Executive Summary

US Army Corps of Engineers

Pebble Project EIS

Draft Environmental Impact Statement

February 2019

www.PebbleProjectEIS.com

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, US ARMY CORPS OF ENGINEERS
REGULATORY DIVISION
PO BOX 6898
JBER, AK 99506-0898

Regulatory Division
POA-2017-271

Re: Release of the Pebble Project Draft Environmental Impact Statement

Dear Reader:

Enclosed is the Pebble Project Draft Environmental Impact Statement (DEIS). The United States Army Corps of Engineers (USACE) received a permit application (POA-2017-271) from Pebble Limited Partnership (PLP), the applicant, on December 22, 2017, for the placement of fill in waters of the US and work in navigable waters of the US for developing the Pebble deposit, pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act.

The Applicant proposes to develop the Pebble copper-gold-molybdenum porphyry deposit (Pebble deposit) as a surface mine in Southwest Alaska near Iliamna Lake, approximately 200 miles southwest of Anchorage and 60 miles west of Cook Inlet. The closest communities are the villages of Iliamna, Newhalen, and Nondalton, each approximately 17 miles from the Pebble deposit. The project would include development of the open pit mine, with associated infrastructure to include a 270-megawatt power generating plant. A 188-mile natural gas pipeline from the Kenai Peninsula across Cook Inlet to the mine site is proposed as the energy source for the mine. The transportation corridor includes mine and port access roads, an 18-mile crossing of Iliamna Lake, and an Amakdedori port facility on the western shore of Cook Inlet.

The DEIS describes the proposed Pebble Project, as detailed in the permit application and subsequent applicant-provided information. It also describes the regulatory processes that guide the project review by USACE and cooperating agencies. The DEIS describes the project scoping process and the key issues that were raised by interested parties, as well as the project's purpose and need. A range of reasonable alternatives was developed based on the purpose and need and input from the scoping process; the alternatives development process is discussed in the DEIS. The document provides information on environmental resources in the EIS analysis area, and an evaluation of the potential environmental effects of all project alternatives. The DEIS also presents the applicant's proposed mitigative measures, which have been incorporated into the project design. After the Final EIS (FEIS) is completed, USACE will prepare a Record of Decision, which will include all mitigation measures required by the permit, if issued.

The DEIS comment period will be March 1 to May 31, 2019, during which time public hearings will be held (details are provided in the Notice Of Availability, and other details will be announced at https://pebbleprojecteis.com and in local media). Comments on the DEIS will be compiled and used to make revisions and draft the FEIS. After the release of the FEIS, USACE will make a decision to issue or deny a permit the applicant.

Written comments and statements must be postmarked no later than May 31, 2019.

Where and How to Access the Document

You may access the document on the internet at https://pebbleprojecteis.com. Requests for an electronic copy of the DEIS can be made to:

Shane McCoy, Program Manager
US Army Corps of Engineers, Alaska District
P.O. Box 6898
JBER, AK, 99506-0898
907-753-2715

An electronic version of the DEIS document may also be viewed at the following public libraries:

- Alaska Resources Library and Information Services, Anchorage
- Bristol Bay Borough Libraries (serving King Salmon, Naknek, and South Naknek)
- Dillingham Public Library, Dillingham
- Georgetown University, Washington, DC
- Homer Public Library, Homer
- Kenai Community Library, Kenai
- Soldotna Public Library, Soldotna
- University of Alaska/Alaska Pacific University Consortium Library, Anchorage
- Z.J. Loussac Public Library, Anchorage

How to Submit Comments

There are several ways to submit comments:

- At a public hearing
- At https://pebbleprojecteis.com
- Send as an email to: drafteis@comments.pebbleprojecteis.com
- Via Fax to 907-753-5567
- Via US Postal Service Mail:

645 G Street, Suite 100-921
Anchorage, AK 99501

Please include your name, address, and affiliation (if any). Please be advised that your entire comment, including your personal identifying information, may be made publicly available. Although you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. All submissions from organizations and businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be available for public review in their entirety.

