the rocky habitat down into the subtidal zone. North of Diamond Point, the western side of Iliamna Bay where the Diamond Point access road would be located has generally angular rubble or rocky upper reaches transitioning to mudflats at mid-tidal elevations. An extensive rock buttress projects into the intertidal zone from the base of a high cliff at the face of Diamond Point. At the lower edge of this rock habitat, a sand/mud flat extends to the west into Cottonwood Bay, and to the north into Iliamna Bay. The lower elevations at Diamond Point are composed in part of bedrock like that at higher elevations. However, boulder/cobble habitat is found at the base of the bedrock and forms the upper edge of the lower mudflat. Scattered eelgrass is present along the shoreline between Diamond Point and Williamsport, as well as west of the point in Cottonwood Bay. More extensive reefs and eelgrass beds are found in the larger Iniskin Bay to the north of Iliamna Bay. Minimal rock habitat exists on the northern shore of Ursus Cove in the vicinity of the natural gas pipeline route. Occasional ribs of bedrock and a few large boulders break up the generally uniform gravel and cobble beach (section 3.24.6.1 in USACE 2020).

The Project would result in loss of foraging habitat for northern sea otters and Steller's eiders (details found in Section 6.0). Permanent benthic habitat loss would result from the conversion of natural substrate to manmade structures such as the Diamond Point port marine components. Areas were the substrate is disturbed, such as trenched areas for installation of the natural gas pipeline and fiber optic cable, would recover in the short time resulting in a temporary disturbance. However, areas were substrate disturbance occurs repeatedly, such as dredging of the navigation channel and basin, which would occur every 5 years (approximately), the benthic habitat loss, especially the infaunal prey loss, may essentially be permanent. Following a dredging event, a certain amount of recovery would be expected to occur by recruiting species from the surrounding undisturbed habitats. However, the potential for the dredge area to generate sufficient quantity and quality (size) of prey to be of value to sea otters and Steller's eiders is unknown. Sessile bivalves within permanent impact areas would likely perish as a result of construction activities.

All remaining benthic prey could become contaminated from incidental or accidental spills leading to bioaccumulation or biomagnification of toxins in listed species, although diesel, the most likely petroleum product that could be spilled in any sort of volume, has a low specific gravity and does not sink and, thus, rarely reaches the seafloor.

The primary underwater sound sources of concern – fill placement, dredging, thruster operations, vessel traffic – are all continuous sound sources operating intermittently and/or over short periods. These sounds do not have potential to harm fish (Popper and Hawkins 2019), but laboratory experiments suggest that they can cause stress (but not confirmed in the wild). Potential sound impacts to invertebrates have focused on impulsive sounds.

A literature synthesis conducted by Normandeau Associates, Inc. (2012) on the effects of industrial noise on invertebrates concluded that while some invertebrates were sensitive to low frequency sound, it was yet unclear whether any are sensitive to actual sound pressure. This disconnect makes developing rigid experiments with conclusive results difficult. More recently, Solan et al. (2016) conducted laboratory experiments that exposed benthic invertebrates (e.g., clam, decapod, brittlestar) to both continuous and impulsive sounds representative of industrial shipping and construction noise and found that both sound types can cause changes in behavior including decreased activity level, increased burrowing depth, and increased bioirrigation (burrow flushing) activity. Thus, behavioral response to otter and eider benthic prey due to underwater noise generated by PLP activities is possible, but whether these responses translate to impacts to otter and eider fitness is unknown, and unlikely given the foraging success of otters in lower Cook Inlet bays with much higher vessel noise levels such as Kachemak Bay. Direct noise effects on otters and eiders are likely of much greater concern than effects on prey.

Short-tailed albatrosses are pelagic feeders outside of Cook Inlet and Project construction activities not likely to affect their feeding grounds in the GOA or Bering Sea. Moving vessels outside of Cook Inlet could temporarily displace of scare prey species, but conditions would return to normal shortly after the vessel passes.

6. PROJECT EFFECTS

This chapter includes the analysis of the combined effects from the Project construction, operations, 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). The avoidance and minimization measures PLP would implement to address these impacts are found in Section 7.0.

6.1. Northern Sea Otter

6.1.1. Disturbance

Fill placement can incidentally harass sea otters where underwater sound levels from placement of fill exceed 160 dB re 1 µPa (rms). USFWS does not recognize 120 dB re 1 µPa (rms) as the Level B threshold for continuous noise, largely because sea otters spend so little time underwater that there are no long-term exposure effects. Consequently, the 160 dB re 1 µPa (rms) threshold for sea otters applies to both impulsive and continuous noise types.

The USFWS has identified "hazard area" radii for various noise-producing construction activities, including fill placement, which assume that any listed sea otter occurring within a hazard area during fill placement would be acoustically "taken" under ESA. Sea otter take is avoided by using trained PSOs to monitor hazard areas and ensure no otters are present within a hazard area at activity initiation, and by initiating shut down of noise-generating activities at the approach of an otter to a hazard area. These are promulgated under the *Observer Protocols for Pile Driving, Dredging and Placement of Fill* (Enclosure 1, USFWS 2015) that were established during the Northern Sea Otter Programmatic Consultation between the USFWS and USACE (Consultation #2013-0016), and includes monitoring times before and after activity, observer qualifications, equipment, and observation recording procedures. For fill placement, the hazard area radius is 984 ft (300 m), although the use of caissons may remediate some noise concerns. (A similar hazard area would be monitored during anchor placement.) By using PSOs to effectively monitor the hazard area and shutting down activities as needed to avoid acoustical take, PLP would limit the potential for fill placement activities to significantly disturb otters.

Available evidence suggests that sea otters are little disturbed by vessel noises. For example, sea otters are well habituated to the heavy vessel traffic noise in the busy Unalaska Bay fishing port, and other ports in Alaska such as Kachemak Bay. Sea otters might react to the presence of cavitation noise from bow thrusters (anchor handling tugs) but based on measurements by LGL/JASCO/Greeneridge (2014), noise levels exceeding the 160-dB Level B threshold range to only 243 ft (74 m). Sea otters would likely avoid and remain away from an operating tugboat during bow operations. However, sea otters in Iliamna, Cottonwood and Iniskin bays have had little exposure to vessels, especially during the winter, and may react more strongly to vessel presence regardless of underwater noise levels, and the collective construction activities might temporarily (occasionally) displace otters from feeding or resting (rafting and haulout) areas.

Sea otters do not appear to overreact to underwater noises in general. Davis et al. (1988) experimentally exposed sea otters in Alaska and California to underwater sounds including sea otter pup calls, killer whale calls, and underwater acoustic devices designed to drive marine mammals away from oil spills. They found that depending on the acoustic level, they could elicit a startle response resulting in otters moving away from the noise source, but response distance was limited to about 238 ft to 656 ft (100 m to 200 m) and the animals quickly (hours to 3-4 days) habituated to the noise sources.

Annual port of calls associated with port operations include 29 supply barge calls, 4 fuel barge calls, 27 concentrate ship calls, and 162 lightering barge calls. Collectively, this vessel traffic would increase underwater noise levels in the operations Action Area, although disturbance from a passing vessel would be temporary. However, sea otters in Cottonwood, Iliamna and Iniskin bays have had little exposure to vessels and may react more strongly to their presence, and the collective construction activities might repeatedly displace otters from feeding or resting (rafting or haulout) areas. Three haulout sites in the Action Area – White Gull, Pomeroy, and Iniskin Islands – support large numbers of sea otters, especially in the winter. White Gull Island is located only 0.4 mi (0.6 km) from the vessel travel lane going into the proposed port, while Iniskin Island (1.5 mi [2.4 km]) and Pomeroy Island (2.6 mi [4.2 km]) are also relatively close to the lane. Repeated flushing of hauled otters might occur and is considered a form of take. In addition, increased vessel traffic could lead to mother/pup separation events, also a form of take. It is possible that otters would eventually become habituated to vessel traffic, but the frequency of traffic associated with the lightering barges in particular could increase the overall stress budget of local otters.

Thus, given the initial exposure of a large population of naïve sea otters to a dramatic increase in vessel (chronic exposure) and the potential for two forms of take (repeated flushing of hauled out otters and separation of mother/pup pairs), the Project poses a significant visual and underwater noise disturbance risk to sea otters.

6.1.2. Vessel Strike

In general, vessel strike is not considered a major risk to sea otters given their mobility and, in the case of this Project, the limited speed of pipeline construction barges and support vessels. Sea otter pups in their first few months of life are too buoyant to escape dive and may not be able move away from an approaching vessel, leading to an unknown risk of injury or mortality. Still, the risk of pup mortality due to vessel strike is low given their numbers and their potential “rescue” by attending mothers. Adult sea otters, usually those that are ill or injured, are occasionally struck by vessels, but there is no evidence that these otters are susceptible to strike from slow vessels traveling at <10 kt (18.5 km/hr) unless they are completely incapacitated and approaching death. Still, the risk of vessel strike mortality to sea otters is possible, especially during port operations when lightering barges would make approximately 162 roundtrips annually within critical habitat, but the risk to individual otters is considered very low based on limited vessel speeds.

6.1.3. Incidental Spill

Sea otters are found in shallow waters where port construction and operation and associated incidental spills or fuel transfer 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 Code 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. Considering implementation of spill prevention plans the amount of a potential spill (e.g., small fuel transfers, leaking lubricants) would be very small (by definition less than 10 gal [38 L]) and would quickly dissipate. The risk would be negligible relative to impairing individual sea otters or the population as a whole.

6.1.4. Accidental Spill

As discussed in Section 5.4, the risk of a significant oil or chemical spill associated with the proposed port operations is measured in one event per hundreds or thousands of years. 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, 18 AAC 75, and 33 CFR part 144. Based on oil spill risk (Table 11) and spill fate modeling the risk for a small accidental diesel or chemical spill risk is negligible and the effect would be small in magnitude. Spills larger than 1,000 gal [3,785 L] or chemical spills are improbable. Therefore the risk to sea otter from potential exposure and accidental still range from improbable to negligible.

6.1.5. Effects on Habitat

6.1.5.1. Effects on Critical Habitat

Effects on sea otter critical habitat in Iliamna and Cottonwood bays include the permanent loss of benthic feeding habitat in 98 ac (39.7 ha) from the placement of Project structures below the HWM and dredging of the navigation channel and basin (Table 12). In addition, approximately 89 ac (36 ha) (Table 12) of benthic habitat would be temporarily lost from Iliamna and Cottonwood bays. 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. The 3.6 mi (5.8 km) natural gas pipeline and fiber optic in Cottonwood Bay would be installed in a trench within the tidal zone during low tide, and backfilled or naturally allowed to backfill. This disturbance would also be temporary. Temporary benthic habitat disturbance is expected to recover and return to normal conditions in the short term. Port construction, dredging, and trenching represent a loss of sea otter foraging and escape habitat affecting PCEs 1, 2, and 4 (Section 4.1.1.1). There is no impact to PCE #3 as there are no known kelp forests (with canopy overstories) within the Action Area (Stutes et al. 2018).

Approximately 10.4 mi (16.7 km) of the 75 mi (120.7 km) natural gas pipeline and fiber optic cable would occur within northern sea otter critical habitat in Ursus Cove equating to about 145.0 ac (58.7 ha) of temporary disturbance to benthic habitat from trenching and side-casting of material. The lightering station anchors would result in a permanent loss of <0.1 ac (<0.1 ha) of critical habitat in Iniskin Bay.

In summary, effects to sea otter critical habitat include the permanent loss of 98 ac (39.7 ha) and temporary loss of 234 ac (94.7 ha) of benthic habitat. However, the amount of critical habit affected is an extremely small portion of the total critical habitat designated for this species (5,791 mi^2 [15,000 km^2]). That said, because there is a permanent loss of critical habitat at a location where otter use is relatively high, and the loss directly affects infaunal prey species that would be removed by the dredging (and dredging would be repeated every 5 years limiting the ability of clams, for example, to reach mature sizes), the effect is considered significant.

Table 12. Project construction footprint benthic habitat loss in northern sea otter critical habitat.

Location	Facility	Activity	Habitat Loss Effect	
			Permanent	**Temporary**
Iliamna Bay	Diamond Point port access road	Road construction	19.1 ac (7.7 ha)	7.2 ac (2.9 ha)[a]
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)[a]
Iliamna Bay	Diamond Point port	Construction and maintenance navigation channel and turning basin	71.4 ac (28.9 ha)	9.7 ac (3.9 ha)[a]
Cottonwood Bay	Natural gas pipeline and fiber optic cable	Installation trench	--	69.1 ac (28 ha)
Subtotal Sea Otter Critical Habitat Cottonwood and Iliamna Bays			**98 ac (39.7 ha)**	**89 ac (36 ha)**
Ursus Cove	Natural gas pipeline and fiber optic cable	Installation trench	--	145.0 ac (58.7 ha)
Iniskin Bay	Lightering station	Anchor placement footprint	<0.1 ac (<0.1 ha)	--
Total Sea Otter Critical Habitat Impacts			**98 ac (39.7 ha)**	**234 ac (94.7 ha)**

[a] 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)

6.1.5.2. Effects on Foraging Habitat and Prey

Northern sea otter foraging habitat within the Action Area extends beyond the limits of the critical habitat boundaries (out to the 66-ft [20 m] depth contour). Construction of the natural gas pipeline and fiber optic cable would temporarily disturb an additional 119.0 ac (48.2 ha) of foraging habitat in the approach to Ursus Cove. The total acreage of impacts to sea otter foraging habitat is therefore calculated by adding this number to the area identified within the sea otter critical habitat in Section 6.1.5.1. Effects on foraging habitat include a total loss of 98 ac (39.7 ha) of benthic habitat, and a temporary loss of 353 ac (143 ha).

6.2. Steller's Eider

6.2.1. Disturbance

Port and pipeline construction would each occur over one summer season. Direct encounters with Steller's eiders would, therefore, potentially occur only after mid-August when birds begin arriving in Kamishak Bay to begin molting. Most summer molting occurs in the lagoons along the north side of the

Alaska Peninsula and at Kuskokwim Shoals at the north end of Kuskokwim Bay, but Rosenberg et al. (2014) recently discovered approximately 2,500 Steller's eiders molting in Kamishak Bay, mostly in the Douglas Shoals area. It is unclear how the distribution of these late summer eiders might overlap with construction activities at Cottonwood, Iliamna, and Iniskin bays, and Ursus Cove. ABR (2015) did not observe them in the Action Area until early November and they remained there through April. The molting process would limit the birds' flying ability and possibly their ability to avoid construction activities.

Wintering birds are expected to move back and forth through the port and vessel operation area during the winter. There are no underwater noise concerns with this bird, but vessel traffic could disturb resting flocks of eiders, although effects are expected to be temporary. Still, repeated disturbance of eider flocks could lead to increased stress and reduced fitness during the already stressful winter period.

Because molting and wintering are both energetically stressful periods for Steller's eiders (although the number of molting birds that might occur in the construction areas is unknown), the Project poses a very low disturbance risk to these birds.

6.2.2. Vessel/Structure Collision

Construction vessels would be present in the late summer when Steller's eiders begin arriving in Kamishak Bay (south of the Action Area) to molt, although the numbers of molting eiders that might occur in the construction Action Area or the vessel travel corridors are unknown. Therefore, there is a low risk of eider collision with construction vessels. There is also a very low risk for late summer eiders striking elevated construction equipment such as cranes and light stanchions (especially if their flight activity is limited by molting).

Based upon previous vessel collision risk modeling conducted by USFWS elsewhere in Alaska, and the plan for bulk carriers to be stationed outside critical habitat, the risk of eiders colliding with PLP vessels is low. Further, PLP would investigate lighting options to both reduce attracting eiders to lighted fixtures such as light stanchions to assist birds in early detection of hazards. Other options include reducing lighting to only levels needed for safe operation of the port and Project vessels including extinguishing unnecessary lighting. Regardless, the port, lightering station, and project vessels all represent new elevated structures in their marine environment and a new anthropogenic threat for eiders. The communication tower would be constructed on land 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. This may pose an attraction to eiders and collision hazard during poor visibility conditions. Therefore, a very low collision risk for individual Steller's eiders remains regardless of mitigation.

6.2.3. Incidental Spill

An incidental spill during port or pipeline construction could lead to a surface sheen of oil, which, if contacted, may be sufficient to impair the ability of a sea duck to efficiently thermoregulate. However, an incidental spill is most likely to occur at the port where cleanup response would be rapid and human activity high enough to limit eider use of the affected area. It is unlikely (but not impossible) such a spill would contact an eider before cleanup or dissipation. The risk to Steller's eiders from incidental spills is considered negligible.

6.2.4. Accidental Spill

Wintering Steller's eiders could be greatly affected if they were present during a large spill of diesel fuel especially since only a small amount of petroleum can lead to lethal thermoregulation problems (O'Hara and Morandin 2010). However, spill risk modeling (Table 11) indicates that large diesel spills (>1,000 gal [>3,785 L]) are improbable (one event per thousands of years). The likelihood of a small (10 to 1,000 gal [38 to 3,785 L]) spill is greater than a large spill, but the risk is negligible (one event per hundreds of years). Therefore, the risk to Steller's eiders from potential exposure and accidental still range from improbable to negligible.

6.2.5. Effects on Habitat

6.2.5.1. Effects on Critical Habitat

Steller's eider critical habitat occurs at the Kuskokwim Shoals unit molting area and at three molting/wintering areas along the northwest coast of the Alaska Peninsula (Izembek Lagoon, Nelson Lagoon, and Seal Island units). None of these areas would be affected by PLP's proposed construction activities in Cook Inlet. Therefore, the Project poses no risk to Steller's eider designated critical habitat.

6.2.5.2. Loss of Foraging Habitat and Prey

Wintering Steller's Eiders usually occur in waters less than 33 ft (10 m), so are usually near the shore except where shallows extend farther offshore in bays and lagoons or near reefs (USFWS 2002). While in marine environments Steller's eiders feed on a variety of crustaceans, bivalves, gastropods, and polychaete worms (Metzner 1993).

Construction of Project facilities in Iliamna and Cottonwood bays would result in the permanent loss of 98 ac (39.7 ha) of benthic feeding habitat (waters less than 33 ft [10 m] deep) from the placement of Project structures below the HWM and dredging of the navigation channel and basin; and the temporary loss of 89 ac (36 ha) of benthic habitat (Table 13). Temporary impacts would result from disturbance of sediments and are expected to recover and return to normal conditions in the short term. Additional temporary impacts to benthic habitat include 99 ac (40 ha) in Ursus Cove and 19 ac (8 ha) near Anchor Point from natural gas pipeline and fiber optic installation trenching activities (Table 13).

Most of the permanent benthic habitat loss would result from dredging activities for construction, and subsequent maintenance, of the navigation channel (71.4 ac [28.9 ha])) in sand/fine nearshore habitat (Figure 27). Approximately 30 ac (12.1 ha) of the navigation channel and basin would be in sand/fine subtidal nearshore habitat. The majority of Steller's eiders observed during ABR's (2015) helicopter surveys between 2006 and 2012 (Figure 37) corresponded with sand/fine nearshore subtidal habitats (Figure 27), with large numbers of eiders observed in Iliamna Bay just offshore of Diamond Point (near the proposed dredge channel). Infauna of this habitat is dominated numerically by a variety of smaller polychaetes; but, in terms of biomass, by larger polychaetes (*Nephtys* spp.) and bivalves (e.g., *Macoma* spp., *Yoldia hyperborean*) (Pentec Environmental Inc. 2012). These are typical prey species of Steller's eiders (Metzner 1993). Iliamna and Cottonwood bays include a total of 1,695 ac (686 ha) of sand/fine subtidal nearshore habitat. Port dredging activities would permanently affect approximately 2 percent (30 ac [12.1 ha]) of the sand/fine nearshore subtidal habitat in Iliamna Bay used by Steller's eiders. The remaining permanent impacts (68 ac [27.5 ha])) would take place in intertidal habitats where Steller's eiders were rarely observed. While the loss of benthic habitat due to dredging is small relative to Iliamna Bay, or available wintering habitat in general, the loss does occur in an area where wintering eiders concentrate (Figure 37). As a result, the loss is considered significant.

Table 13. Project construction footprint benthic habitat loss in Steller's eider foraging habitat.

Location	Facility	Activity	Habitat Loss Effect	
			Permanent	Temporary
Iliamna Bay	Diamond Point port access road	Road construction	19.1 ac (7.7 ha)	7.2 ac (2.9 ha)[a]
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)[a]
Iliamna Bay	Diamond Point port	Construction and maintenance navigation channel and turning basin	71.4 ac (28.9 ha)	9.7 ac (3.9 ha)[a]
Cottonwood Bay	Natural gas pipeline and fiber optic cable	Installation trench	--	69.1 ac (28 ha)
Subtotal Steller's Eider Foraging Habitat - Cottonwood and Iliamna Bays			**98 ac (39.7 ha)**	**89 ac (36 ha)**
Ursus Cove	Natural gas pipeline and fiber optic cable	Installation trench	--	99.0 ac (40.0 ha)
Anchor Point	Natural gas pipeline and fiber optic cable	Installation trench	--	19.0 ac (8.0 ha)
Total Steller's Eider Foraging Habitat Impacts			**98 ac (39.7 ha)**	**207 ac (83.8 ha)**

[a] 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)

6.3. Short-tailed Albatross

6.3.1. Disturbance

Short-tailed albatrosses are primarily a shelf edge species in Alaska. Potential encounters with proposed vessel traffic are limited to where the route crosses Bering Sea shelf edge waters near Dutch Harbor, Unimak Pass, or the GOA. This species commonly feeds on offal from fishing factory ships and is relatively immune to vessel noise. During the non-breeding season (mid-July through late October) these albatrosses forage in the Bering Sea off the Aleutian Islands at the water's surface mainly at night or twilight and rest during the day. Vessel traffic may disturb birds, although the probability of a vessel encountering an albatross such that it would result in a behavioral effect is unlikely and the risk of disturbance is negligible.