ACRONYMS

ADF&G	Alaska Department of Fish and Game
AHRS	Alaska Heritage Resources Survey
APDES	Alaska Pollutant Discharge Elimination System
ARD	acid rock drainage
AS	Alaska Statute
BBEDC	Bristol Bay Economic Development Corporation
BMP	best management practice
BSEE	Bureau of Safety and Environmental Enforcement
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	Compensatory Mitigation Plan
CWA	Clean Water Act
DA	Department of the Army
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
ES	Executive Summary
FEIS	Final Environmental Impact Statement
GHG	greenhouse gas
HDD	horizontal directional drilling
HUC	hydrologic unit code
LEDPA	least environmentally damaging practicable alternative
LPB	Lake and Peninsula Borough
MAD	mean annual discharge
ML	metal leaching
MLLW	mean lower low water
mm	millimeter
NEPA	National Environmental Policy Act
NFK	North Fork Koktuli River
NHPA	National Historic Preservation Act
NWI	National Wetlands Inventory
NWUS	navigable waters of the US
PAG	potentially acid generating
PLP	Pebble Limited Partnership
RFI	Request for Information
RHA	Rivers and Harbors Act
ROD	Record of Decision
ROW(s)	right(s)-of-way
SCP	seepage collection pond
SFK	South Fork Koktuli River
SWHS	Statewide Harvest Survey
TES	Threatened and Endangered Species
TSF	tailings storage facility
TSS	total suspended solids
US	United States
USACE	US Army Corps of Engineers
USC	US Code
USCG	US Coast Guard
USGS	US Geologic Survey
UTC	Upper Talarik Creek
WMP	water management pond
WOUS	waters of the US
WQC	Water Quality Criteria
WTP	water treatment plant

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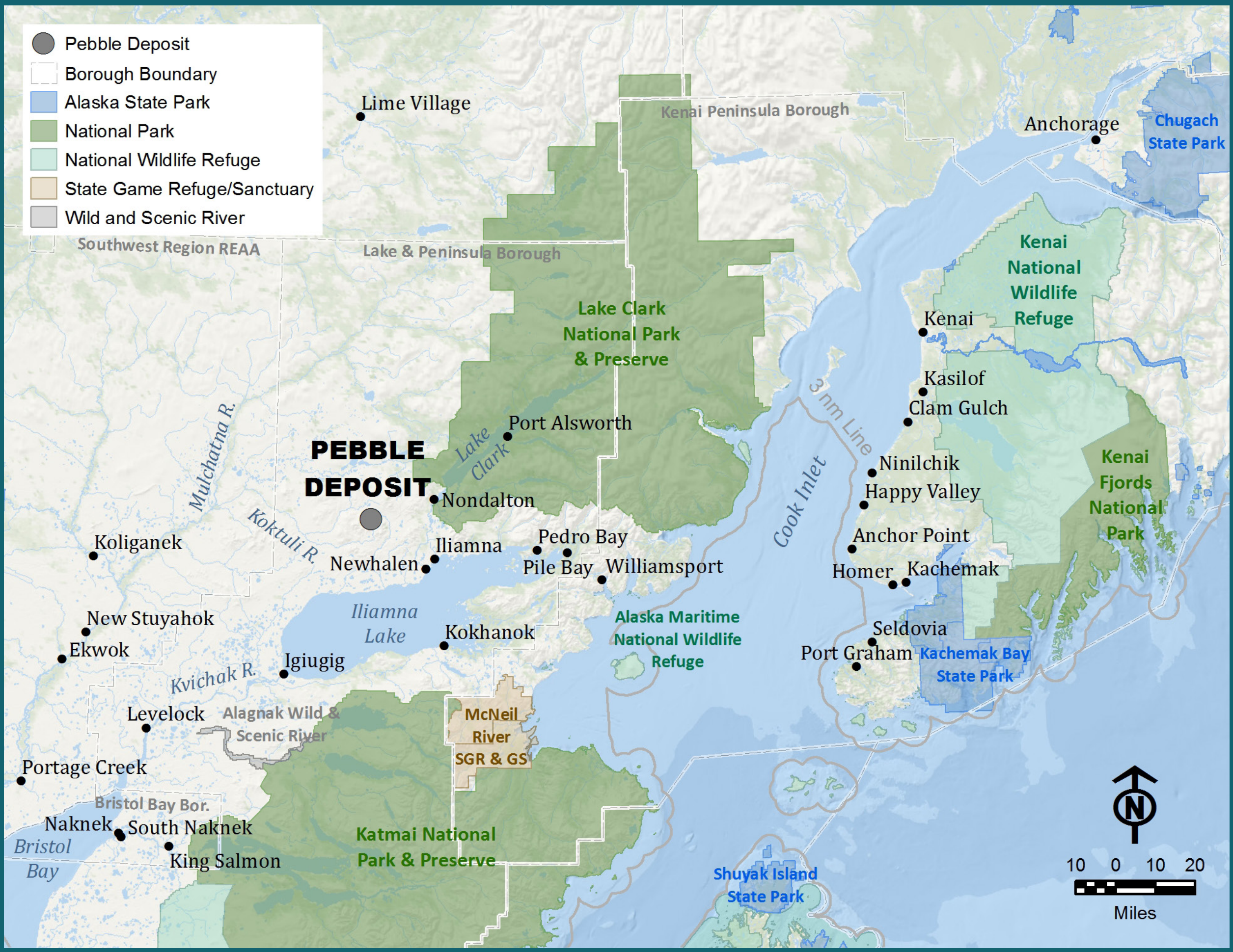

Pebble Deposit
Borough Boundary
Alaska State Park
National Park
National Wildlife Refuge
State Game Refuge/Sanctuary
Wild and Scenic River
Lime Village
Kenai Peninsula Borough
Anchorage
Chugach State Park
Southwest Region REAA
Lake & Peninsula Borough
Kenai National Wildlife Refuge
Lake Clark National Park & Preserve
Kenai
Kasilof
Clam Gulch
3 nm Line
Port Alsworth
PEBBLE DEPOSIT
Lake Clark
Mulchatna R.
Nondalton
Ninilchik
Happy Valley
Kenai Fjords National Park
Koktuli R.
Cook Inlet
Koliganek
Iliamna
Pedro Bay
Anchor Point
Newhalen
Pile Bay
Williamsport
Homer
Kachemak
New Stuyahok
Iliamna Lake
Alaska Maritime National Wildlife Refuge
Seldovia
Ekwok
Kokhanok
Port Graham
Kachemak Bay State Park
Kvichak R.
Igiugig
Levelock
Alagnak Wild & Scenic River
McNeil River SGR & GS
Portage Creek
Bristol Bay Bor.
Naknek
South Naknek
Bristol Bay
King Salmon
Katmai National Park & Preserve
Shuyak Island State Park
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1.0 PURPOSE AND NEED

1.1 Lead and Cooperating Agencies and Authorities

The US Army Corps of Engineers (USACE), Alaska District, Regulatory Division, is examining the potential environmental impacts associated with Pebble Limited Partnership's (PLP) submittal of a Department of the Army (DA) Permit application (POA-2017-271). PLP, the applicant, has asked for authorization to discharge fill material into waters of the US (WOUS) and work in navigable waters of the US (NWUS) for developing a copper-gold-molybdenum porphyry deposit (Pebble deposit), pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA) and Section 404 of the Clean Water Act (CWA).

Through review of the application, the USACE identified two additional federal decision-makers: the US Coast Guard (USCG), and the Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE). USCG has authority over locations and clearances of bridges and causeways in or over NWUS. USCG authorization is required for a proposed bridge over the Newhalen River, as set forth in implementing regulations in 33 Code of Federal Regulations (CFR) Parts 114-118.

A joint record of decision (ROD) by the USACE, BSEE, and USCG, issued at the end of the National Environmental Policy Act (NEPA) process, would record each appropriate federal agency's decision(s), identify the alternatives considered in reaching those decision(s) and identify practicable means to avoid or minimize environmental harm (if required). The USACE is the lead agency, under NEPA, in preparing this Environmental Impact Statement (EIS).

Seven federal agencies, the State of Alaska, Lake and Peninsula Borough (LPB), and two tribal governments are serving as cooperating agencies with the USACE in developing this EIS, and are listed below. Cooperating agencies have jurisdiction over some part of the project by law or have special expertise in potential environmental effects addressed in the EIS.

- Advisory Council on Historic Preservation
- US Department of Interior Bureau of Safety and Environmental Enforcement
- Curyung Tribal Council
- Lake and Peninsula Borough
- Nondalton Tribal Council
- US Department of Interior National Park Service
- US Department of Transportation Pipeline and Hazardous Materials Safety Administration
- State of Alaska
- US Coast Guard
- US Environmental Protection Agency
- US Department of Interior Fish and Wildlife Service

1.2 Background

The proposed project is located on land acquired by the State of Alaska in 1974 via a three-way land swap with the federal government and Cook Inlet Region, Inc. The land was selected by the state specifically, for its mineral development potential. The initial discovery of the Pebble deposit was made in 1988 by Cominco Alaska, a division of Cominco Ltd. (Cominco). Cominco (later acquired by Teck Resources Limited) discontinued work on potential development of the Pebble deposit in 1997; and in 2001, the Pebble claims were optioned by a subsidiary of Northern Dynasty Minerals Ltd. (Northern Dynasty). In 2005, Northern Dynasty exercised its option to acquire the Pebble deposit, and in the same year discovered a significant, higher-grade eastern extension to the deposit. Over the next 7 years, knowledge of the size of the Pebble deposit was expanded through exploratory drilling. In 2007, Northern Dynasty formed PLP with another company and placed the deposit into the partnership. Over the next 6 years, PLP continued to advance exploratory drilling of the deposit through additional drilling, environmental data collection, and engineering studies. In 2013, PLP reverted to a wholly owned subsidiary of Northern Dynasty.