6.3.2. Vessel Collision

Project vessels would transit through the GOA and Bering Sea when short-tailed albatrosses are foraging. Albatrosses often fly around vessels and risk vessel collisions during darkness and periods of inclement weather. However, the greatest concern for albatross vessel collisions are fishing trawlers as the birds are attracted to the offal they produce, and not with marine transport vessels. Vessel traffic corridors that would be used by the supply barges and bulk concentrate vessels are used annually by thousands of vessels (Section 2.4.7) and the addition of Project vessels would be a negligible increase in the overall vessel collision risk. The risk of vessel collision is negligible.

6.3.3. Incidental Spill

Albatrosses are not found in the Diamond Point port or the lightering station waters, where incidental spills are most likely to occur. Because there is no exposure pathway, there is no effect to short-tailed albatross from incidental spills.

6.3.4. Accidental Spill

The greatest risk to short-tailed albatrosses from vessel activity would be from an oil spill event resulting from a vessel grounding in the Aleutian Islands. Oil spill trajectories north or south of the pass could reach short-tailed albatross feeding habitat. The IMO has adopted measures to reduce the risk of pollution and damage to the environment (section 5.4.1), which are expected to be effective at reducing the risk of spills in the Aleutian Islands Archipelago from a vessel running aground. PLP vessel transportation corridors across the Aleutian Islands are consistent with the IMO guidance. Furthermore, based on spill risk modeling (Table 11), the likelihood of a large (<1,000 gal [3,785 L]) spill is improbable, and the risk of a smaller spill (10 gal to 1,000 gal [(38 to 3,785 L]) is negligible. Therefore the risk to short tail albatross from potential exposure and accidental spill ranges from improbable to negligible

6.3.5. Effects on Critical Habitat

There is no critical habitat designated for this species in the U.S.

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. Most of the construction activities would occur after wintering eiders have returned to northern breeding grounds but before the late-summer arrival of molting birds thereby avoiding temporal overlap with these birds from May to mid-August.

Minimization measures include:

- Removing the alternate lightering location west of Augustine Island from the Project to minimize lightering barge traffic through sea otter foraging habitat.
- 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 PSOs to monitor shutdown safety zones during activities that produce excessive underwater noise levels (e.g., fill placement).
- Reducing vessel speeds to 10 kt (18.5 km/hr) while operating within sea otter foraging habitat.
- Using state-of-the-art double-hulled barges to transport diesel fuel.
- Developing a lighting plan to reduce construction and operation lights that might attracted eiders or implement lighting that might assist eiders in early detection of structures.

7.1. Mitigation Measures – Sediment Control

Construction mitigation measures for this Project would follow standard construction practices, including sediment control BMPs, to avoid or minimize sediment in the water column. 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. 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 sea otters, PLP would develop and implement a Marine Mammal Monitoring and Mitigation Plan (4MP). 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 around the fill placement activities, and employing PSOs to monitor these zones and initiate activity shutdown as needed to prevent harassment take of sea otters. (Construction associated with the lightering facility and pipeline is not expected to produce underwater noise levels sufficient to require monitoring by PSOs.) The PSOs would follow an established set of protocols, which apply to species under both USFWS and NMFS jurisdictions, 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/Structure Collision

The following measures would be implemented to mitigate potential vessel/structure collision for northern sea otters and Steller's eiders:

- PLP will not utilize an alternate lightering location initially proposed west of Augustine Island to minimize lightering barge traffic through sea otter foraging habitat.
- Vessel speeds would be limited to 10 kt (18.5 km/hr) for all Project construction vessels operating inside the northern sea otter critical habitat.
- During operations, supply barges, fuel barges, and concentrate bulk vessels would travel at their normal cruising speeds when entering lower Cook Inlet but would reduce speeds to less than 10 kt (18.5 km/hr) when entering sea otter foraging habitat (delimited by the 66-ft [20 m] depth contour), (although normal barge speeds rarely exceed 10 kt [18.5 km/hr]). All lightering barges would operate at speeds less than 10 kt (18.5 km/hr).
- Guide cables will not be used to secure the communications tower to minimize avian collision risk.

- Electronically transmitted (virtual) aids to navigation will be used to avoid the need of physical aids to navigation on water.
- PLP would develop a lighting plan to reduce construction and operation lights that might attracted eiders or implement lighting that might assist eiders in early detection of structures, including:
    - PLP would follow USFWS best practices for communication tower lighting by avoiding or minimizing the use of lights or utilizing flashing lights options that comply with FAA requirements.
    - Any light stanchions or equipment located on the causeway/marine jetty during the first summer of construction would be lowered or removed before winter if not in use, thereby reducing or eliminating eider collision risk.
    - Utilize lighting options for the causeway and jetty that minimize bird attraction (such as orienting the lighting downward) while still providing enough light for safe operational activities.
    - Mitigation lighting for anchored bulk carriers would also be examined.

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 sea otters in the Aleutian Island region.

7.4. Mitigation Measures – Accidental Spill

To reduce the risk of an accidental spill event, the following mitigation measures would 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 gal [15 million L]) 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, 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 of 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 5.4.1.

8. DETERMINATION OF EFFECTS

Determinations of Project effects on northern sea otters, Steller's eiders, and short-tailed albatrosses, based on the risk posed by the four potential stressors (disturbance, collision, incidental spill, accidental spill) evaluated in Section 6.0, are presented below. Risks to northern sea otter and Steller's eider critical habitat are also evaluated. A compilation of the determinations is provided in Table 14.

8.1. Northern Sea Otter

8.1.1. Species Determination

The determination for northern sea otters is ***May Affect, Likely to Adversely Affect*** based on the high volume of vessel traffic proposed during Project operations in Iliamna and Iniskin bays coupled with the high density of sea otters occurring there that are potentially unaccustomed to such traffic levels. Vessel encounters with sea otters could lead to events considered by USFWS as take (e.g., separation of mothers and pups, repeated disturbance of hauled out groups or individuals).

8.1.2. Critical Habitat Determination

The determination for northern sea otter critical habitat is ***May Affect, Likely to Adversely Affect*** as construction activities would result in a loss (port construction, dredging, and anchor block placement) and disturbance (pipeline trenching) of habitat, especially benthic foraging habitat. However, the amount of critical habitat affected is extremely small compared to the total habitat designated (5,791 mi^2 [15,000 km^2]).

8.2. Steller's Eider

8.2.1. Species Determination

The determination for Steller's eider is ***May Affect, Likely to Adversely Affect*** based on a permanent loss of benthic foraging habitat in Iliamna Bay due to initial and maintenance dredging. While the loss is but a small fraction of the available habitat in the bay, it does occur in an area where large groups of wintering Steller's eiders have been repeatedly observed (ABR 2015; Figure 37).

8.2.2. Critical Habitat Determination

The Project would have ***No Effect*** on critical habitat designated for Steller's eiders. All critical habitat occurs well outside the Action Area.

8.3. Short-tailed Albatross

8.3.1. Species Determination

The determination for short-tailed albatross is ***May Affect, Not Likely to Adversely Affect*** based primarily on very negligible risks of disturbance and collision with vessel traffic in the GOA and Bering Sea.

8.3.2. Critical Habitat Determination

There is currently no critical habitat designated for the short-tailed albatross.

Table 14. Determination of effects for each ESA-listed species potentially occurring within PLP's proposed Action Area.

Species	Overall
Northern Sea Otter	Likely to Adversely Affect
Northern Sea Otter Critical Habitat	Likely to Adversely Affect
Steller's Eider	Likely to Adversely Affect
Steller's Eider Critical Habitat	No Effect
Short-tailed Albatross	Not Likely to Adversely Affect

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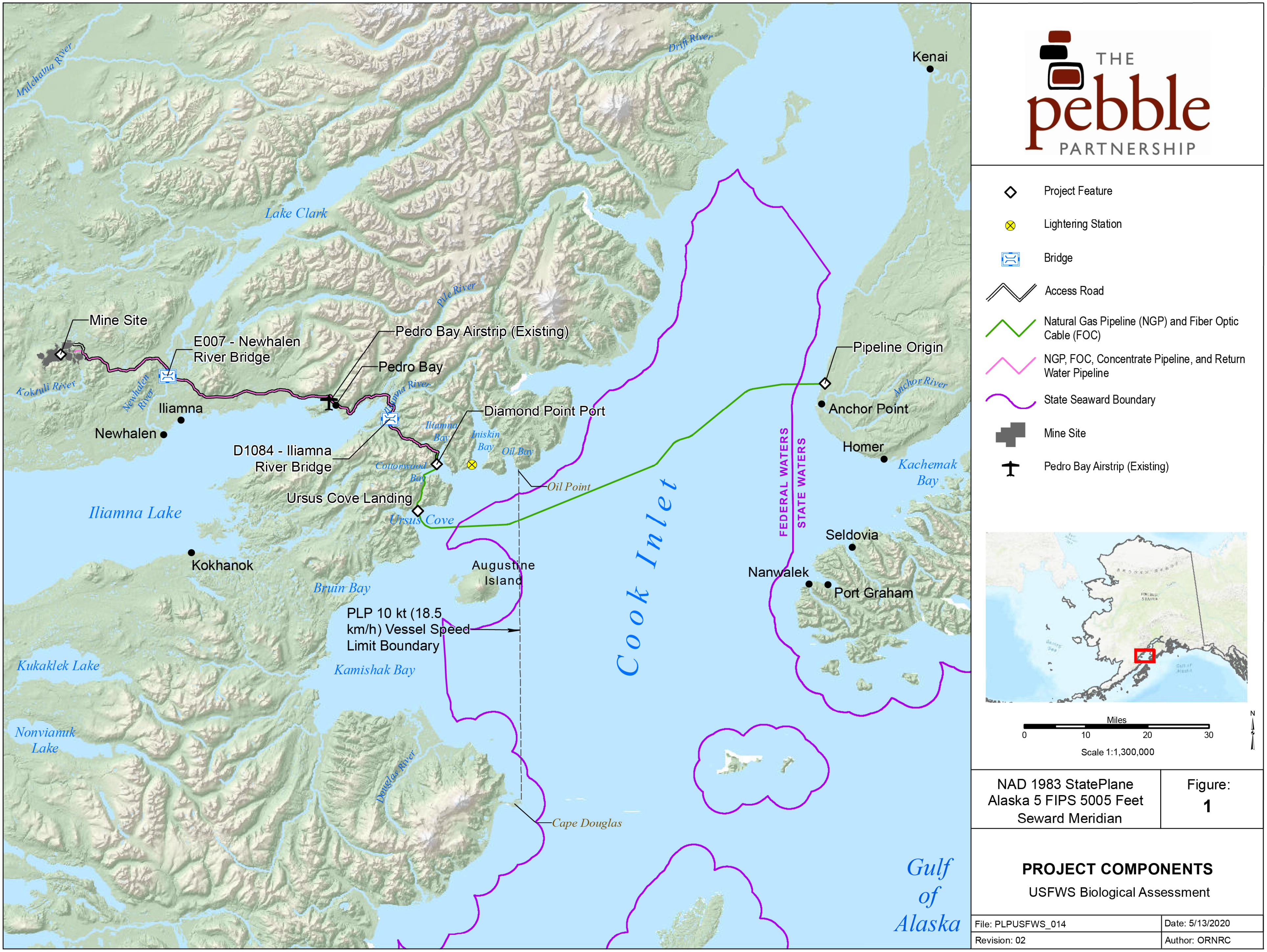
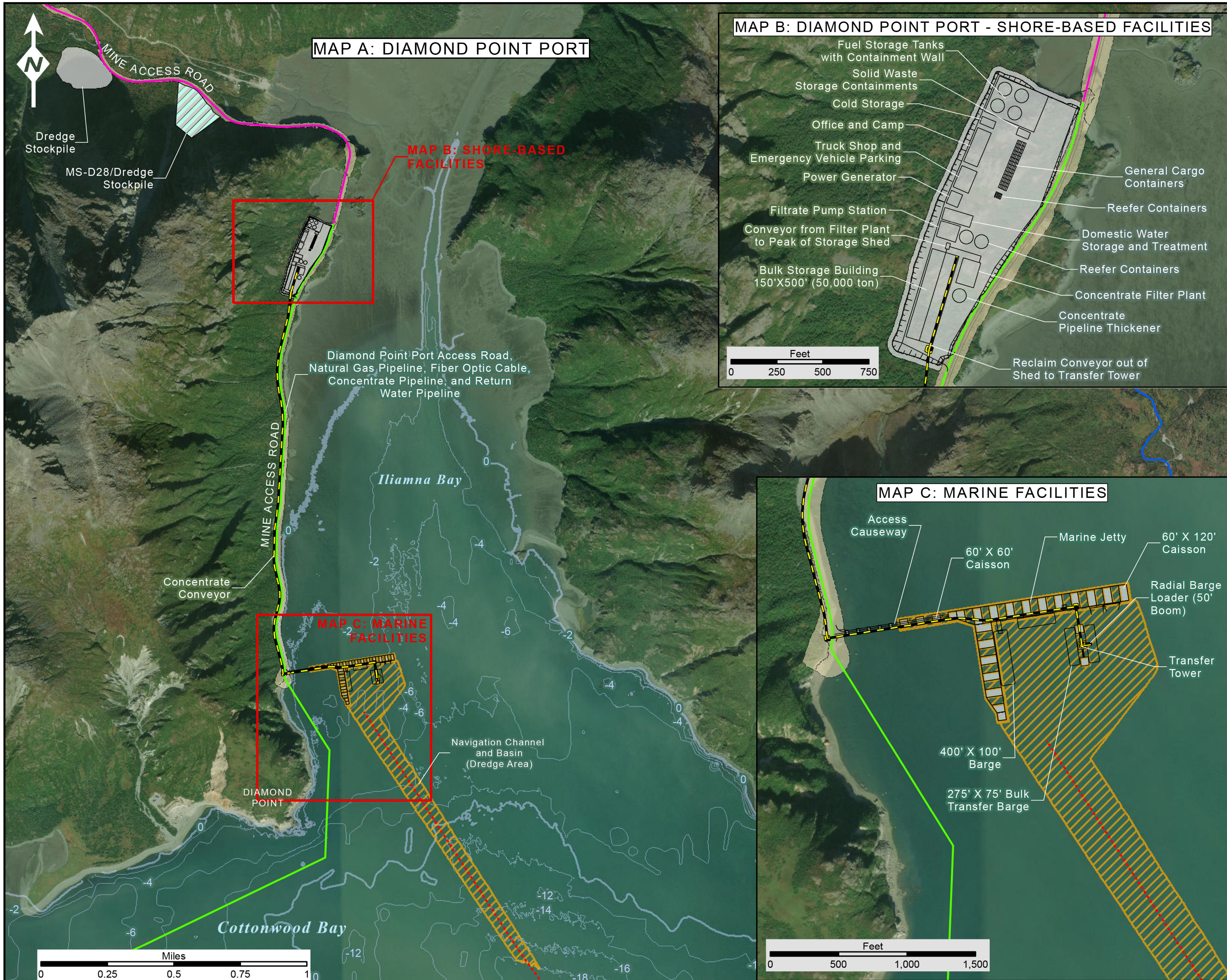
FIGURES

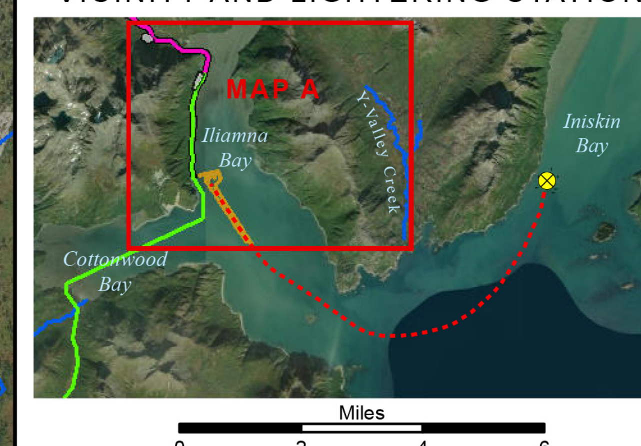


Mulchatna River
Drift River
Kenai
Lake Clark
Pile River
Mine Site
E007 - Newhalen
River Bridge
Pedro Bay Airstrip (Existing)
Pedro Bay
Kokruli River
Newhalen River
Iliamna River
Iliamna
Newhalen
Diamond Point Port
Iliamna Bay
Iniskin Bay
Oil Bay
D1084 - Iliamna
River Bridge
Cottonwood Bay
Oil Point
Ursus Cove Landing
Ursus Cove
Iliamna Lake
Pipeline Origin
Anchor River
Anchor Point
Homer
Kachemak Bay
FEDERAL WATERS
STATE WATERS
Cook Inlet
Seldovia
Kokhanok
Augustine
Island
Bruin Bay
Nanwalek
Port Graham
PLP 10 kt (18.5
km/h) Vessel Speed
Limit Boundary
Kukaklek Lake
Kamishak Bay
Nonvianuk
Lake
Douglas River
Cape Douglas
Gulf
of
Alaska
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
N
NAD 1983 StatePlane
Alaska 5 FIPS 5005 Feet
Seward Meridian
Figure:
1
PROJECT COMPONENTS
USFWS Biological Assessment
File: PLPUSFWS_014
Date: 5/13/2020
Revision: 02
Author: ORNRC



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



Scale 1:23,500

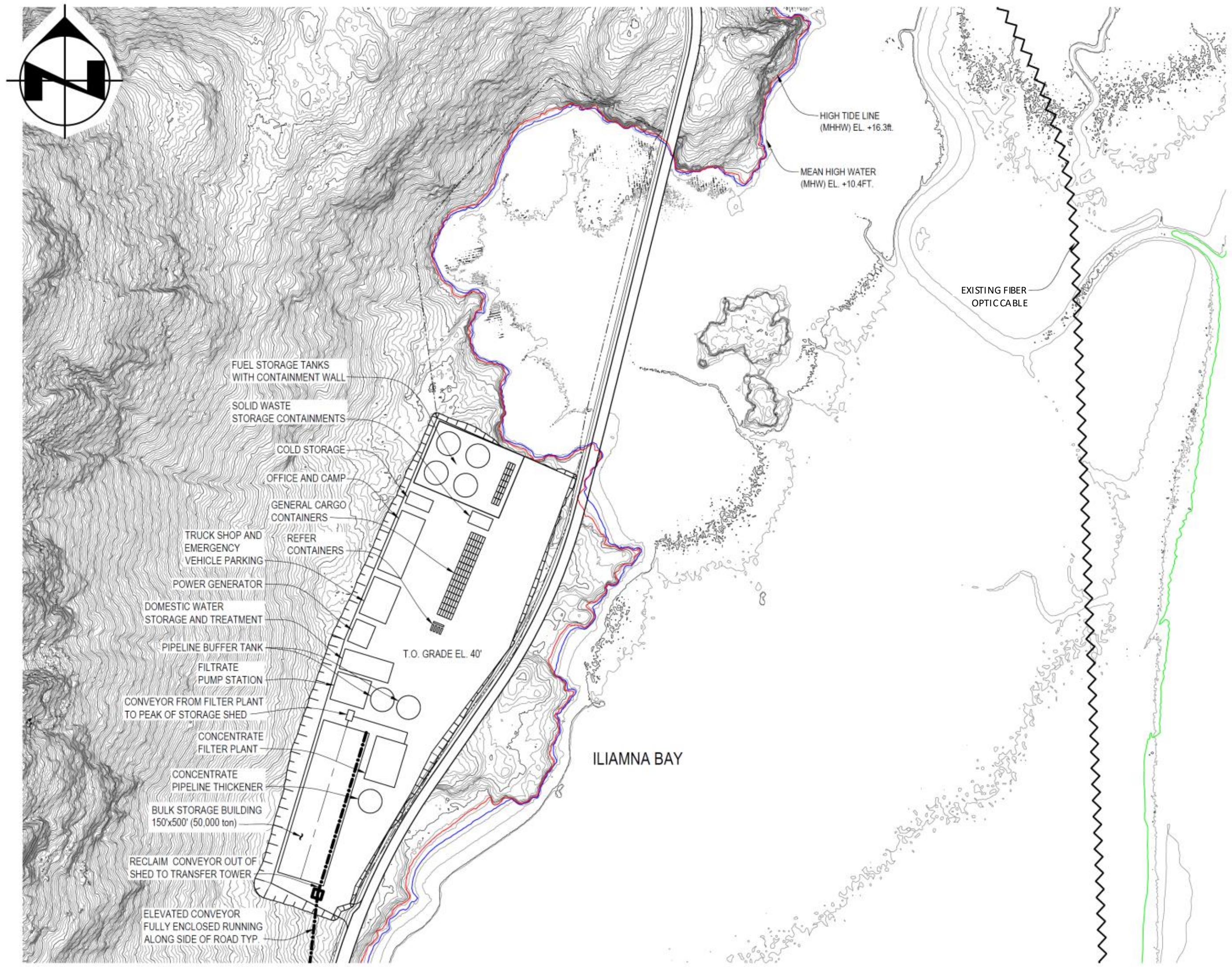
NAD 1983 StatePlane Alaska 5 FIPS 5005 Seward Meridian

Figure: 2

DIAMOND POINT PORT AND LIGHTERING STATION

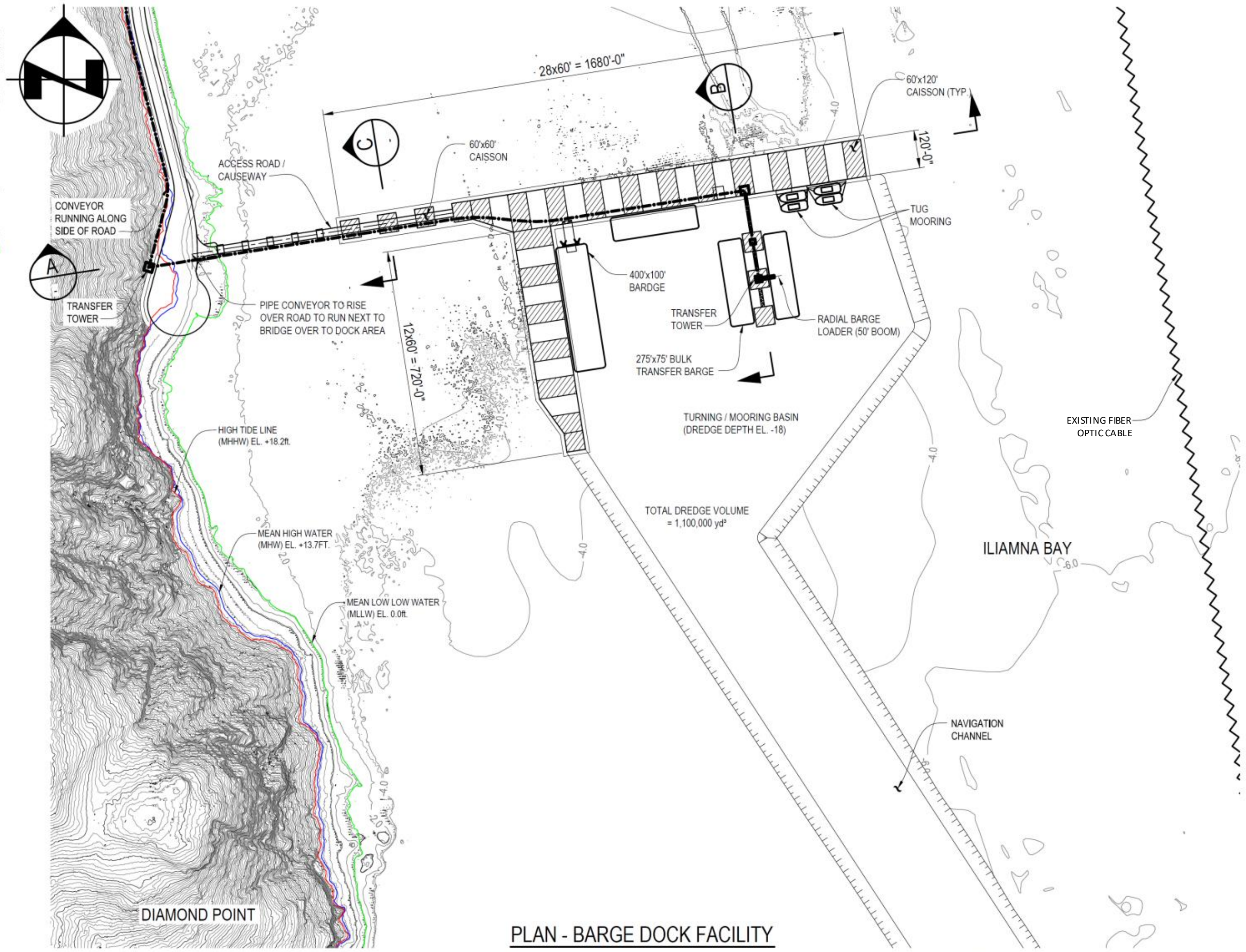
USFWS Biological Assessment

File: PLPUSFWS_030 | Date: 5/20/2020
Revision: 02 | Author: ORNRC



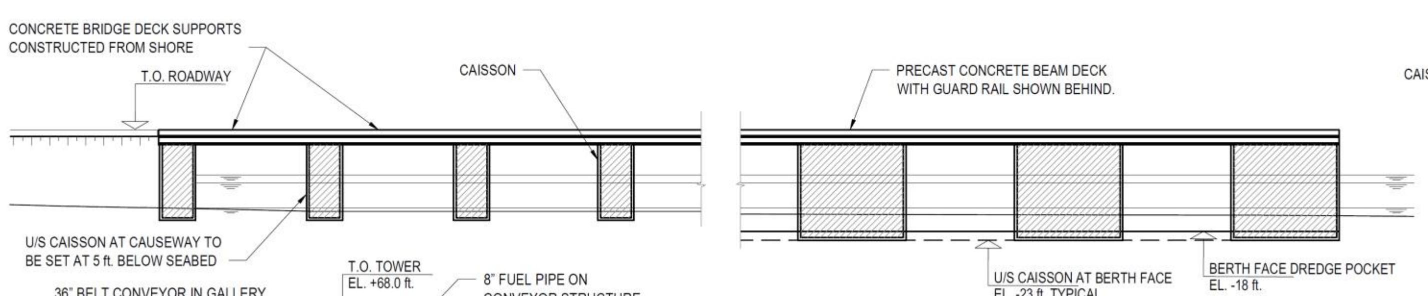
PLAN - CONCENTRATE TERMINAL FACILITIES

1" = 250'



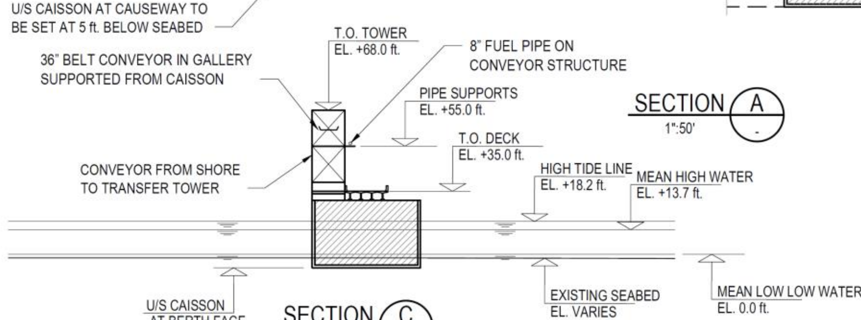
PLAN - BARGE DOCK FACILITY

1" = 250'



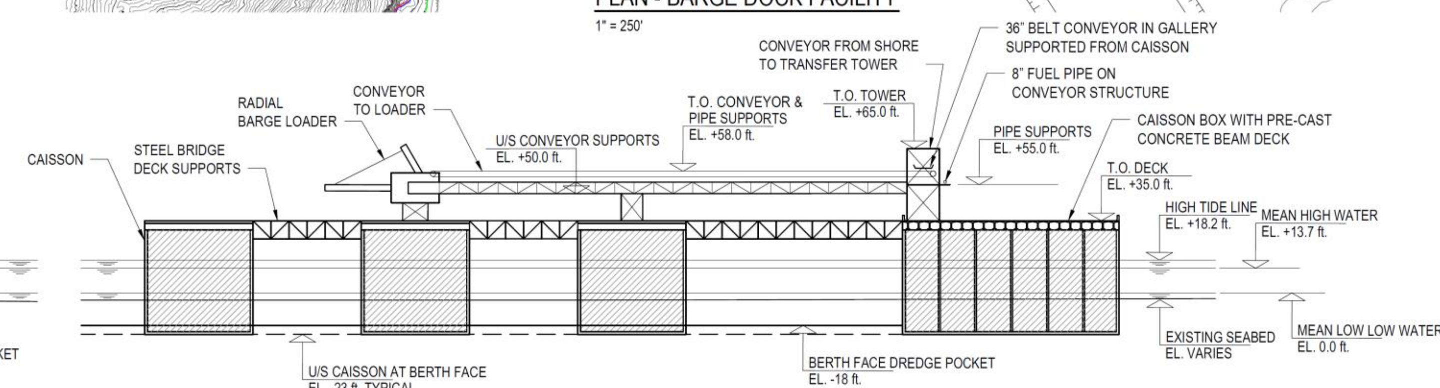
SECTION A

1":50'



SECTION C

1":50'



SECTION B

1":50'

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'

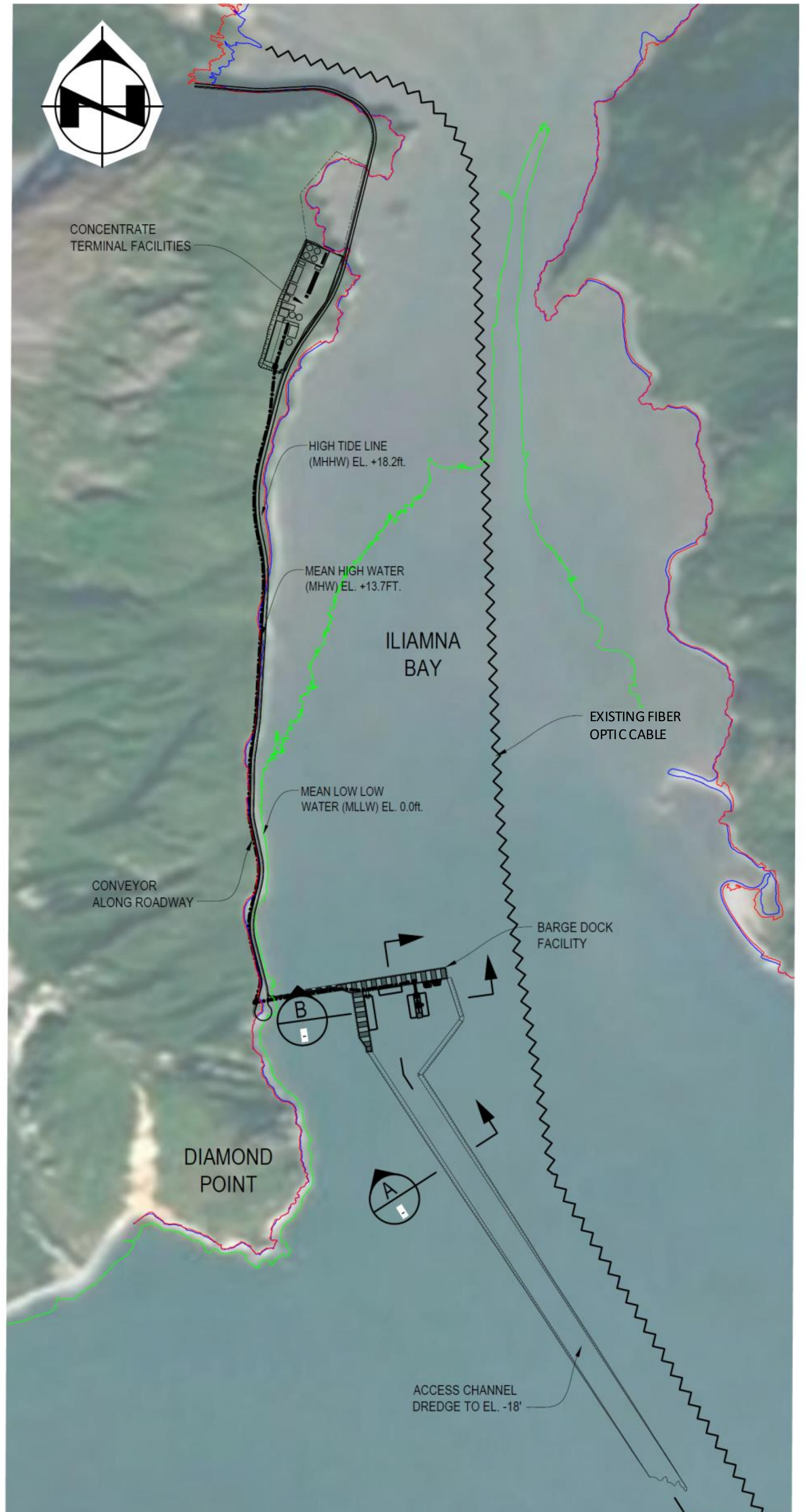
THE pebble PARTNERSHIP

FIGURE 3

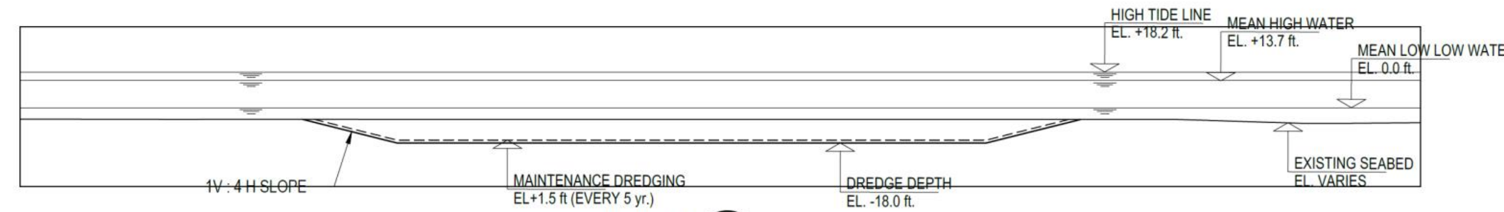
DIAMOND POINT PORT PLAN AND CROSS SECTION VIEW

USFWS Biological Assessment

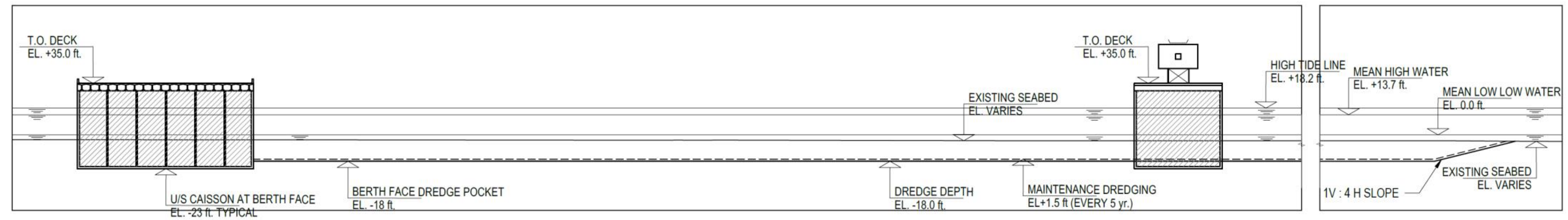
File: PLPUSFWS_032	Date: 5/8/2020
Revision: 00	Author: ORNRC



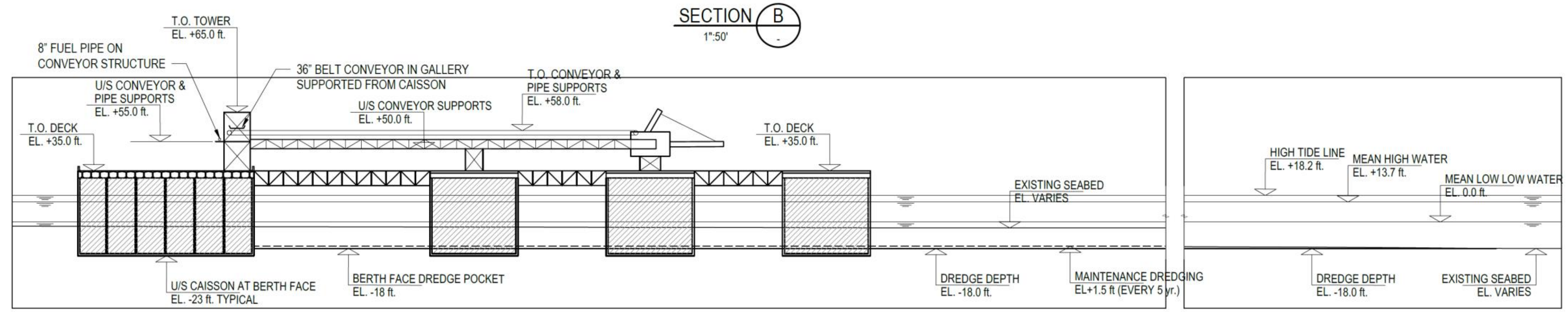
PLAN
1" = 1500'



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'