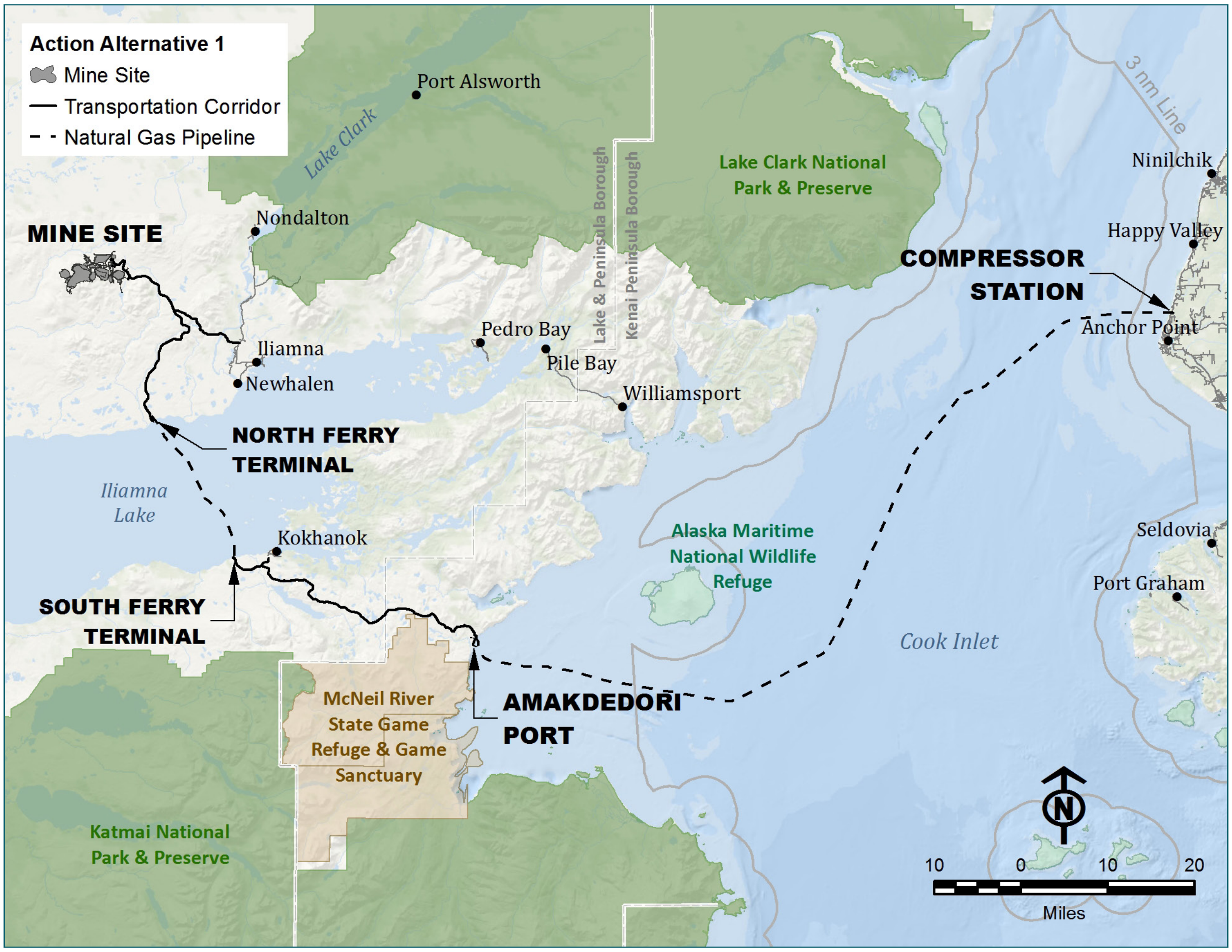


Figure ES-1: Action Alternative 1 – General Project Layout

1.3 Project Overview

PLP is proposing to develop the Pebble deposit as an open pit mine, with associated infrastructure. The project has four major components: the mine site, the transportation corridor, the Amakdedori port, and the natural gas pipeline corridor (Figure ES-1). At the end of operations, facilities would be closed and reclaimed in compliance with permit conditions.

The project would progress through four distinct phases: construction, operations (also referred to as the production phase), closure, and post-closure. Construction would last for approximately 4 years, during which the facilities would be built, and pre-production mining would occur. The workforce during construction is expected to peak at 2,000 personnel. During operations, the project would have an operating schedule of two 12-hour shifts per day, 365 days per year, and employ an average annual of approximately 850 personnel. Commissioning to transition the facilities into full operational status would commence near the end of the construction phase, and continue into the operations phase (approximately 4 to 6 months). The operations phase would last for 20 years. This phase would consist of mining in the open pit, processing of the mineralized material, expansion of the tailings facilities, and water management. Closure would commence once mining and processing are complete, and would last for 20 years. During closure, the production-related facilities would be removed, the material would be removed from the pyritic tailings storage facility (TSF), and other facilities reclaimed. Water management would continue through the closure phase. The post-closure phase is the period of time after the closure phase when water quality would be closely monitored, and changes and adjustments to the treatment process would be made over the long term, as needed.