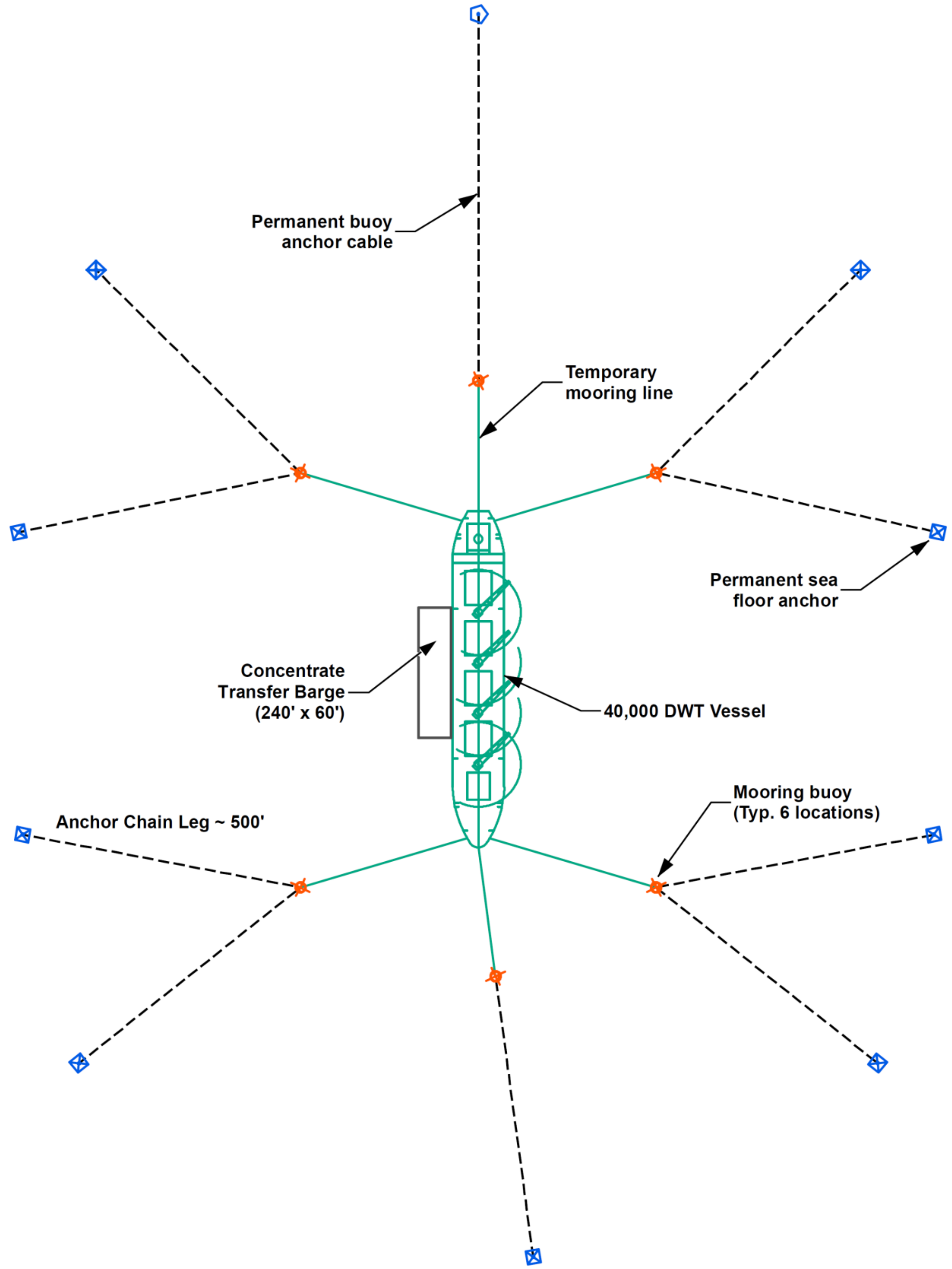
THE pebble PARTNERSHIP

FIGURE 4

NAVIGATION CHANNEL AND BASIN PLAN AND CROSS SECTION VIEW

USFWS Biological Assessment

File: PLPUSFWS_031	Date: 5/8/2020
Revision: 00	Author: ORNRC



LIGHTERING SPREAD MOORING SYSTEM ARRANGEMENT

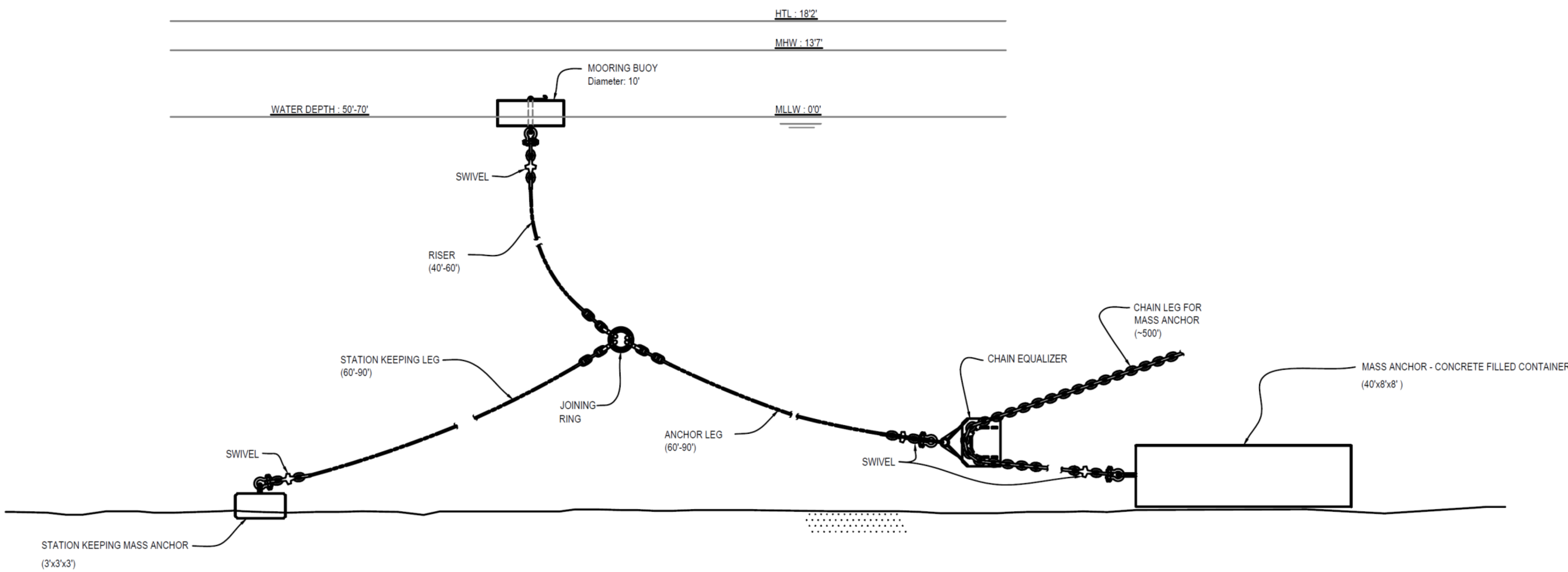
THE pebble PARTNERSHIP

FIGURE **5**

SPREAD ANCHOR
MOORING SYSTEM

USFWS Biological Assessment

File: PLPUSFWS_018	Date: 5/7/2020
Revision: 01	Author: ORNRC



TYPICAL ANCHOR DESIGN

THE pebble PARTNERSHIP

FIGURE **6**

TYPICAL ANCHOR ARRANGMENT

USFWS Biological Assessment

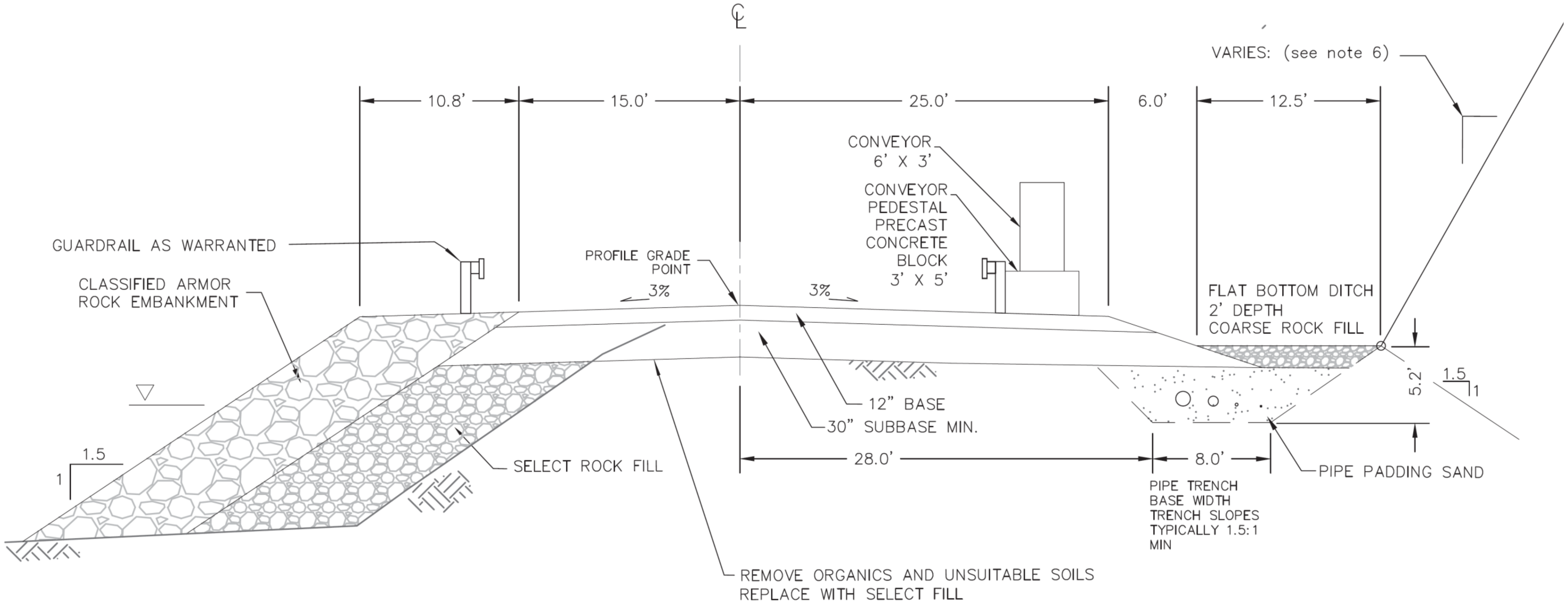
File: PLPUSFWS_019	Date: 5/7/2020
Revision: 01	Author: ORNRC

THE pebble PARTNERSHIP

FIGURE 7

ROAD TYPICAL SECTION FOR EMBANKMENT IN INTERTIDAL AREAS

USFWS Biological Assessment



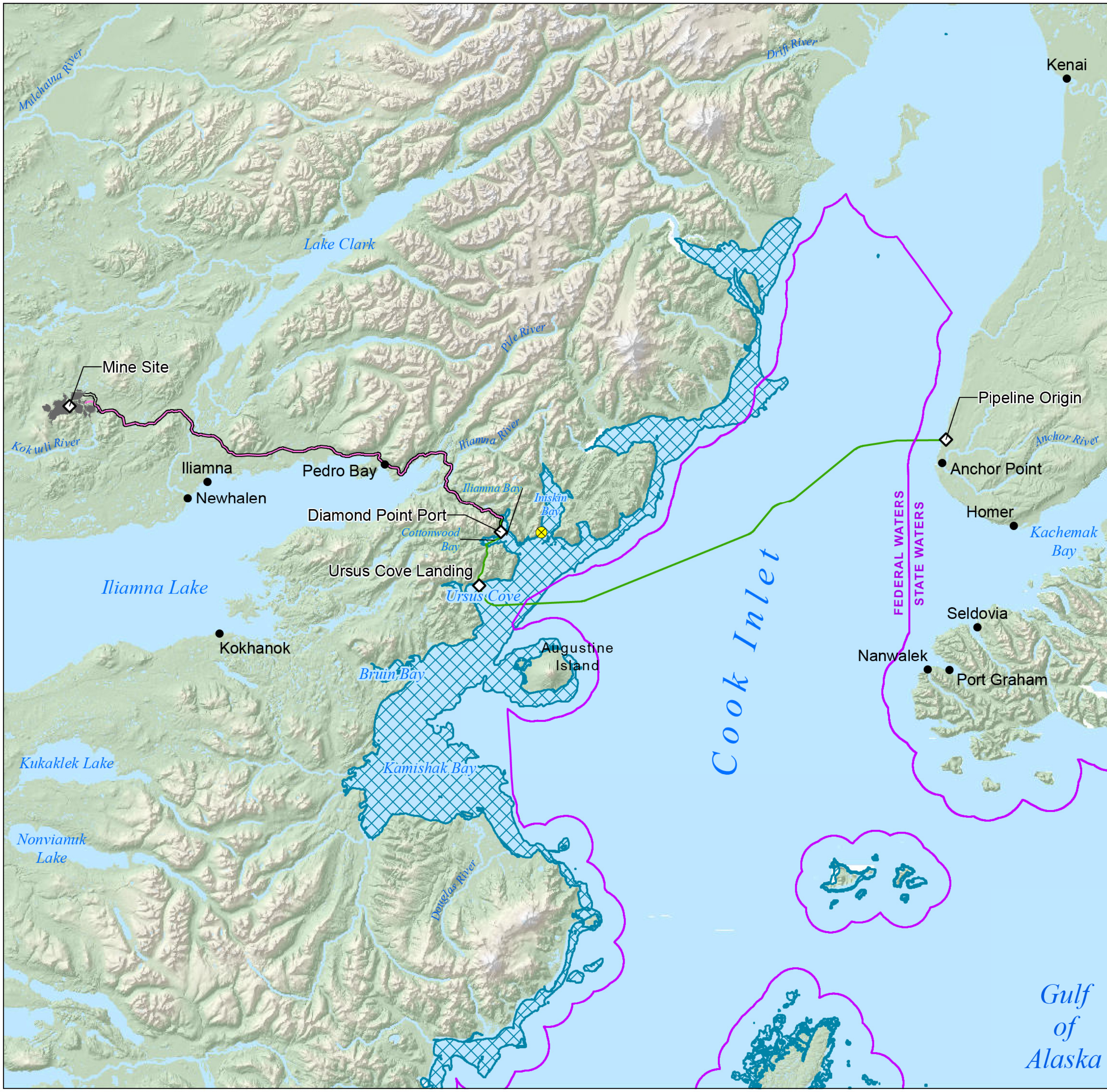
NOTES:

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'

File: PLPUSFWS_024	Date: 5/8/2020
Revision: 01	Author: ORNRC



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
Mine Site
Northern Sea Otter Critical Habitat

Miles
0 8 16 24 32
Scale 1:1,300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

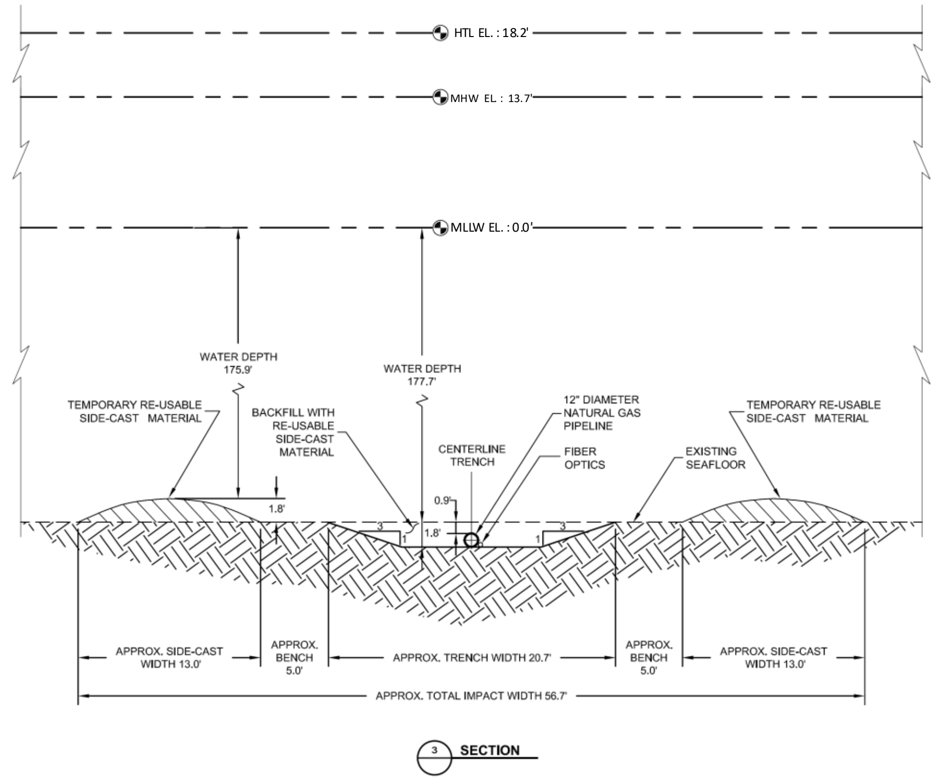
Figure: 8

NATURAL GAS PIPELINE AND FIBER OPTIC CABLE LOCATION

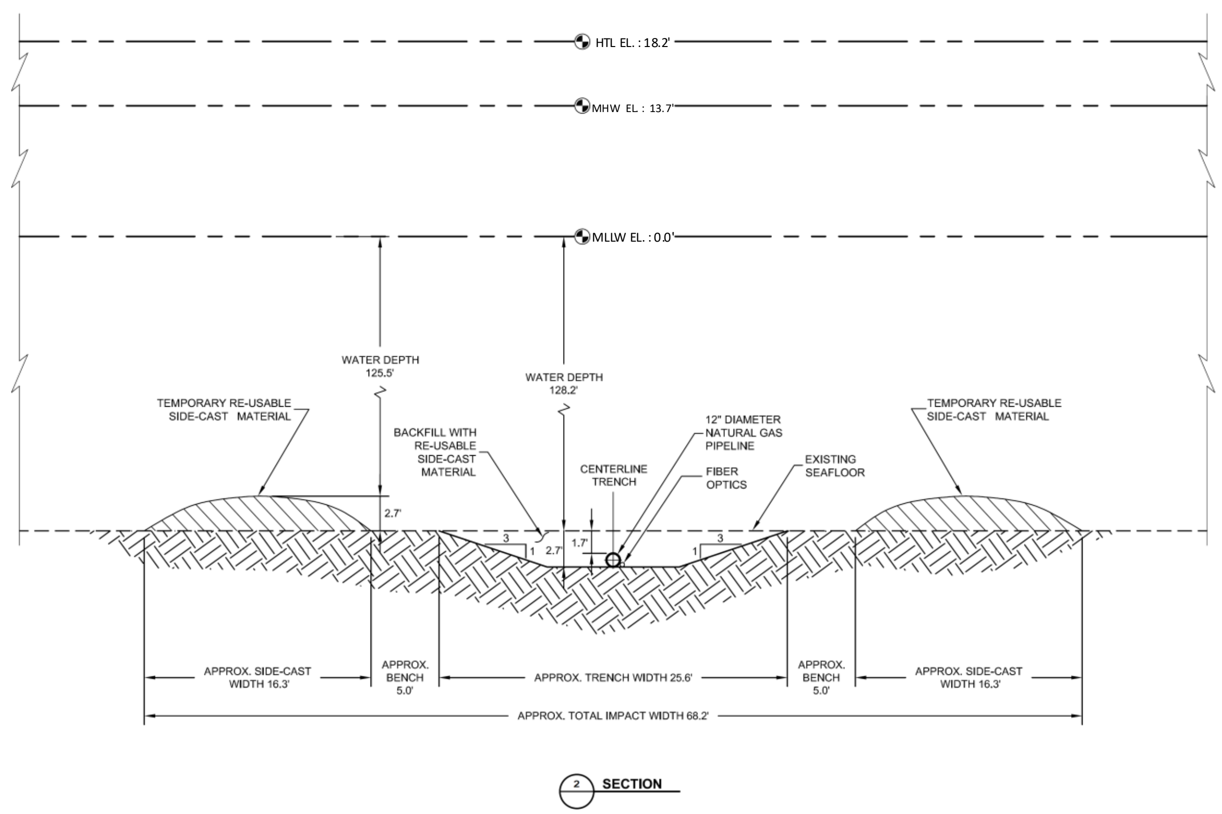
USFWS Biological Assessment

File: PLPUSFWS_015
Date: 5/12/2020
Revision: 02
Author: ORNRC

56.7 FT TOTAL IMPACT WIDTH



68.2 FT TOTAL IMPACT WIDTH



THE pebble PARTNERSHIP

FIGURE **9**

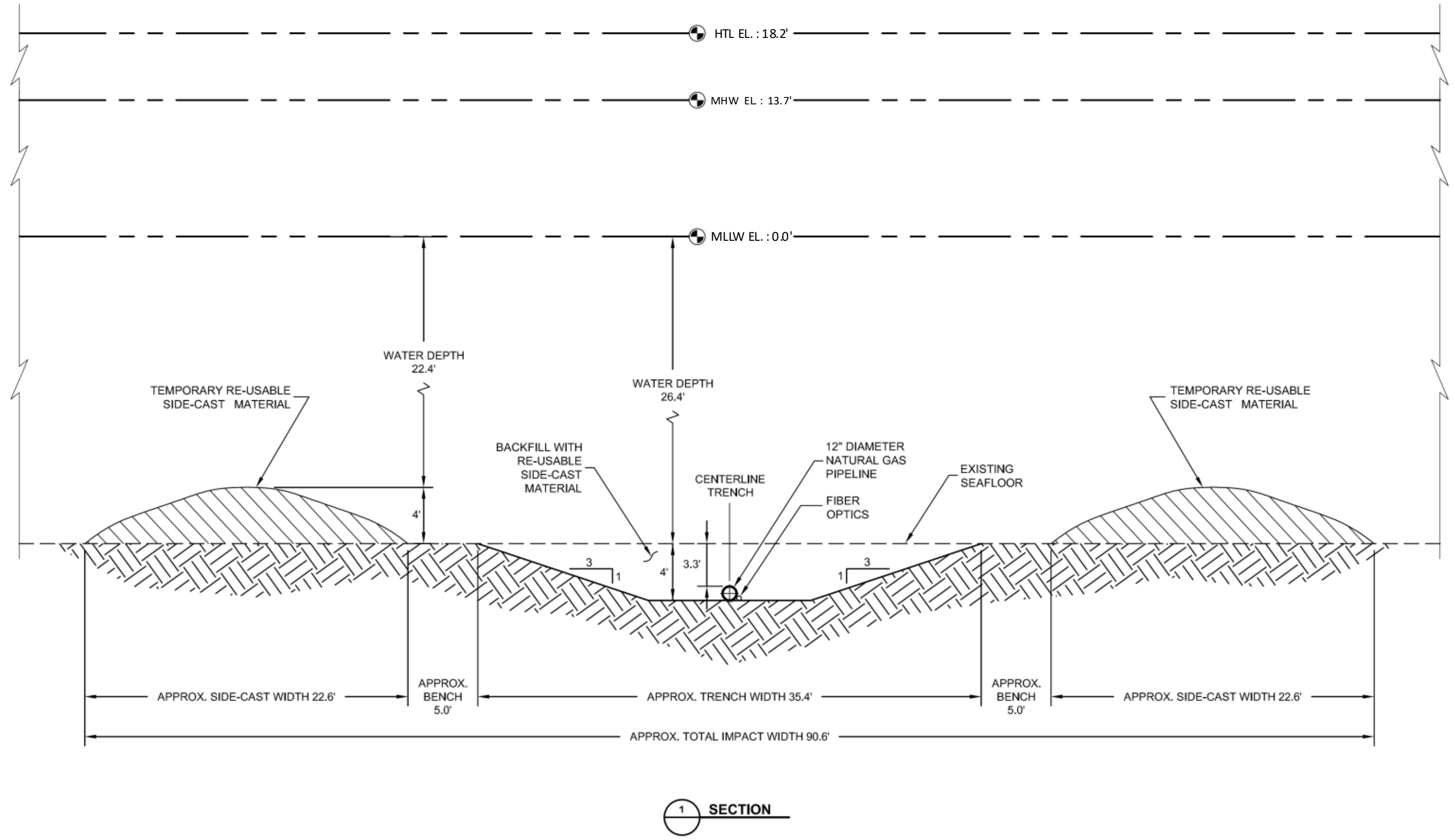
NATURAL GAS PIPELINE AND FIBER OPTIC CABLE SEABED TYPICALS (56.7 FT AND 68.2 FT IMPACT WIDTH)

(See Table 3 and Figure 12)