1.4 Issues Selected for Analysis

Social, physical, or biological resources or other concerns were selected for analysis based on scoping comments, and are organized by:

Social Resources:

- Needs and Welfare of the People – Socioeconomics
- Subsistence
- Commercial and Recreational Fisheries
- Cultural Resources
- Historic Properties
- Land Ownership, Management, and Use
- Transportation and Navigation
- Recreation
- Environmental Justice
- Health and Safety
- Aesthetics
- Food and Fiber Production

Physical Resources:

- Air Quality
- Soils
- Geology
- Geohazards
- Surface Water Hydrology
- Groundwater Hydrology
- Noise
- Water and Sediment Quality

Biological Resources:

- Vegetation
- Fish Values
- Wetlands and Other Waters/Special Aquatic Sites
- Wildlife Values
- Threatened and Endangered Species

Other Concerns:

- Climate Change
- Invasive Species
- Tailings Dam Failures
- Concentrate, Fuel and Reagent Spills
- Natural Gas Supply and Pipeline Safety

1.5 Project Purpose and Need

A permit applicant's stated purpose and need is used as part of the NEPA process to inform the reasonable alternatives to a proposed action, and the stated need is used by the USACE to determine the overall purpose (and thus, practicable alternatives for the CWA 404(b)(1) evaluation), and to evaluate a proposed project from the public's perspective (under the public interest review criteria).

The applicant's stated purpose is:

> “ *to produce commodities, including copper, gold, and molybdenum from the Pebble deposit in a manner that is commercially viable, using proven technologies that are suitable for the project's remote location.”*

According to the applicant, because the area the applicant has leased for mineral development is not served by existing infrastructure, achieving the project purpose requires the construction of facilities for the mining and processing of mineral-bearing rock, as well as construction of support and access infrastructure. The purpose of the natural gas pipeline from the Kenai Peninsula is to provide a long-term stable supply of natural gas to meet the energy needs of the project by connecting to the existing regional gas supply network.

The applicant's stated need is:

> “ *to meet the increasing global demand for commodities such as copper, gold, and molybdenum.”*

To develop the EIS purpose and need statement pursuant to NEPA regulations (40 CFR Section 1502), the USACE focused on PLP's statement, exercising independent judgement in defining purpose and need for the project from both PLP's and the public's perspective. The USACE and cooperating agencies are neither proponents nor opponents of the proposed project.

The USACE determined that the overall project purpose is:

> “ *to develop and operate a copper, gold, and molybdenum mine in Alaska to meet current and future demand.”*

2.0 ALTERNATIVES

NEPA requires consideration of a reasonable range of alternatives that can accomplish the purpose and need of the proposed action. Consideration of alternatives is also pertinent to CWA 40 CFR Part 230 Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (hereafter identified as 404(b)(1) guidelines), which require the analysis of practicable alternatives to the proposed discharge.

The EIS team developed and screened potential action alternatives suggested during public scoping around three criteria: 1) Purpose and need; 2) Reasonable under Council on Environmental Quality (CEQ) guidance and practicable under 404(b)(1) guidelines; and 3) Environmental impacts. Options that failed to meet one of the three criteria, which were followed sequentially, were eliminated from detailed consideration in the DEIS.

Options that met screening criteria were packaged into action alternatives (i.e., an alternative must be a functioning project and include power, a port, transportation, and mine facilities). The alternatives screening process resulted in the identification of three major action alternatives (listed below). Variations to components of the project that do not comprise a complete functioning alternative are analyzed as variants under action alternatives. Each action alternative analyzes one to three variant alternatives. Although a variant may be analyzed under a specific action alternative, the USACE's determination of the least environmentally damaging practicable alternative (LEDPA) in its final permit decision may include a combination of components from the various alternatives and variants analyzed in the EIS.

NA 2.1 No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Although no resource development would occur, permitted resource exploration activities currently associated with the project may continue. PLP would retain the ability to apply for continued mineral exploration activities under the State's authorization process, as well as any activity that would not require federal authorization. In addition, there are many valid mining claims in the area, and these lands would remain open to mineral entry and exploration by other individuals or companies.

Current State-authorized activities associated with mineral exploration and reclamation and scientific studies would be expected to continue at levels similar to recent post-exploration activity. PLP would be required to reclaim any remaining sites at the conclusion of their State-authorized exploration program. If reclamation approval is not granted immediately after the cessation of reclamation activities, the State may require continued authorization for ongoing monitoring and reclamation work as deemed necessary by the State of Alaska.