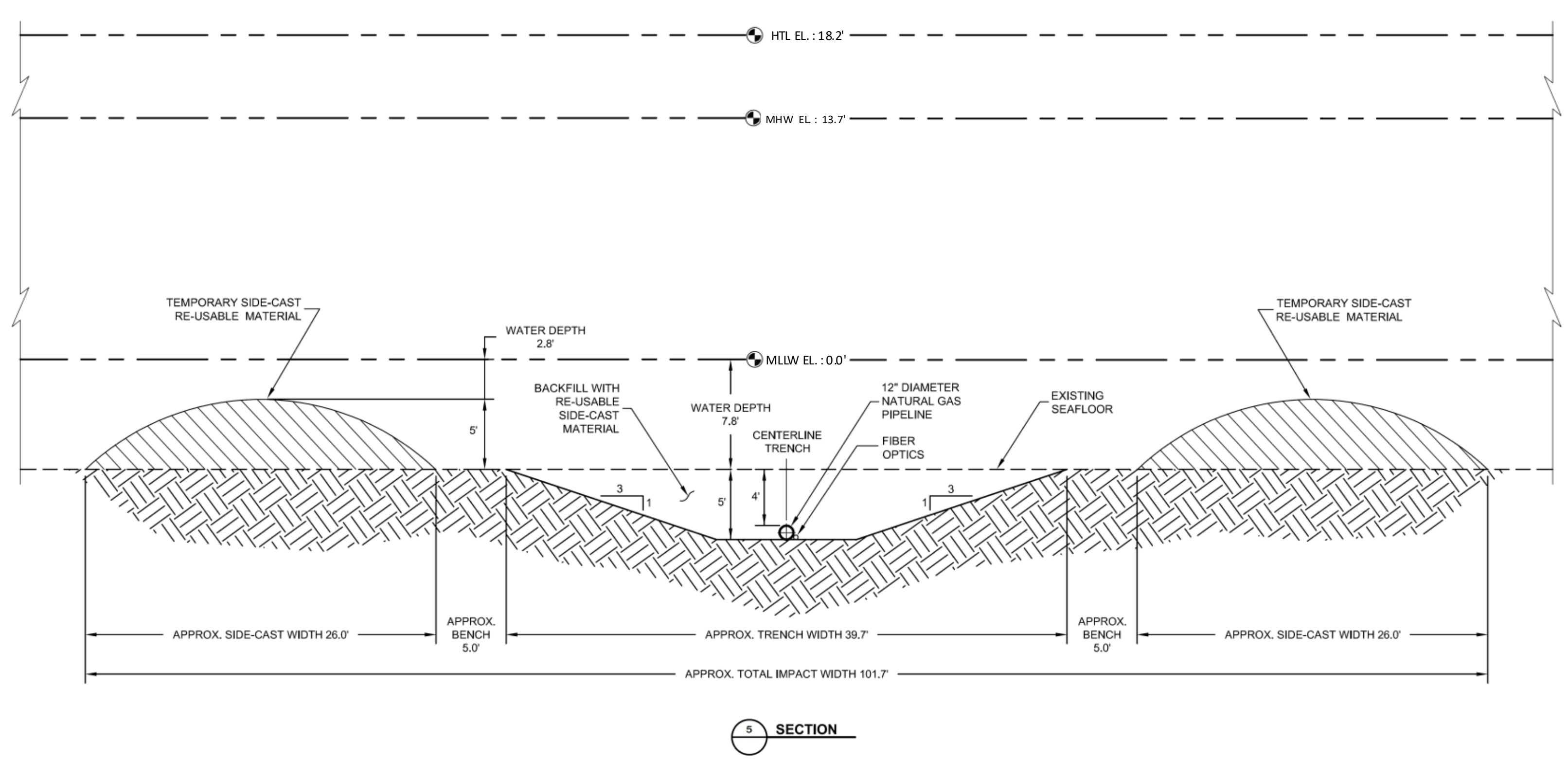
USFWS Biological Assessment

File: PLPUSFWS_016	Date: 5/5/2020
Revision: 02	Author: ORNRC

90.6 FT TOTAL IMPACT WIDTH



101.7 FT TOTAL IMPACT WIDTH



THE pebble PARTNERSHIP

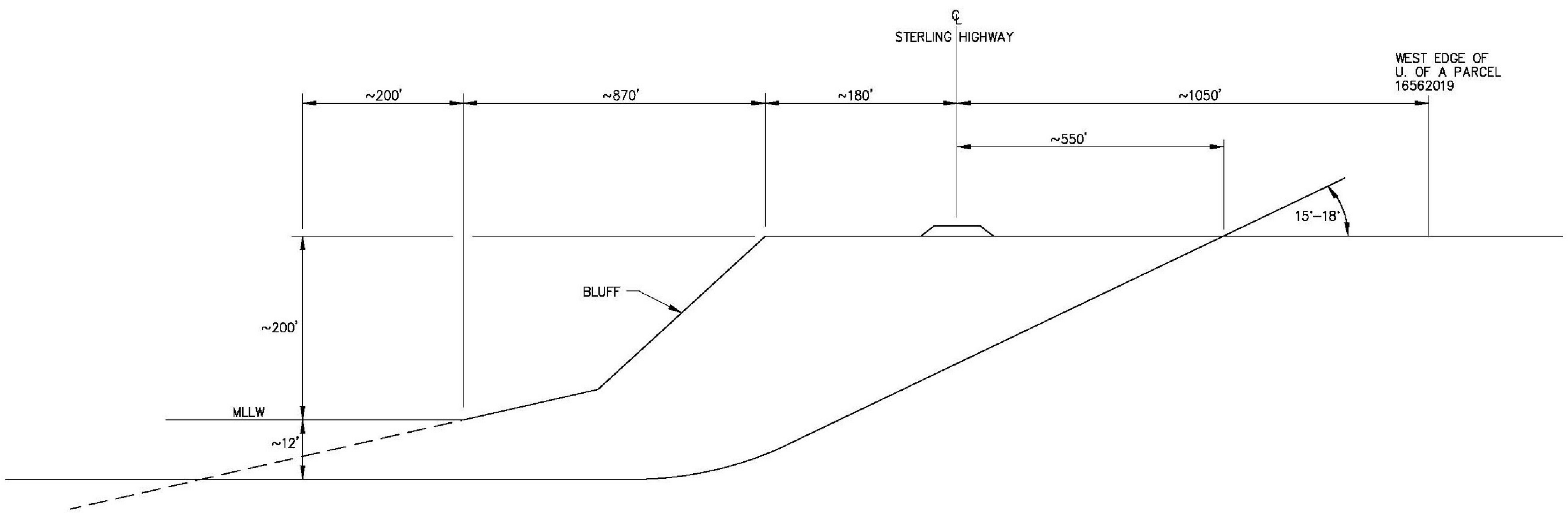
FIGURE **10**

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

(See Table 3 and Figure 12)

USFWS Biological Assessment

File: PLPUSFWS_028	Date: 5/5/2020
Revision: 01	Author: ORNRC



CONCEPTUAL PEBBLE NATURAL GAS PIPELINE HDD

SCALE: NTS

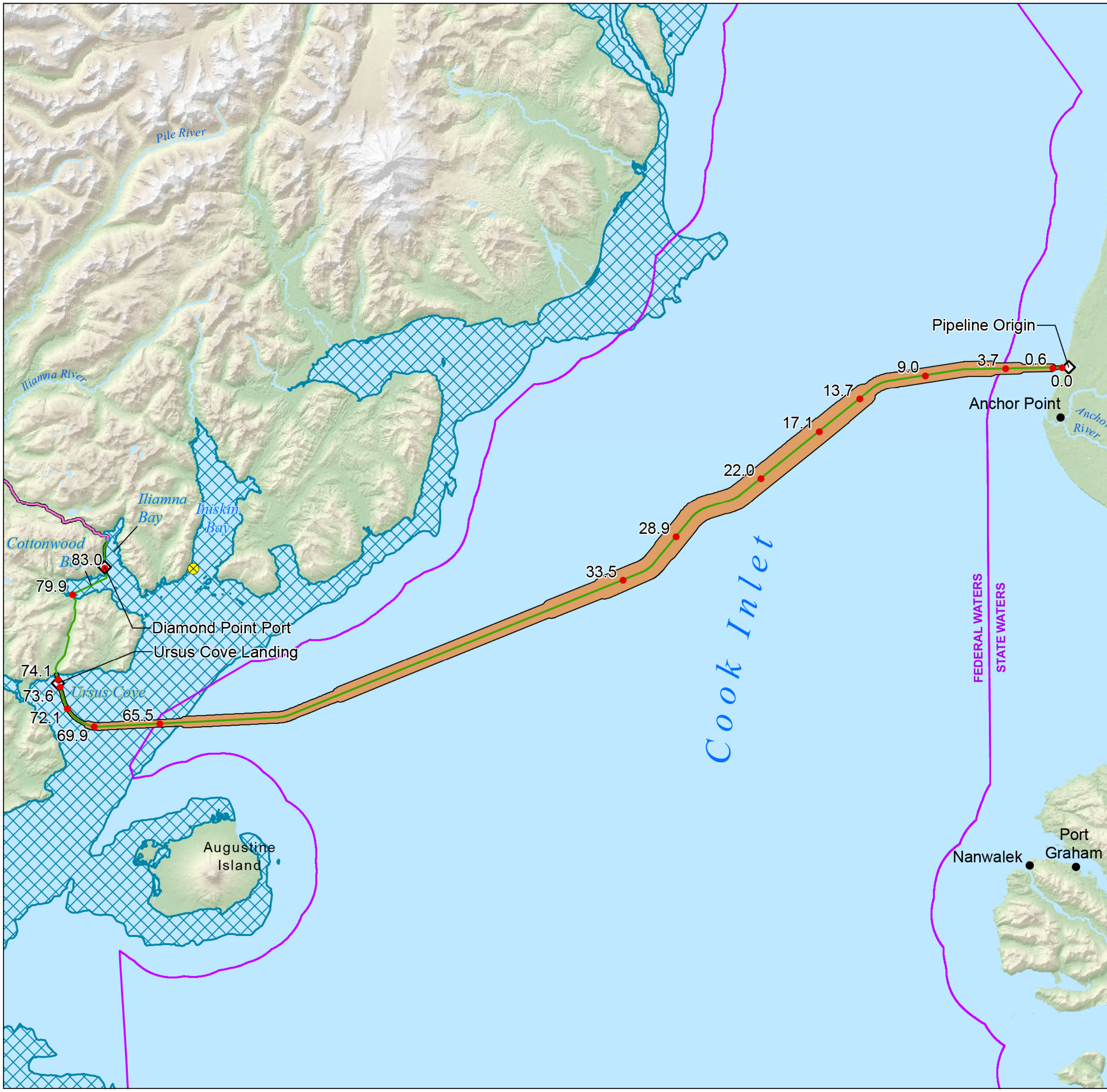
THE pebble PARTNERSHIP

FIGURE 11

NATURAL GAS PIPELINE ANCHOR POINT BLUFF HDD TYPICAL SECTION

USFWS Biological Assessment

File: PLPUSFWS_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
- Northern Sea Otter Critical Habitat

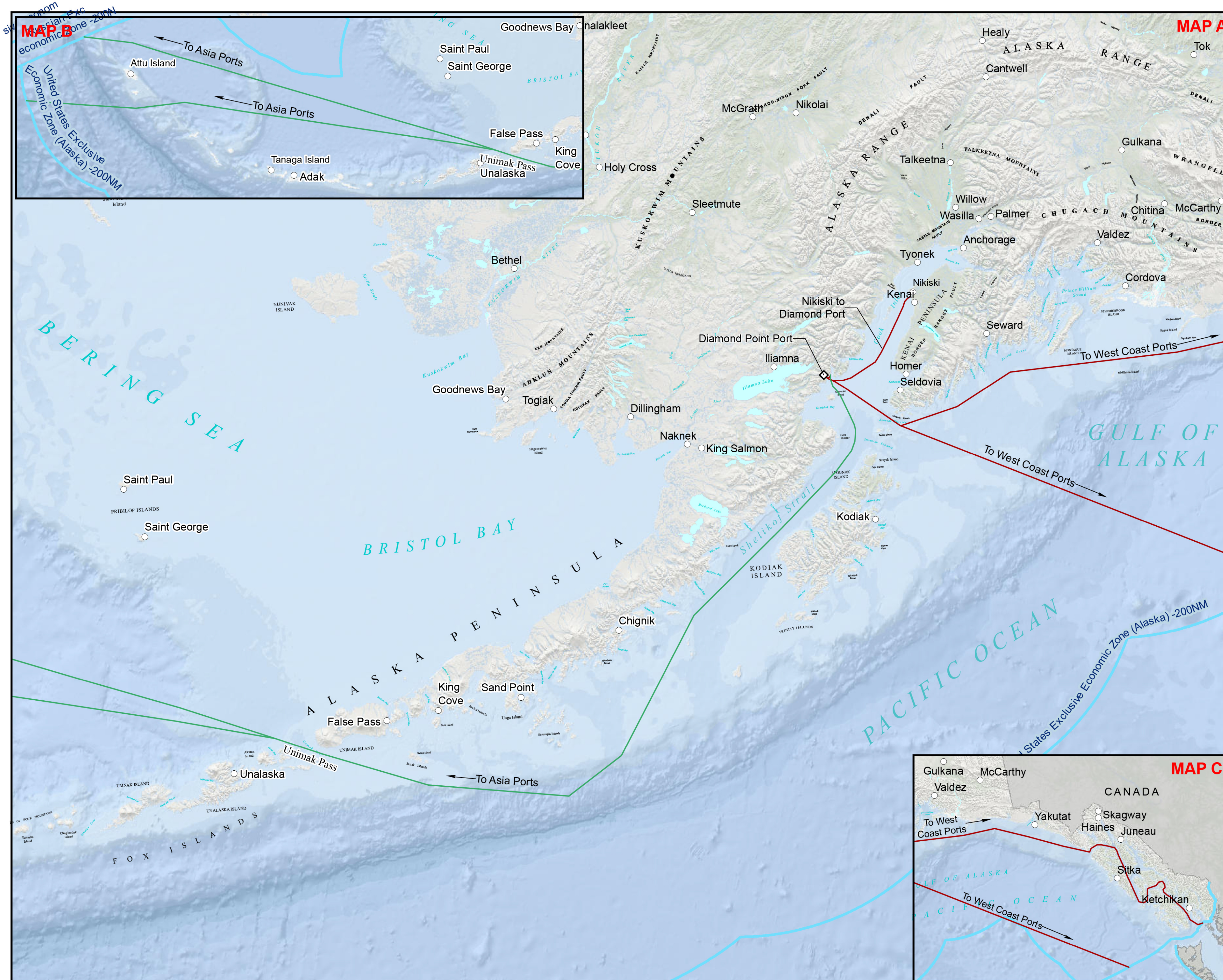
Miles
0 2.5 5 7.5 10 12.5
Scale 1:600,000

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

NATURAL GAS PIPELINE AND FIBER OPTIC CABLE ANCHOR PLACEMENT CORRIDOR

USFWS Biological Assessment

File: PLPUSFWS_001	Date: 5/20/2020
Revision: 03	Author: ORNRC



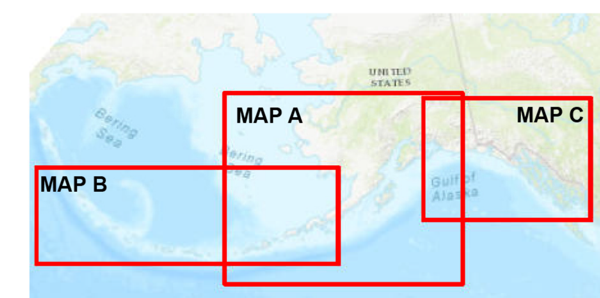
Project Feature

Exclusive Economic Zone Boundary (EEZ)

Maritime Travel Routes

Concentrate Bulk Vessels

Supply Barges



Miles

0 50 100 150 200

Scale 1:5,500,000

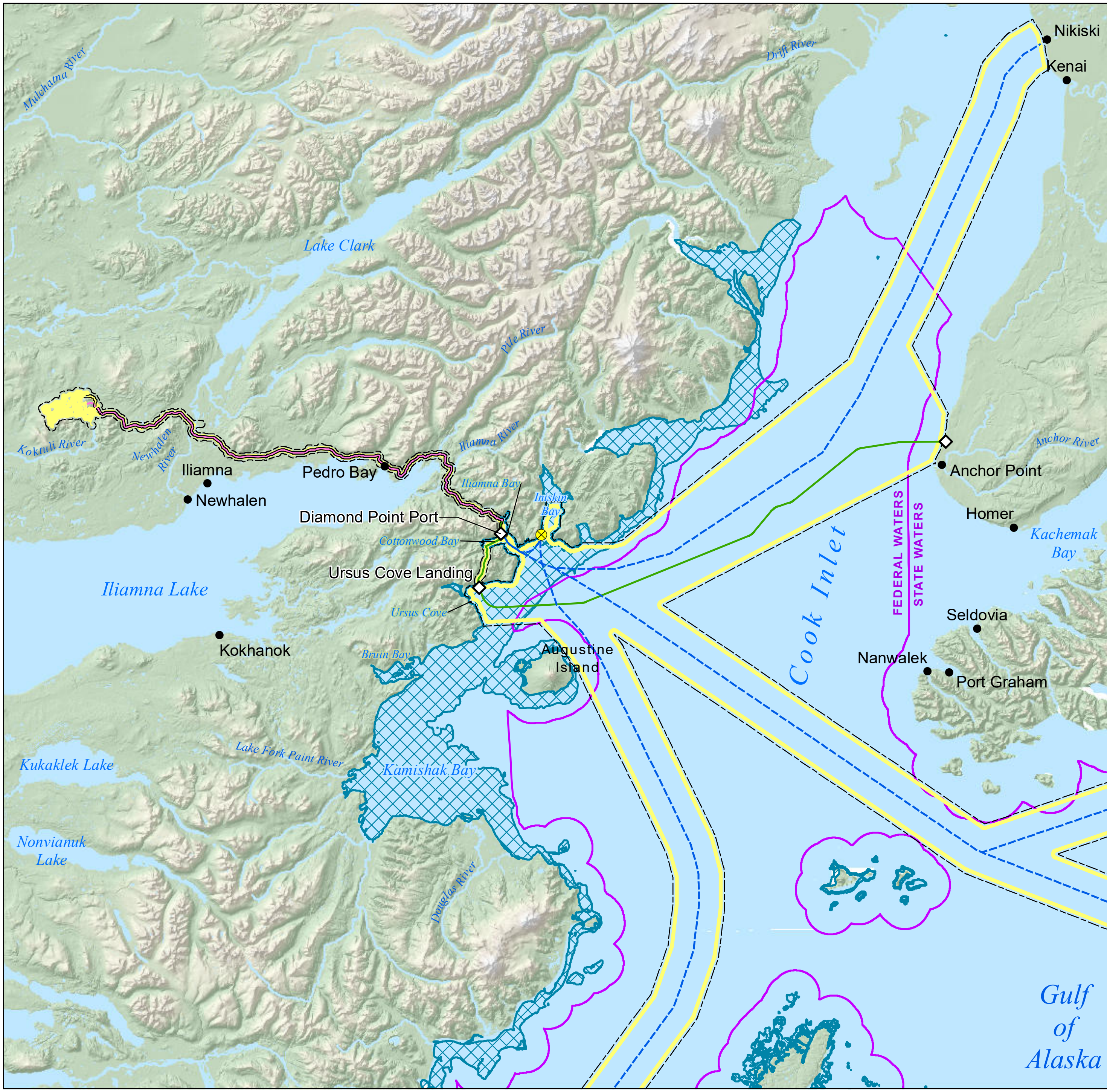
NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

Figure:
13

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

USFWS Biological Assessment

File: PLPUSFWS_027	Date: 5/13/2020
Revision: 02	Author: ORNRC



THE pebble PARTNERSHIP

Project Feature

Lightering Station

Maritime Traffic

Access Road

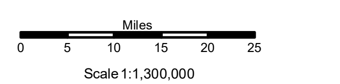
Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)