AA1 2.2 Action Alternative 1 – Applicant's Proposed Alternative

This section summarizes the applicant's proposed alternative. Detailed information about engineered facilities and operations for the project from initial construction through closure and reclamation is included in PLP's Project Description, included in EIS Appendix N. EIS Appendix K2 provides the proposed construction schedule and a summary of the Action Alternative 1 permanent footprint for each project component (mine site, transportation corridor, port, and natural gas pipeline). Proposed mitigation measures, project elements, and environmental protections, including best management practices (BMPs), that PLP is proposing to implement to avoid and minimize impacts are described in EIS Chapter 5, Mitigation. A technical glossary of mining-related and physical science terms applied throughout project documents can be accessed online at: https://pebbleprojecteis.com/overview/glossary.

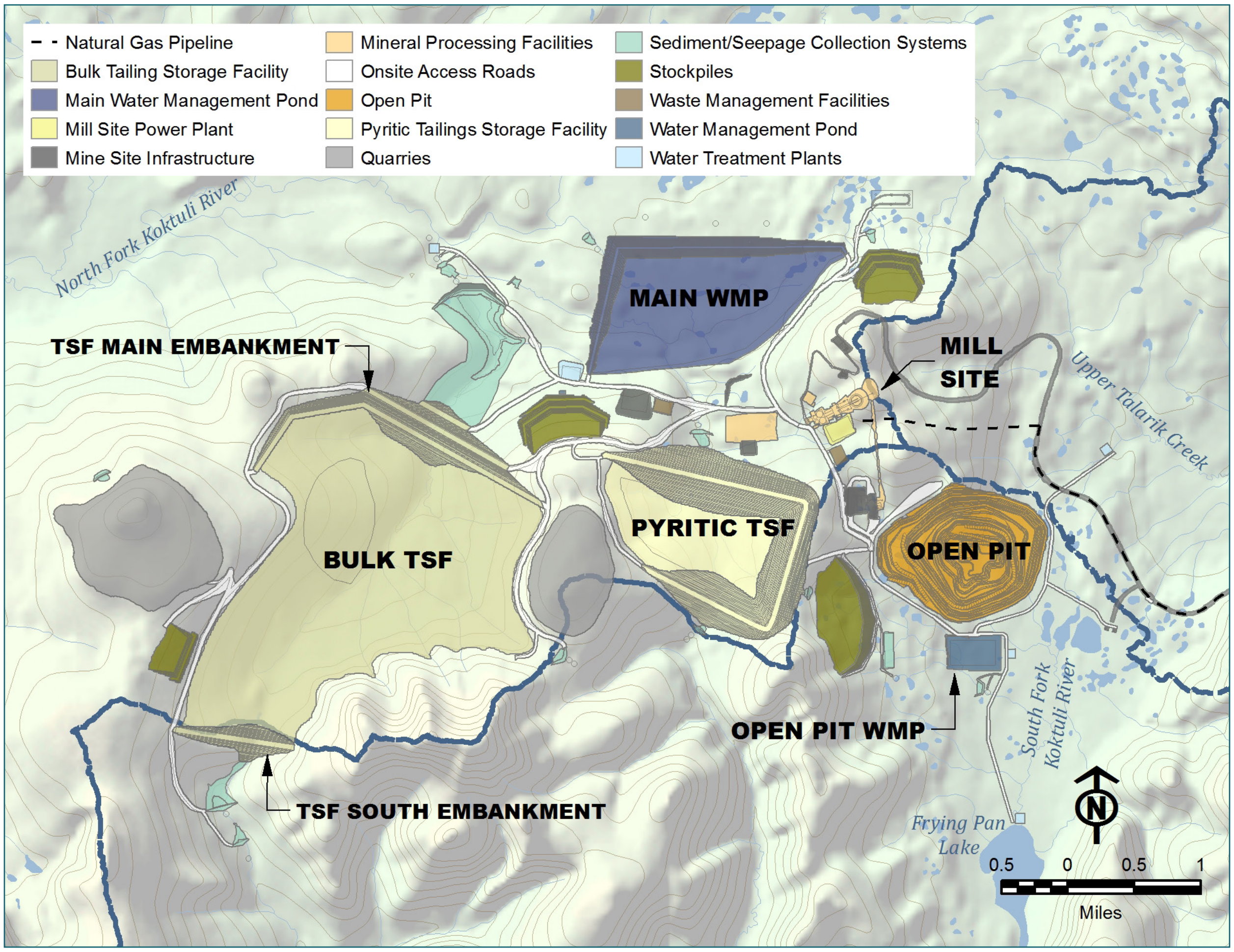


Figure ES-2: Action Alternative 1 – Mine Site Layout

PLP proposes to develop the Pebble deposit as an open pit mine with associated infrastructure. The project is in a sparsely populated region of southwest Alaska near Iliamna Lake, in the LPB and Kenai Peninsula Borough. The Pebble deposit is approximately 200 miles southwest of Anchorage and 60 miles west of Cook Inlet. The closest communities are Iliamna, Newhalen, and Nondalton, each approximately 17 miles from the Pebble deposit.