NGP, FOC, Concentrate Pipeline, and Return Water Pipeline

State Seaward Boundary

Action Area

Northern Sea Otter Critical Habitat



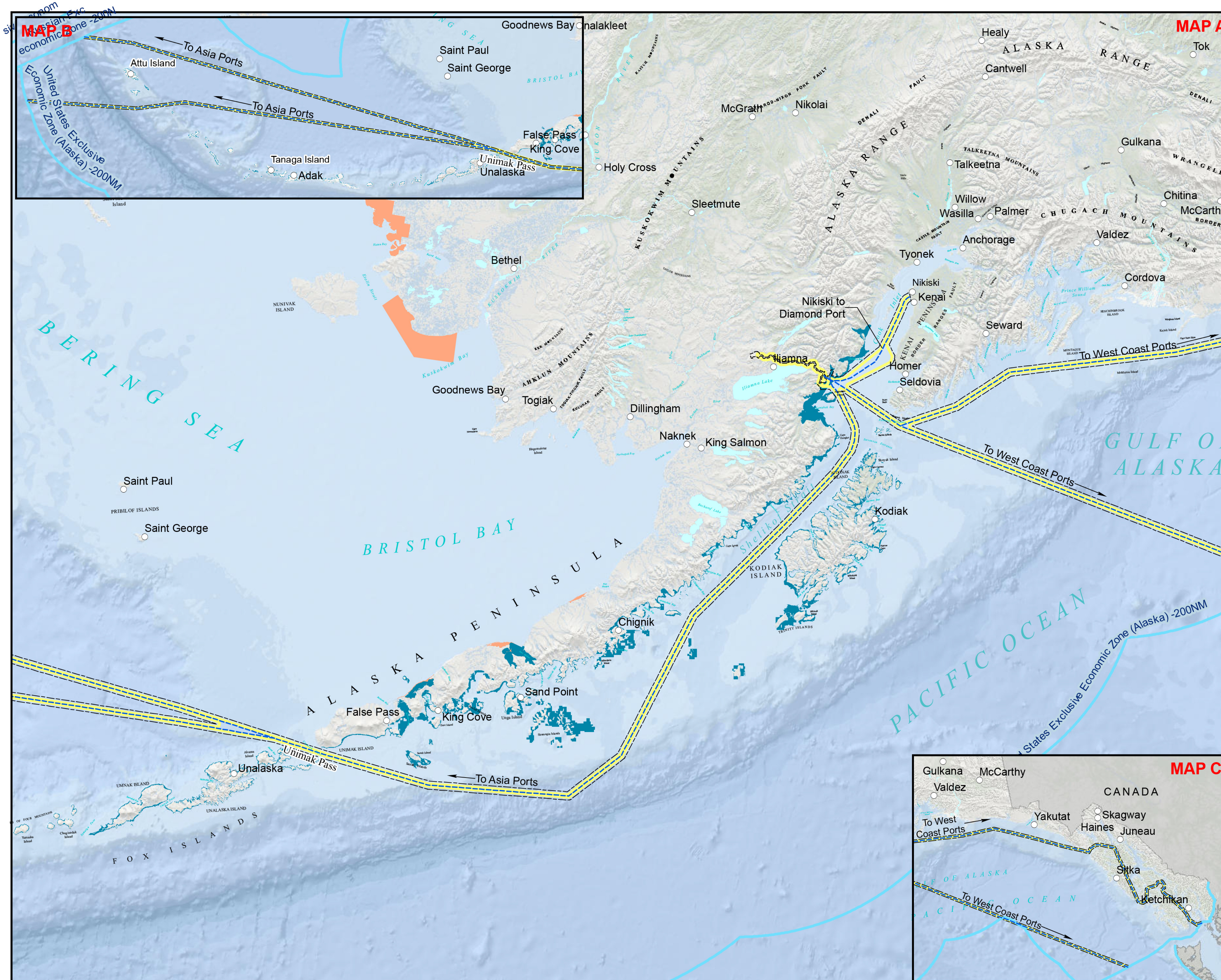
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 14

ACTION AREA AND CRITICAL HABITATS - COOK INLET

USFWS Biological Assessment

File: PLPUSFWS_003	Date: 5/20/2020
Revision: 03	Author: ORNRC

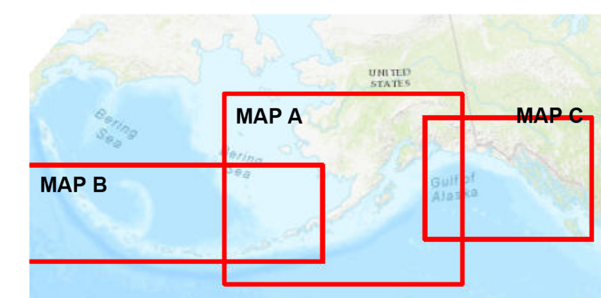


THE pebble PARTNERSHIP

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

USFWS Critical Habitat

- Steller's Eider
- Northern Sea Otter



Miles

0 50 100 150 200

Scale 1:5,500,000

NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

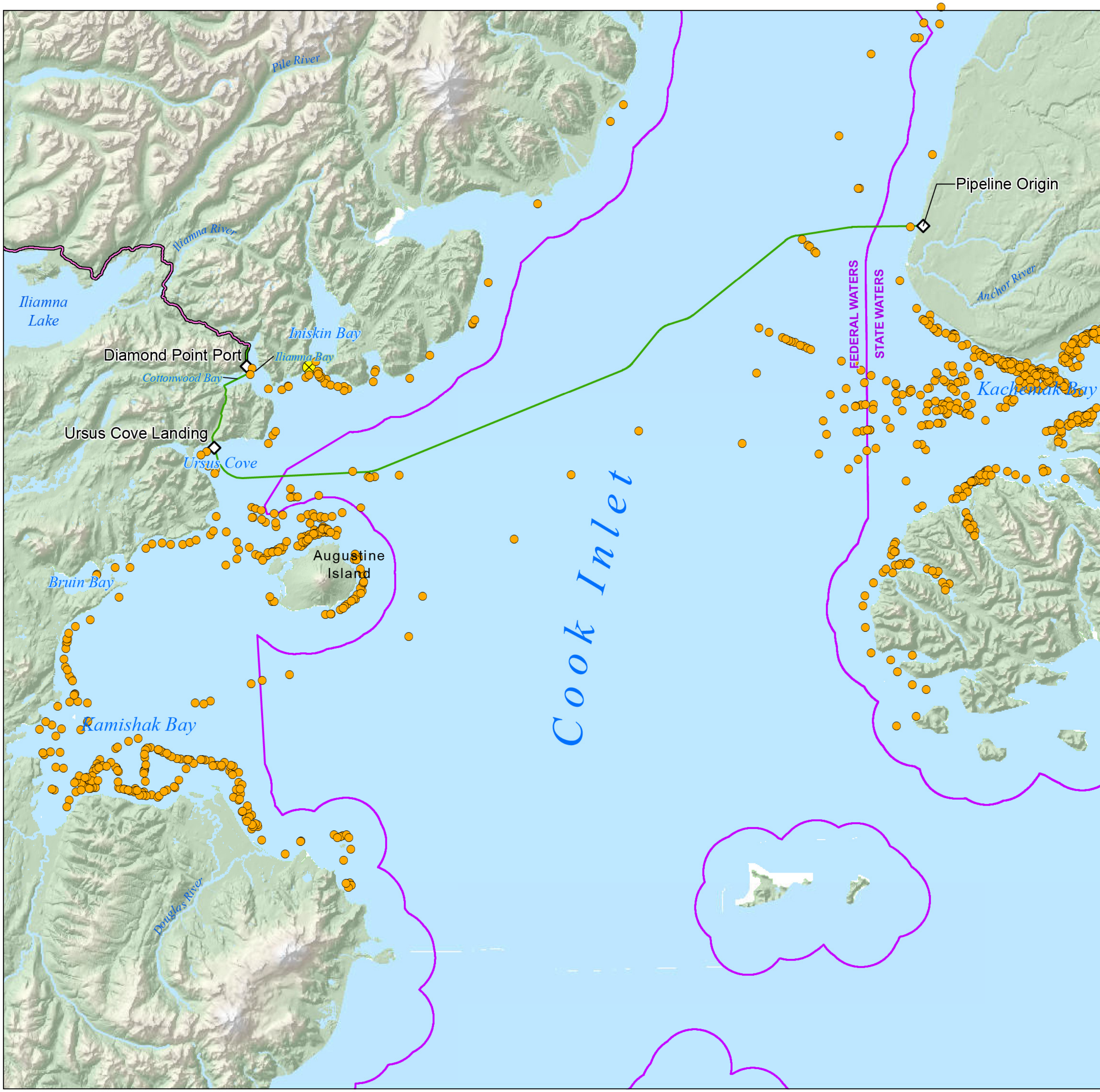
Figure: 15

ACTION AREA AND CRITICAL HABITATS - ALEUTIANS AND PACIFIC OCEAN

USFWS Biological Assessment

File: PLPUSFWS_029	Date: 5/13/2020
Revision: 02	Author: ORNRC

THE pebble PARTNERSHIP



Northern Sea Otter
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 4 8 12 16 20
Scale 1:850,000
N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **16**

NORTHERN SEA OTTER LOCATIONS FROM NMFS SURVEYS 1993-2016

USFWS Biological Assessment

File: PLPUSFWS_004	Date: 5/20/2020
Revision: 3	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

Northern Sea Otter

1 - 37

38 - 100

101 - 225

226 - 440

Miles

0 2 4 6 8

Scale 1:330,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **17**

NORTHERN SEA OTTER LOCATIONS FROM ABR HELICOPTER SURVEYS 2006-2012

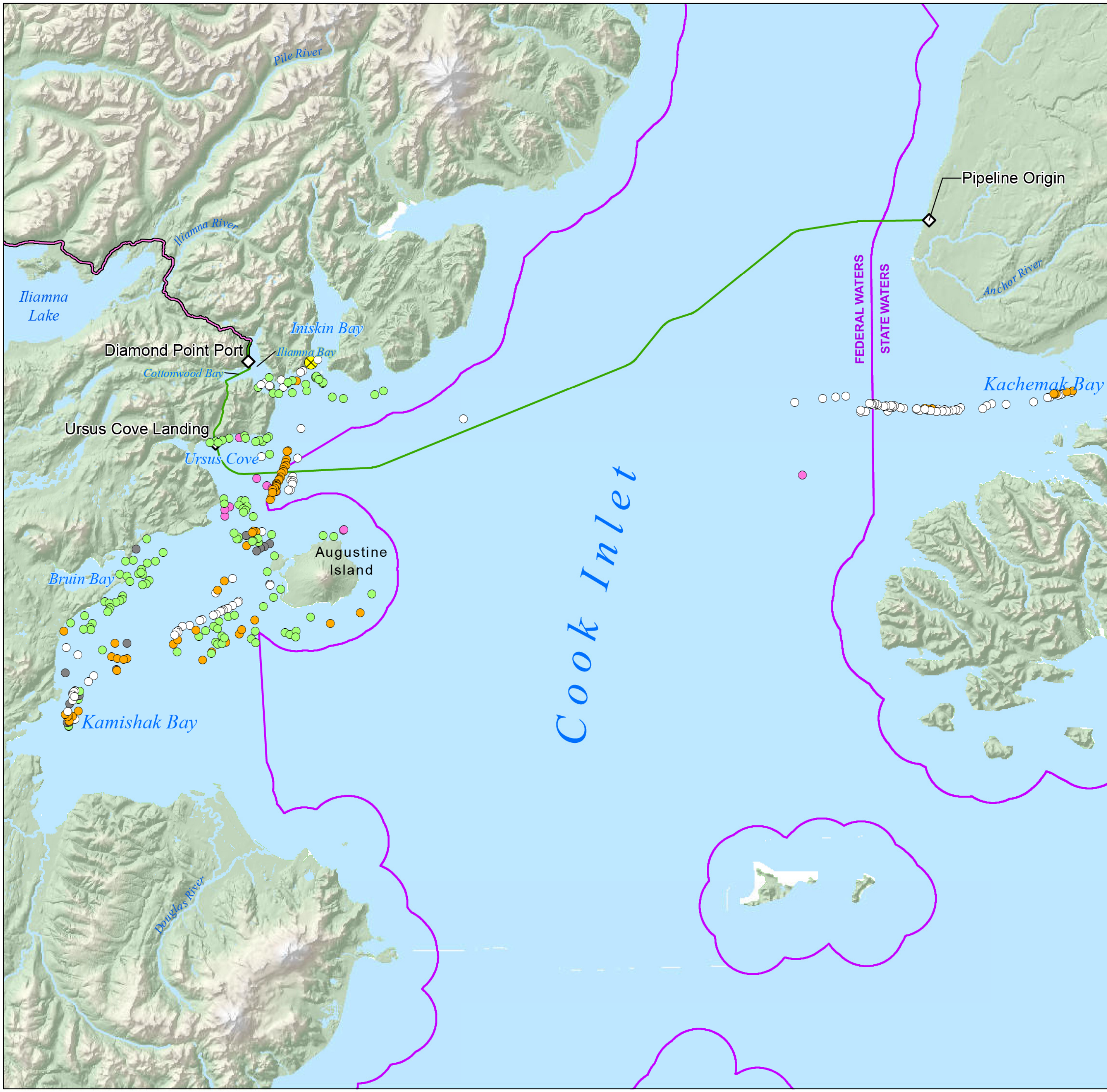
USFWS Biological Assessment

File: PLPUSFWS_026

Date: 5/20/2020

Revision: 03

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
State Seaward Boundary

Northern Sea Otter

- March
- April
- May
- June
- July

Miles
0 4 8 12 16 20
Scale 1:850,000

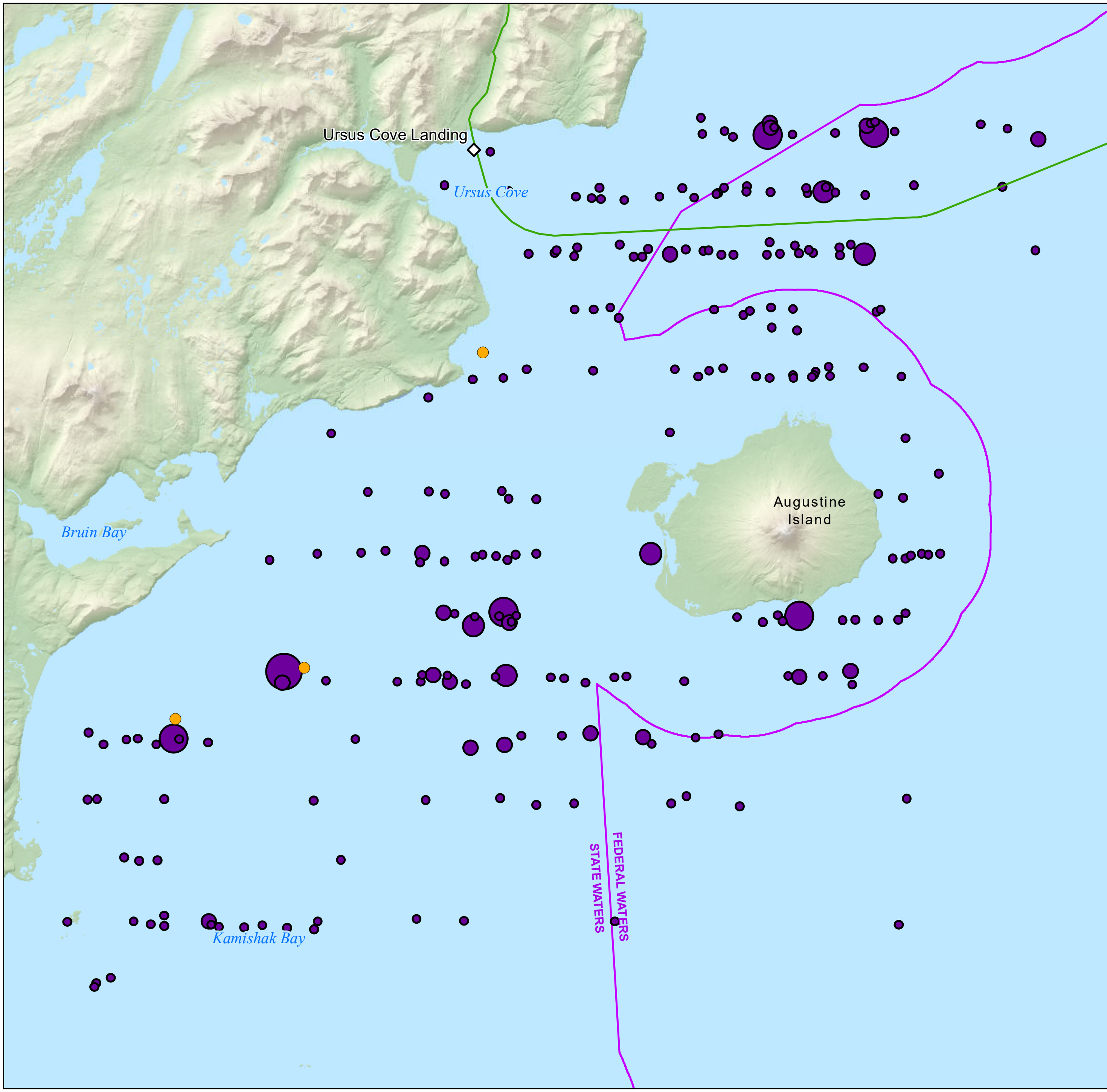
N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **18**

NORTHERN SEA OTTER LOCATIONS FROM ABR SURVEYS MARCH-JULY 2018

USFWS Biological Assessment

File: PLPUSFWS_004	Date: 5/20/2020
Revision: 3	Author: ORNRC



THE pebble PARTNERSHIP

Northern Sea Otter Haulouts in March
Project Feature
Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
State Seaward Boundary

Northern Sea Otter
1 - 6
7 - 12
13 - 19
20 - 34
35 - 50

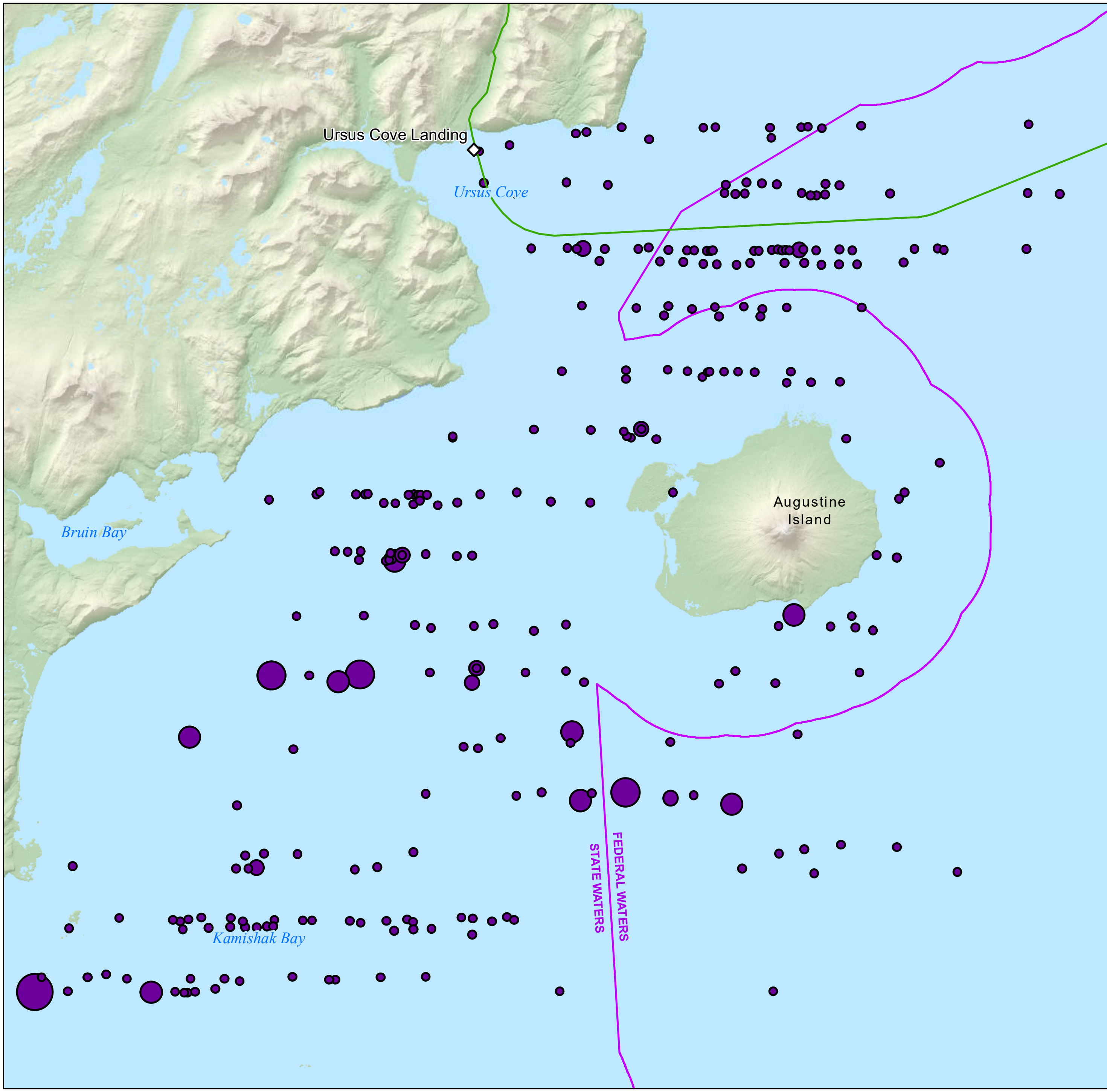
Miles
0 1.5 3 4.5 6 7.5
Scale 1:300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: 19