Mine Site

The fully developed mine site (approximately 8,086 acres) would include the open pit, bulk TSF, pyritic TSF, overburden stockpiles, material sites, main and open pit water management ponds (WMPs), seepage collection ponds (SCPs), sediment ponds, milling and processing facilities, and supporting infrastructure such as the 270-megawatt power plant, water treatment plants (WTPs), camp facilities, and storage facilities (Figure ES-2). The site is currently undeveloped, and not served by any transportation or utility infrastructure.

The mine would be a conventional drill, blast, truck, and shovel operation; with an average mining rate of 70 million tons per year, and an overall stripping ratio of 0.12 ton of waste per ton of mineralized material. Mine pre-production would commence with dewatering of the open pit, approximately one year before the start of pre-production mining. This water would be primarily collected from perimeter wells, and either stored for mill start-up or treated and discharged into the South Fork Koktuli (SFK) drainage south of the open pit. The purpose of the pre-production mining is to prepare the open pit for production. Approximately 33 million tons of material, primarily overburden and waste rock with a small amount of accompanying mineralized material, would be removed during this period and used for construction of mine infrastructure, or stored as overburden.

Mine production during the operations phase encompasses the period during which economic-grade mineralized material would be fed to the mill. Mineralized material would be fed through the process plant at a rate of 180,000 tons/day. Approximately 1.4 billion tons of material would be planned to be mined during the operations phase. The final footprint of the open pit at the end of the operations phase would be 608 acres.

Mineral processing facilities such as the mill site process plant, crusher and conveyor, and container yard would be located at the mine site near the open pit. Mineralized rock would be blasted in the pit and fed to a crushing plant, and then conveyed to a coarse ore stockpile, which in turn would feed a grinding mill. At various points throughout the mill, water and reagents would be added to the process. In the grinding mill, mineralized materials would be reduced to the consistency of very fine sand. The next step in the process is froth flotation, in which the copper and molybdenum minerals would be separated from the remaining material to produce concentrates. Multiple floatation steps would produce the copper-gold and molybdenum concentrates. The concentrates would then be filtered for shipment.

Gravity concentrators would be placed at various locations throughout the grinding and flotation circuits within the process plant, with the intent of recovering a portion of the free gold and silver within the plant feed. The concentrates from these facilities will consist primarily of higher-density particles with accompanying gold and silver.

The copper-gold concentrate would be loaded into covered bulk shipping containers, and the molybdenum concentrate would be packaged in bulk bags and loaded into shipping containers for off-site transport. Other economically valuable minerals—such as palladium and rhenium—would be present in the concentrates, and may be recovered at the refineries. The gravity concentrate would be packaged in bulk bags and shipped off site by air.

Processing mineralized material to recover concentrates would result in two types of tailings: bulk tailings[1], and pyritic tailings[2]. Separate TSFs for the bulk tailings (approximately 2,796 acres) and pyritic tailings (approximately 1,071 acres) would be located primarily in the North Fork Koktuli (NFK) watershed, but would also have some footprint in the SFK watershed. The main WMP (approximately 955 acres) would be located in the NFK. Both TSFs and the main WMP would have associated SCP facilities. Total TSF capacity would be sufficient to store the 20-year mine life tailings volume. Approximately 88 percent of the tailings would be bulk tailings, and approximately 12 percent would be pyritic tailings.

The bulk TSF would have two embankments: the main embankment, constructed using the centerline construction method; and the south embankment, constructed using the downstream construction method[3]. The bulk TSF would be designed to allow the tailings to dewater and solidify by draining through the main embankment. The main embankment would not be lined, and a seepage collection system would be constructed downstream of the facility to allow collection and treatment of tailings contact water. The upstream slope of the south embankment would be covered with a liner system to minimize water seepage through the south embankment. This would force the seepage out of the TSF to flow in a northerly direction, and ultimately flow through and under the main embankment and its underdrains, instead of through and under the south embankment. After closure, the bulk TSF would continue to dewater and the tailings mass would become a stable landform.

The pyritic TSF would be fully lined and would have three embankments constructed using the downstream method of construction. The pyritic TSF would contain the pyritic tailings and would have a full water cover during operations to prevent the oxidation of the pyritic material. The pyritic TSF would also be used to store potentially acid-generating (PAG) waste rock during operations. At closure, the pyritic tailings and PAG waste rock would be relocated to the bottom of the completed open pit, and maintained in a subaqueous condition in perpetuity by the lake that would naturally form in the pit.

WMPs at the mine site include the open pit WMP, bulk TSF main SCP, pyritic TSF SCP, seepage collection and recycle ponds, sediment ponds, and main WMP. The main WMP is the primary water management structure at the mine site. It would be a fully lined facility, and the enclosing embankment would be constructed using quarried earthfill and rockfill materials founded on competent bedrock.