NORTHERN SEA OTTER LOCATIONS FROM ABR SURVEYS MARCH 23 - 24, 2019

USFWS Biological Assessment

File: PLPUSFWS_007	Date: 5/20/2020
Revision: 03	Author: ORNRC



THE pebble PARTNERSHIP

Project Feature

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

State Seaward Boundary

Northern Sea Otter

1 - 6

7 - 12

13 - 19

20 - 34

35 - 80

Miles

0 1.5 3 4.5 6 7.5

Scale 1:300,000

N

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **20**

NORTHERN SEA OTTER LOCATIONS FROM ABR SURVEYS MAY 24 - 25, 2019

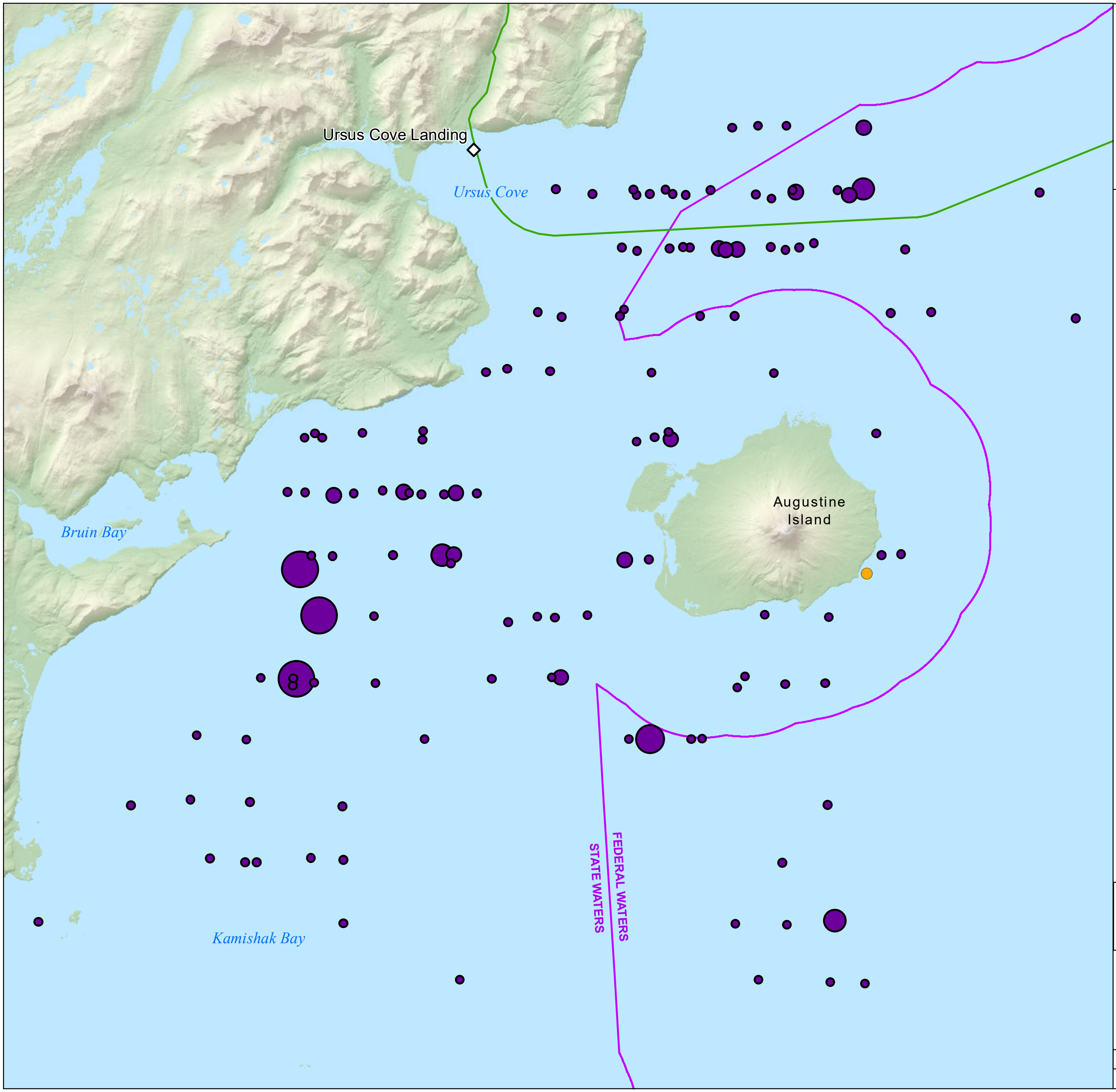
USFWS Biological Assessment

File: PLPUSFWS_007

Date: 5/20/2020

Revision: 03

Author: ORNRC



THE pebble PARTNERSHIP

Northern Sea Otter Haulouts on June 21 & 22
Project Feature
Natural Gas Pipeline (NGP) and Fiber Optic Cable (FOC)
State Seaward Boundary

Northern Sea Otter

1 - 6
7 - 12
13 - 19
20 - 34
35 - 50

Miles
0 1.5 3 4.5 6 7.5
Scale 1:300,000

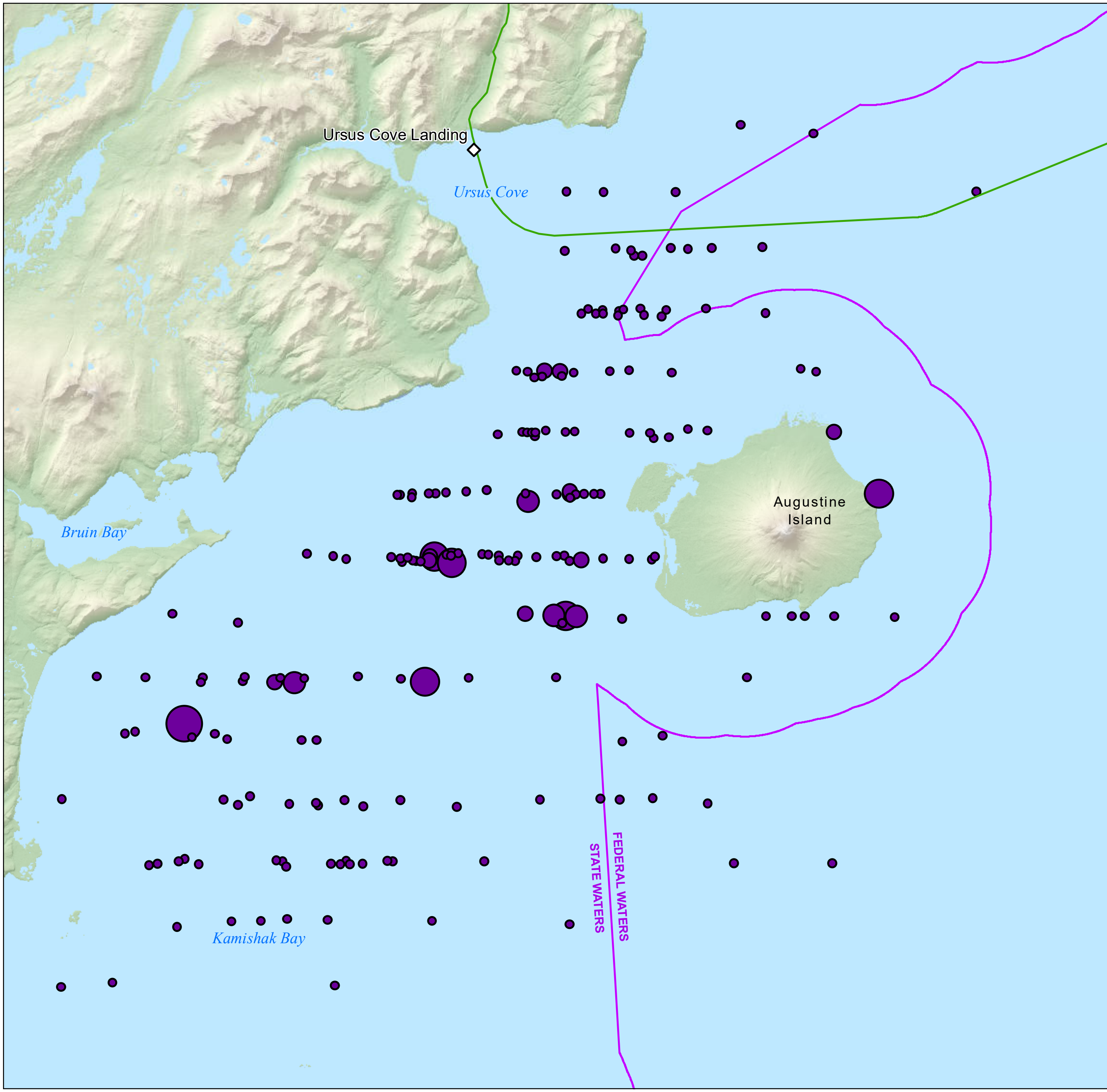
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **21**

NORTHERN SEA OTTER LOCATIONS FROM ABR SURVEYS JUNE 21 - 22, 2019

USFWS Biological Assessment

File: PLPUSFWS_007 | Date: 5/20/2020
Revision: 03 | Author: ORNRC



THE pebble PARTNERSHIP

Project Feature

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

State Seaward Boundary

Northern Sea Otter

- 1 - 7
- 8 - 15
- 16 - 35
- 36 - 47
- 48 - 90

Miles

0 1.5 3 4.5 6 7.5

N

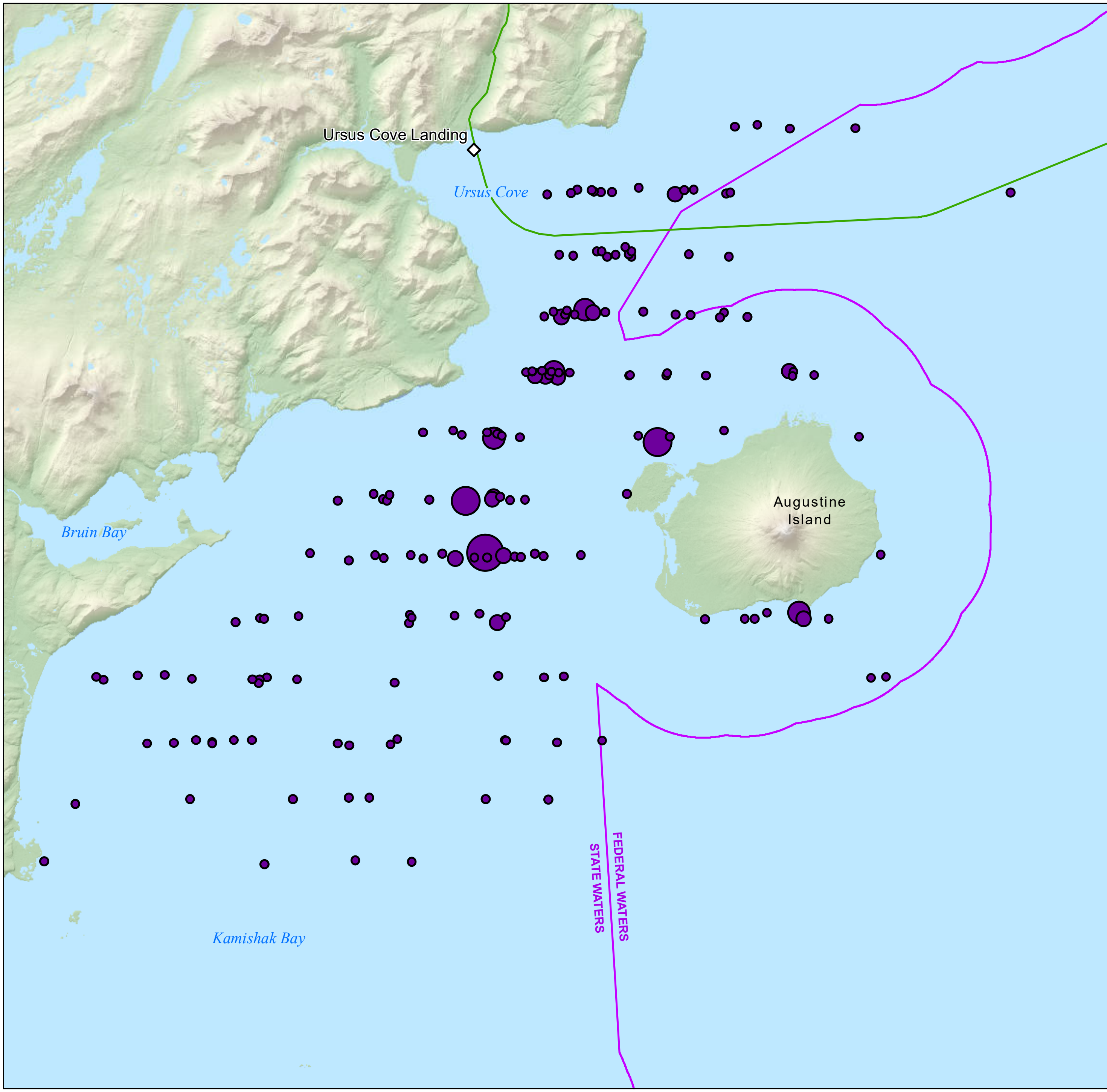
Scale 1:300,000

NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian	Figure: **22**

NORTHERN SEA OTTER LOCATIONS FROM ABR SURVEYS OCTOBER 3 - 4, 2019

USFWS Biological Assessment

File: PLPUSFWS_007	Date: 5/20/2020
Revision: 03	Author: ORNRC



THE pebble PARTNERSHIP

Project Feature

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

State Seaward Boundary

Northern Sea Otter

1 - 4

5 - 10

11 - 18

19 - 30

31 - 120

Miles

0 1.5 3 4.5 6 7.5

Scale 1:300,000

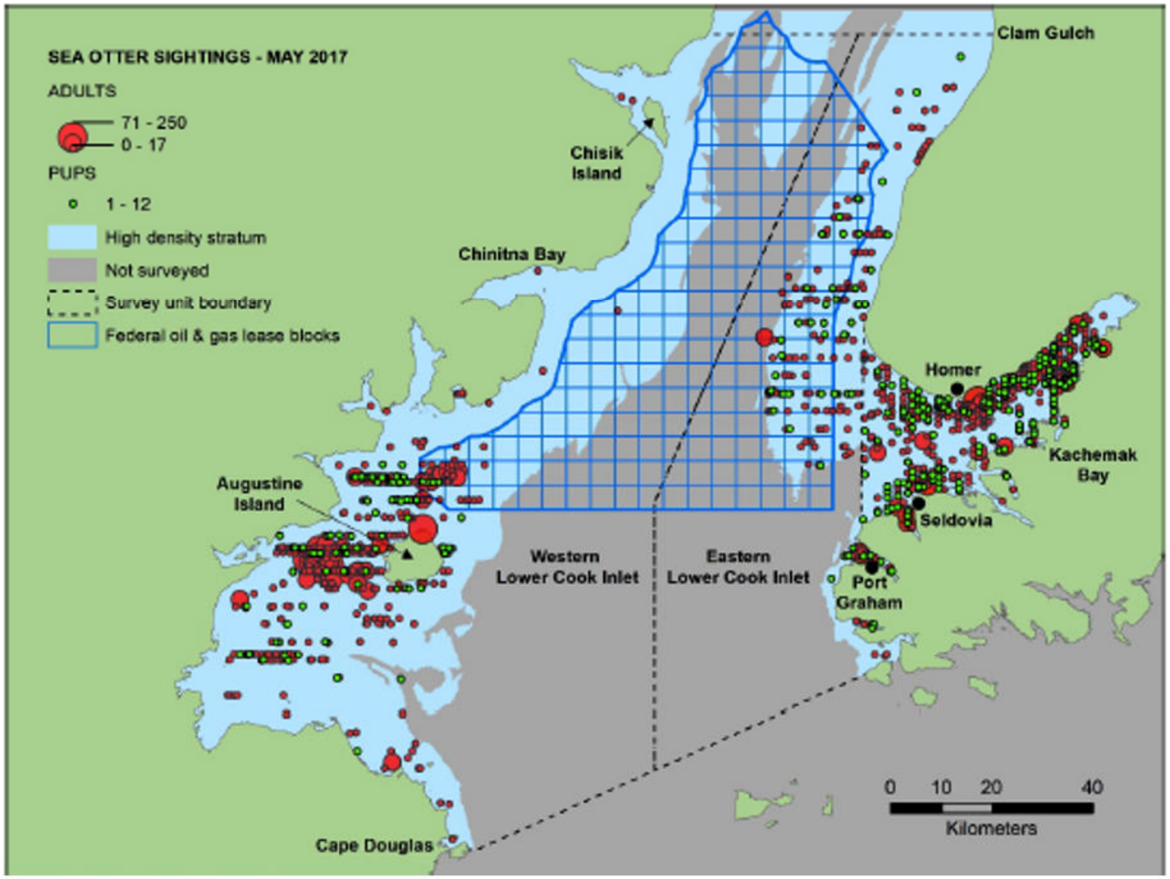
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **23**

NORTHERN SEA OTTER LOCATIONS FROM ABR SURVEYS OCTOBER 30 - 31, 2019

USFWS Biological Assessment

File: PLPUSFWS_007	Date: 5/20/2020
Revision: 03	Author: ORNRC



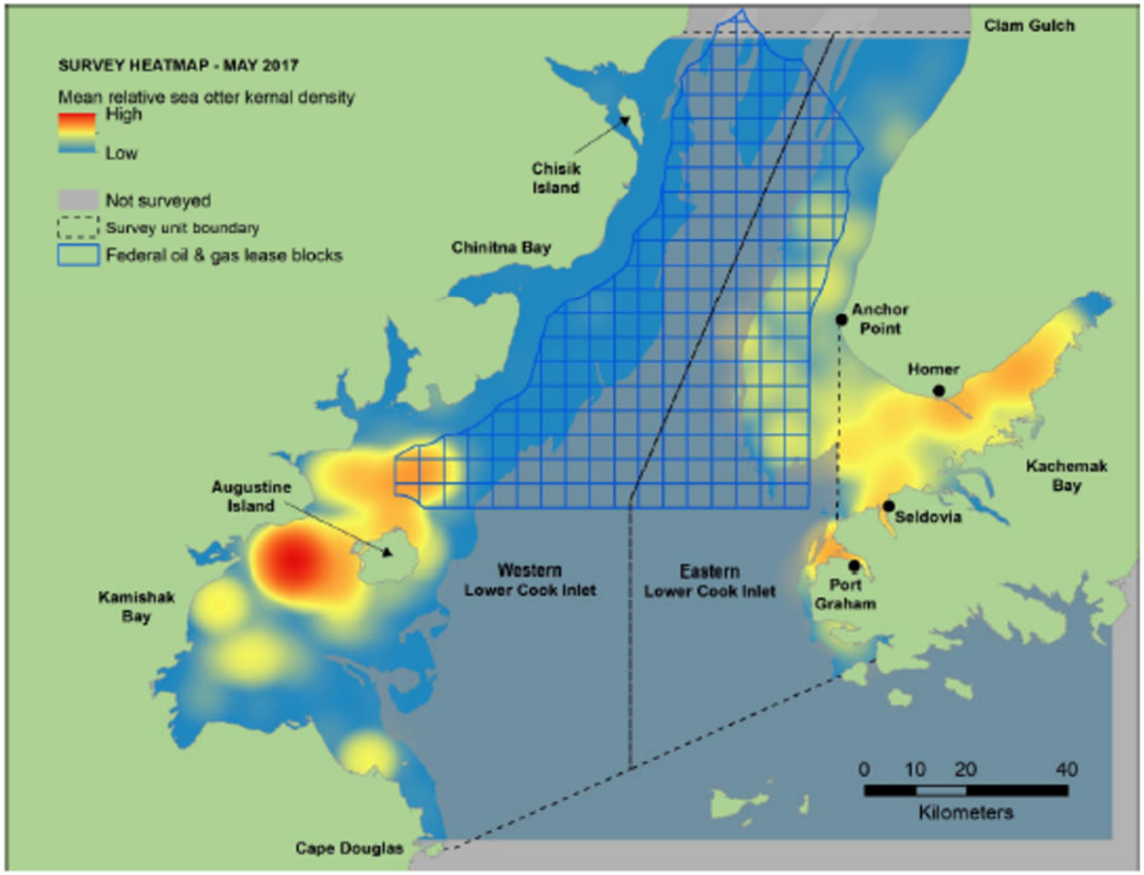
NAD 1983 State Plane
Alaska 5 FIPS 5005 Feet
Seward Meridian

Figure:
24

NORTHERN SEA OTTER LOCATIONS FROM USFWS/USGS SURVEYS 2017 (GARLICH-MILLER ET AL. 2018)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC



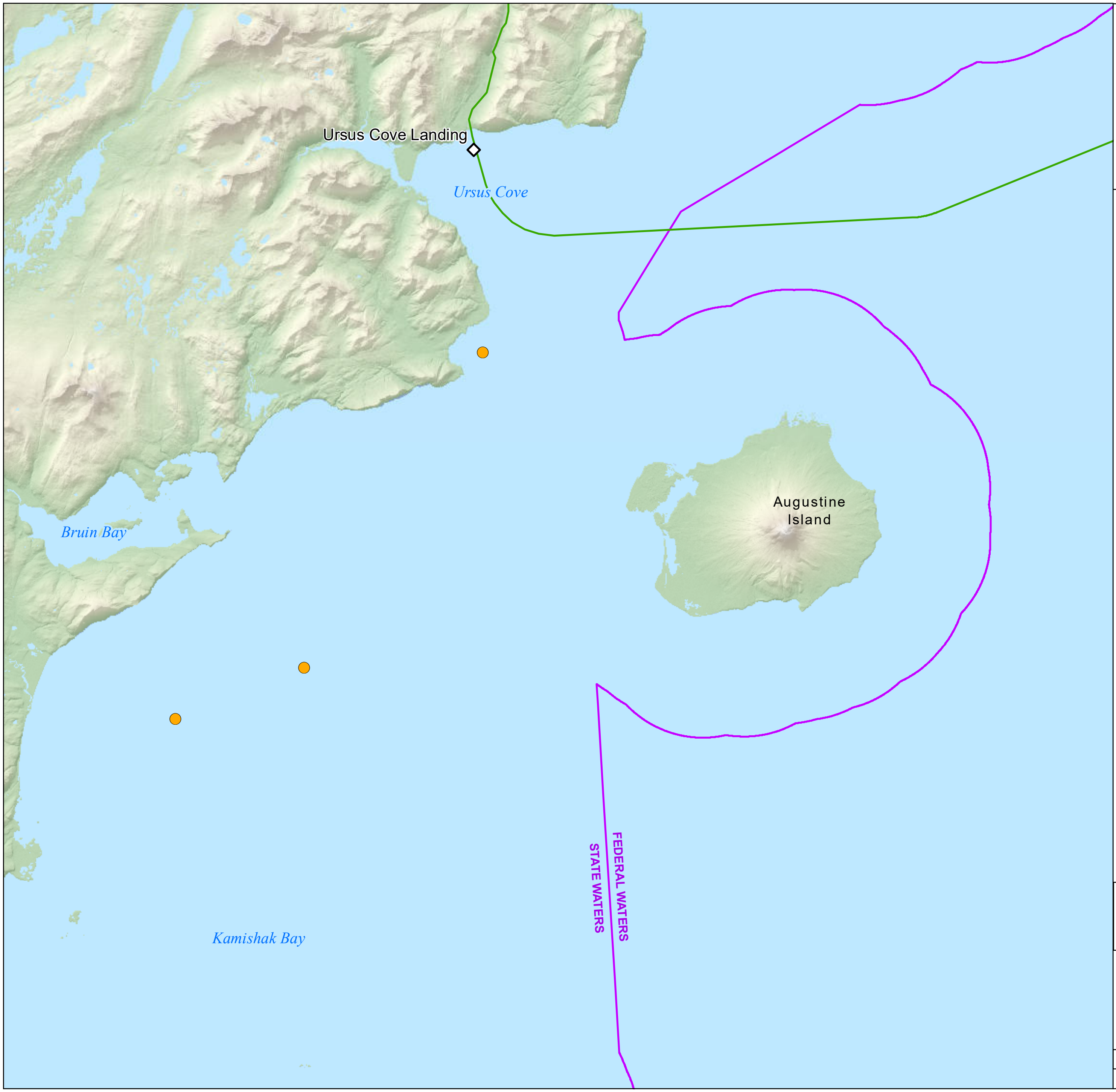
NAD 1983 State Plane
Alaska 5 FIPS 5005 Feet
Seward Meridian

Figure:
25

NORTHERN SEA OTTER DENSITIES FROM USFWS/USGS SURVEYS 2017 (GARLICH-MILLER ET AL. 2018)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC



THE pebble PARTNERSHIP

Northern Sea Otter Haulouts in March

Project Feature

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

State Seaward Boundary

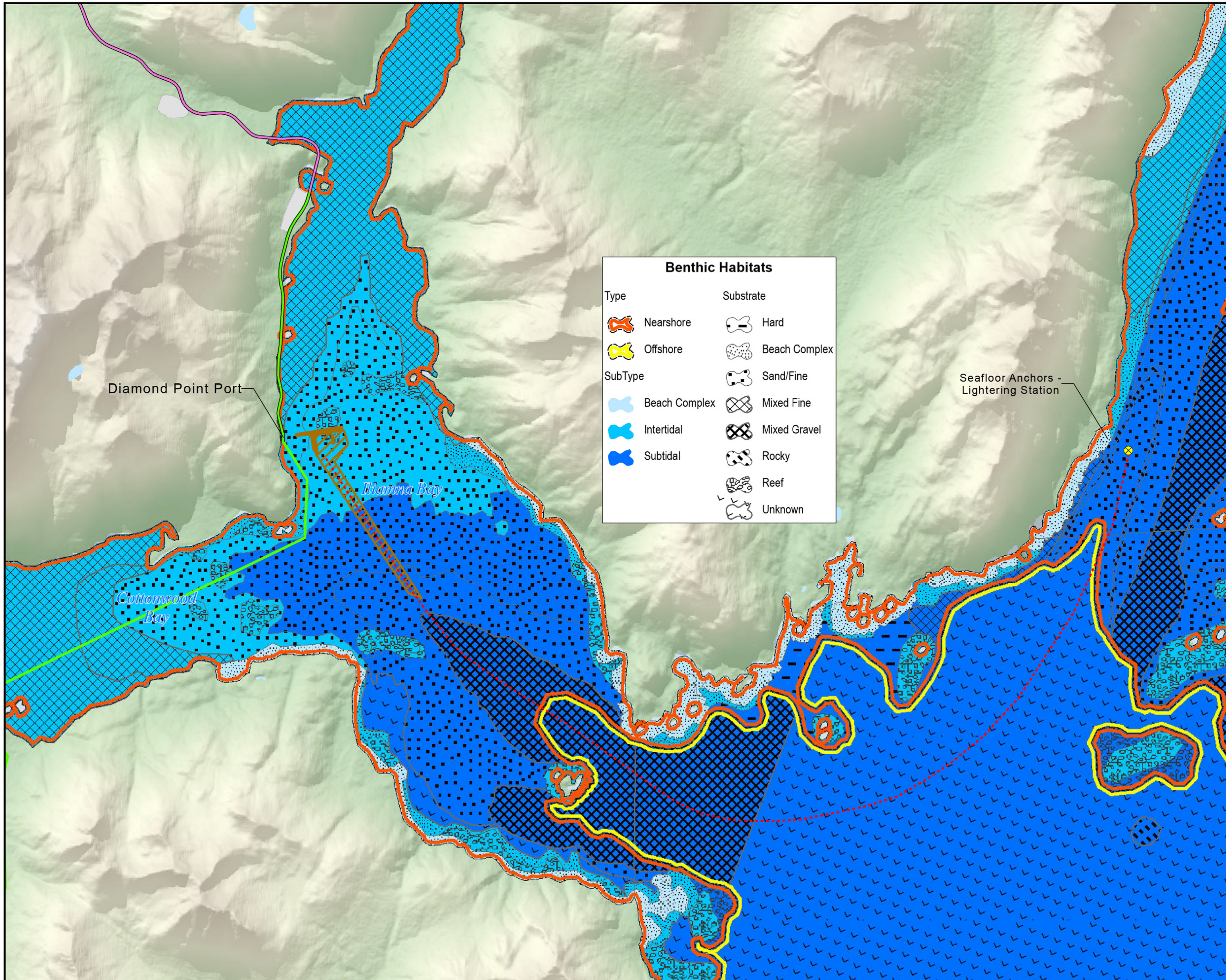
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: 26

NORTHERN SEA OTTER HAULOUT LOCATIONS FROM ABR 2019 MARCH SURVEYS

USFWS Biological Assessment

File: PLPUSFWS_007	Date: 5/20/2020
Revision: 03	Author: ORNRC



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

Miles
0 0.5 1 1.5 2
Scale 1:43,000

NAD 1983 StatePlane
Alaska 5 FIPS 5005
Seward Meridian

Figure:
27

BENTHIC HABITATS
(STUTES ET AL. 2018)

USFWS Biological Assessment

File: PLPUSFWS_023
Date: 5/20/2020
Revision: 03
Author: ORNRC

NAD 1983 State Plane
Alaska 5 FIPS 5005 Feet
Seward Meridian

Figure:
28

STELLER'S EIDER LOCATIONS
JANUARY 2004 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC

THE pebble PARTNERSHIP

NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **29**

STELLER'S EIDER LOCATIONS FEBRUARY 2004 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC

NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **30**

STELLER'S EIDER LOCATIONS MARCH 2004 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC

NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **31**

STELLER'S EIDER LOCATIONS APRIL 2004 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC

NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **32**

STELLER'S EIDER LOCATIONS DECEMBER 2004 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC

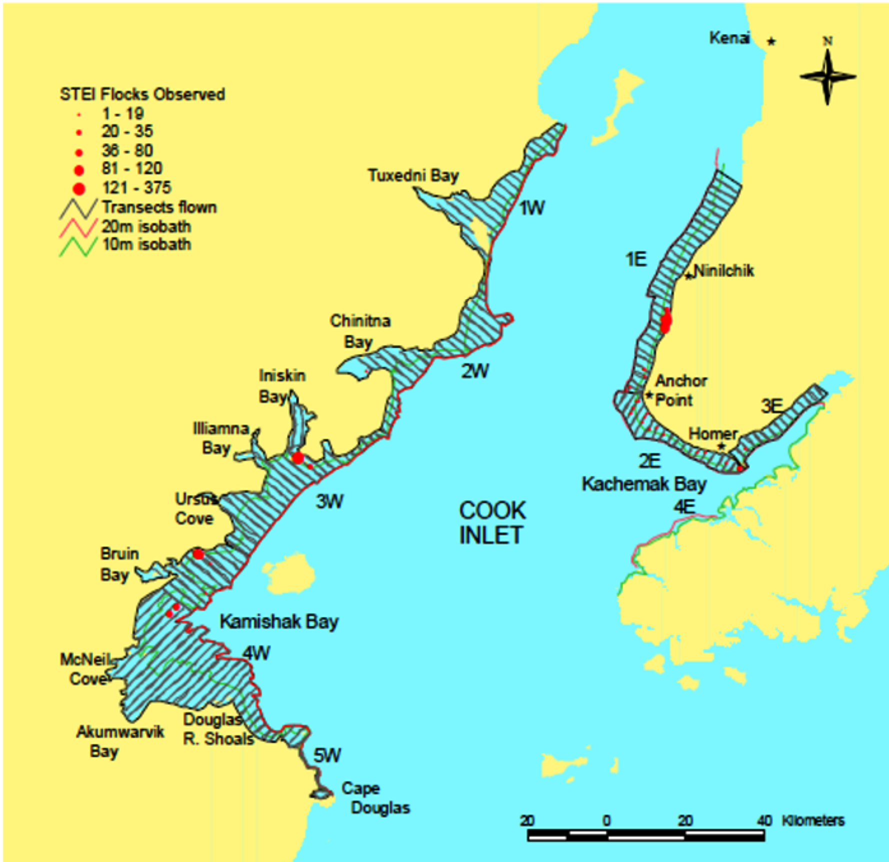
NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **33**

STELLER'S EIDER LOCATIONS JANUARY 2005 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC



NAD 1983 State Plane
Alaska 5 FIPS 5005 Feet
Seward Meridian

Figure:
34

STELLER'S EIDER LOCATIONS
FEBRUARY 2005 (LARNED 2006)
USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC

THE pebble PARTNERSHIP

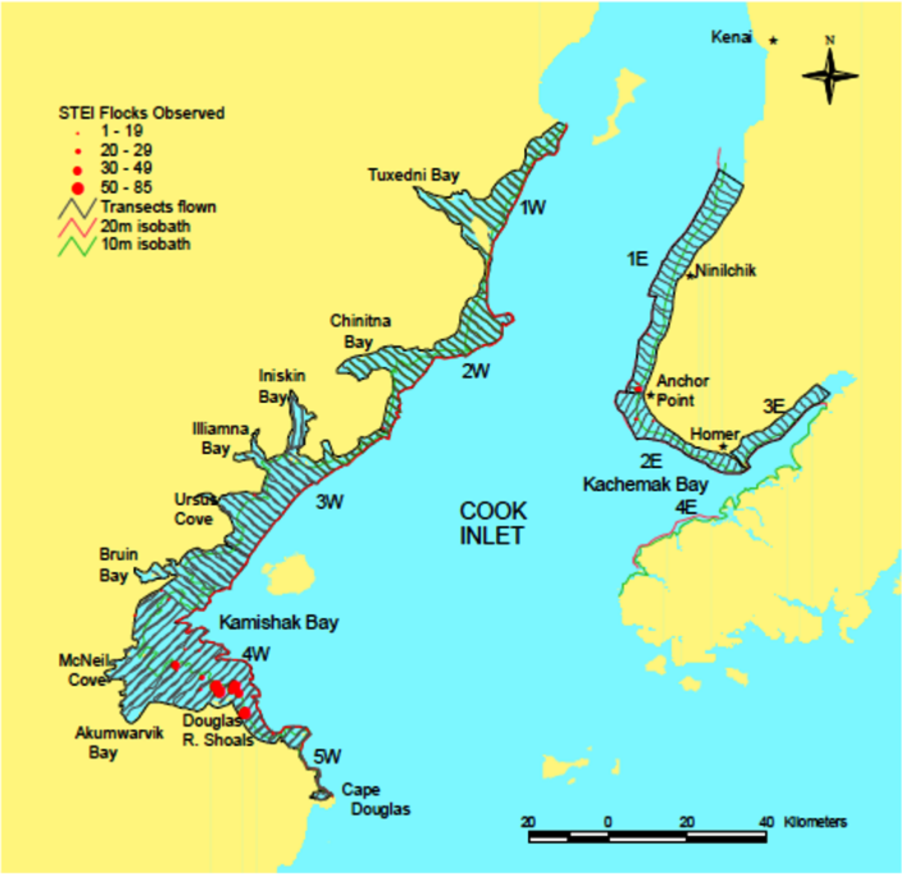
NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **35**

STELLER'S EIDER LOCATIONS MARCH 2005 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	Author: ORNRC



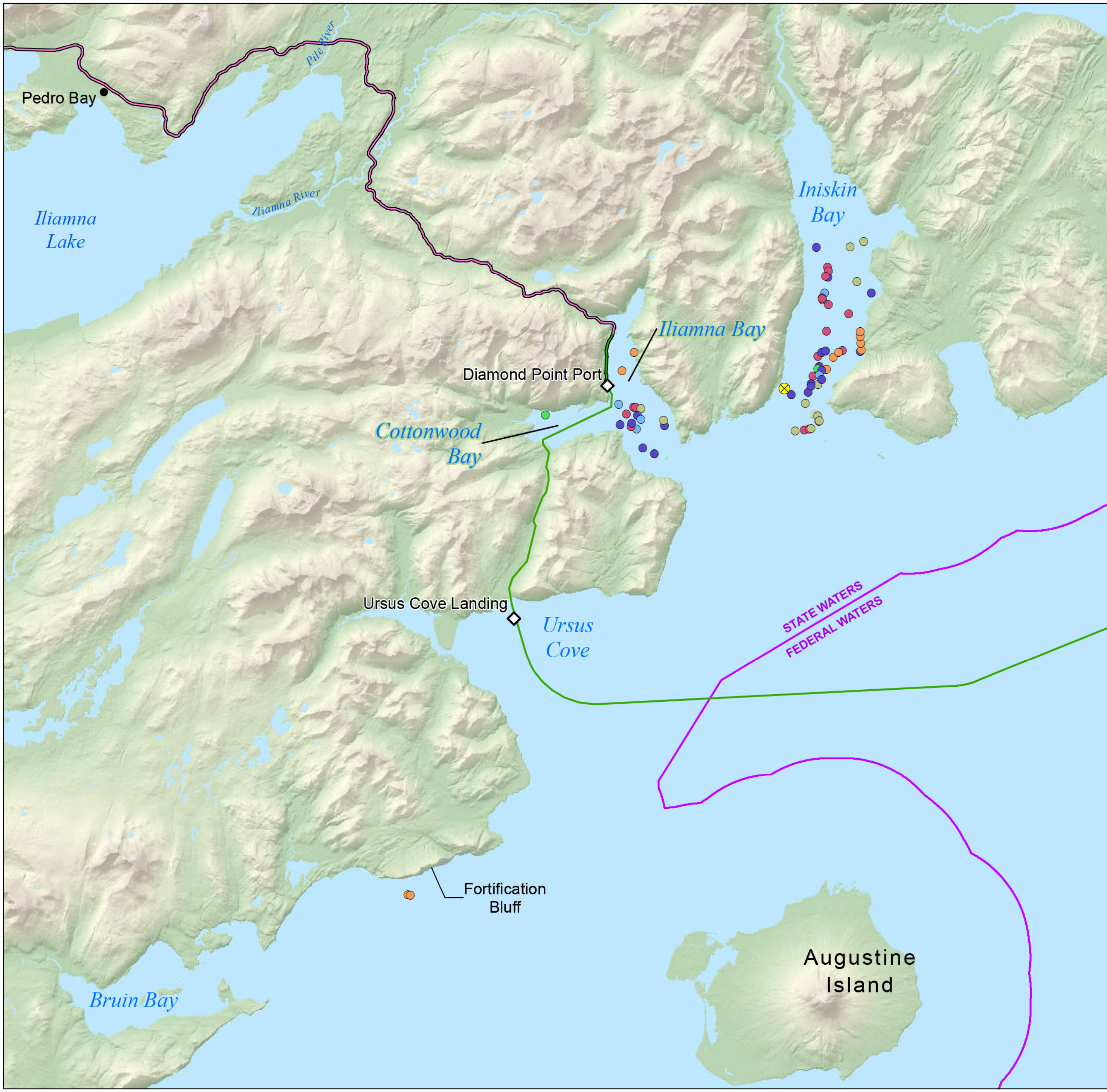
NAD 1983 State Plane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **36**

STELLER'S EIDER LOCATIONS APRIL 2005 (LARNED 2006)

USFWS Biological Assessment

File: PLPUSFWS_025	Date: 5/14/2020
Revision: 01	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

State Seaward Boundary

Steller's Eider Locations

January	April
February	November
March	December

Miles

0 1.5 3 4.5 6

Scale 1:300,000

N

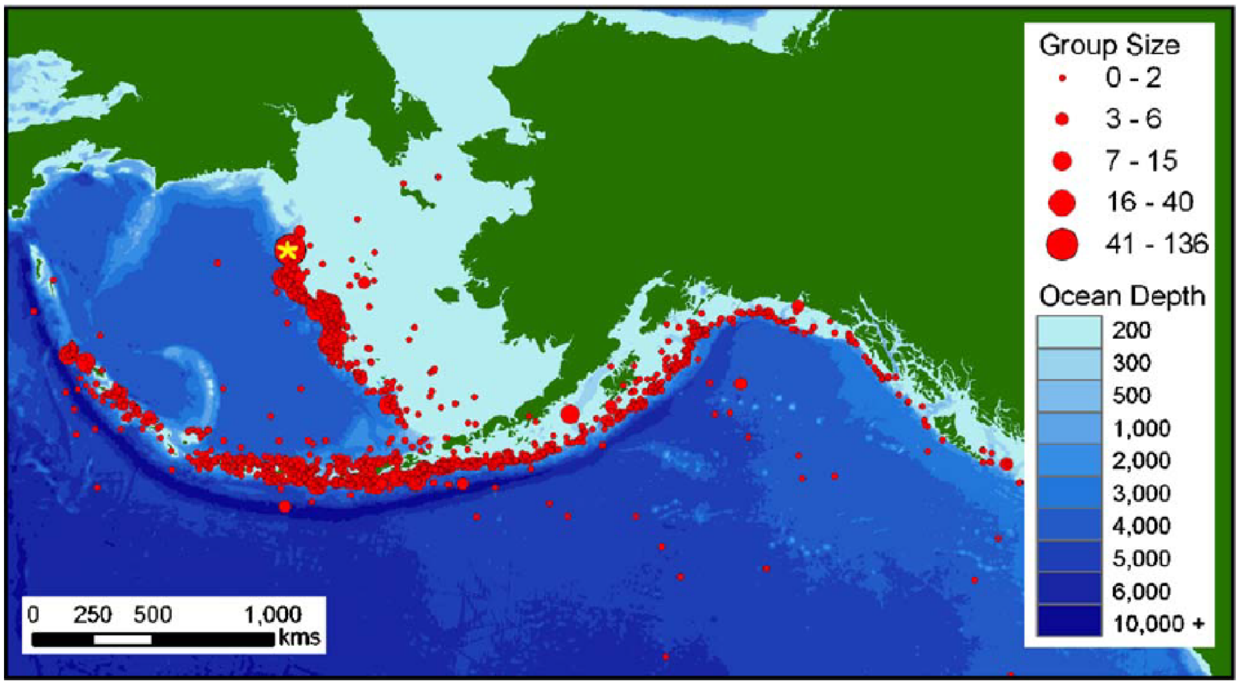
NAD 1983 StatePlane Alaska 5 FIPS 5005 Feet Seward Meridian

Figure: **37**

STELLER'S EIDER LOCATIONS FROM ABR HELICOPTER SURVEYS 2006-2012

USFWS Biological Assessment

File: PLPUSFWS_021	Date: 5/20/2020
Revision: 03	Author: ORNRC



THE pebble PARTNERSHIP

NAD 1983 StatePlane
Alaska 5 FIPS 5005 Feet
Seward Meridian

Figure:
38

SHORT-TAILED ALBATROSS LOCATIONS (PIATT ET AL. 2006)

USFWS Biological Assessment

File: PLPUSFWS_034
Date: 5/14/2020
Revision: 08
Author: ORNRC