[1] Bulk tailings are primarily composed of non-acid-generating finely ground rock material that remains after economic minerals and most pyritic materials have been extracted through mineral processing at the mine site.

[2] Pyritic tailings are composed of potentially acid-generating finely ground rock material containing the naturally occurring mineral pyrite that remains after economic minerals have been extracted through mineral processing at the mine site.

[3] Downstream and centerline construction are methods of dam (embankment) construction in which a rockfill dam is raised. With the downstream construction, the dam is raised completely in the downstream direction using the placement of fill on top of the crest and downstream slope of the previous raise. Therefore, the upstream slope would remain as a uniform slope. With the centerline construction method, the rockfill embankment is raised with the objective of continually raising the crest vertically upwards. This requires the concurrent placement of fill on top of the tailings beach, the remaining upstream slope, the crest, and the downstream slope of the previous raise during the raise process. The result is a zigzag-shaped upstream face, with the upstream part of the raise founded on the part of the tailings beach closest to the embankment

Supporting infrastructure and facilities that would be constructed within the mine site footprint include the mill site power plant, shops, onsite access roads, permanent personnel camp, potable water supply, communications, laboratories, and fire and emergency response. A temporary construction camp (in addition to the permanent personnel camp) would be constructed at the mine to provide accommodations for initial construction. Construction crews would use the temporary construction camp and the permanent camp after it was constructed. As construction is completed and crew sizes reduce, they would transition to the temporary camp only. This would enable the permanent accommodations complex to be refurbished to single-room occupancy for the mine operations staff.

A landfill and incinerator would be constructed and operated at the mine site for domestic waste handling. Used tires and rubber products would be reused to the extent practicable. Used tires, along with other damaged parts and worn pipes, would be packaged and back-loaded into empty containers for shipment and disposal off site. Wood pallets and packaging would be incinerated with domestic waste. Scrap steel would be shipped off site to appropriate disposal sites. Waste oils not suitable for burning, including lubricants, would be collected into drums, sealed, and stored in containers for shipment to be recycled or disposed of off site at an approved facility. Miscellaneous hazardous wastes that may accumulate on site, such as paint, used solvents, and empty reagent containers with residual chemicals, would be managed and shipped off site to approved facilities according to applicable BMPs and regulations.

Separate sewage treatment plants would be located at the camp and the process plant. The camp sewage treatment plant would be designed to remove biological oxygen demand, total suspended solids (TSS), total phosphate, total nitrogen, and ammonia to meet State domestic waste-discharge criteria. The process plant sewage treatment plant would receive effluent that may have metallic residues from the workers' change house and associated laundry, and therefore would also be designed for metals removal. Treated water would be discharged to the pyritic TSF, and sludge from both plants would be stabilized and disposed of in the proposed on-site landfill.

The mine area would have two WTPs during operations: the open pit WTP (WTP #1), and the main WTP (WTP #2), and one to two WTPs (WTP #2 and WTP #3) during various phases of closure and post-closure. All WTPs would be constructed with multiple independent treatment trains, which would enable ongoing water treatment during mechanical interruption of any one train, or to manage increased flow rates.

The physical site closure work would commence as operations end. The mine open pit would be stabilized to meet the requirements of 11 Alaska Administrative Code 97.200(c). Pyritic tailings and PAG waste rock would be placed into the open pit for long-term storage below the pit lake water level. Once the material has been transferred to the open pit, the pit lake (i.e., the water that would accumulate in the open pit as a lake at closure) would continue to fill, and would be allowed to rise to the pre-determined control elevation threshold (about 890 feet). Once the level of the open pit lake rises to the control elevation, water would be pumped from the open pit, treated as required to meet State water quality standards, and discharged to the environment. By maintaining the water level at this elevation, which is at least 50 feet below the elevation at which groundwater flow would be directed outward from the open pit, upset conditions resulting in an unplanned discharge would be avoided, because there would be time to address any problems with the WTP before flows reverse.

The mill, pyritic TSF, main WMP, and other infrastructure not required for post-closure would be removed from the site, and/or reclaimed as part of the site closure and reclamation. Any hazardous materials that could not be stored permanently on the site would be transported off-site and delivered to a licensed hazardous waste storage facility. The bulk TSF would be closed by grading its surface so that all drainage would be directed off the TSF, and then the tailings surface would be covered with soil and/or rock and possibly a geomembrane or other synthetic material. This would prevent water from ponding on the TSF surface, and is known as a dry closure. Once this surface runoff from the bulk TSF is demonstrated to meet water quality criteria, it would be directly discharged to the environment. Seepage water from the bulk TSF embankment SCPs would be collected and either treated in the WTPs or directed to the pit lake until determined to be suitable for discharge—anticipated after approximately Year 50 post-closure.

PLP's proposed Alternative includes use of an all-season ice-breaking ferry

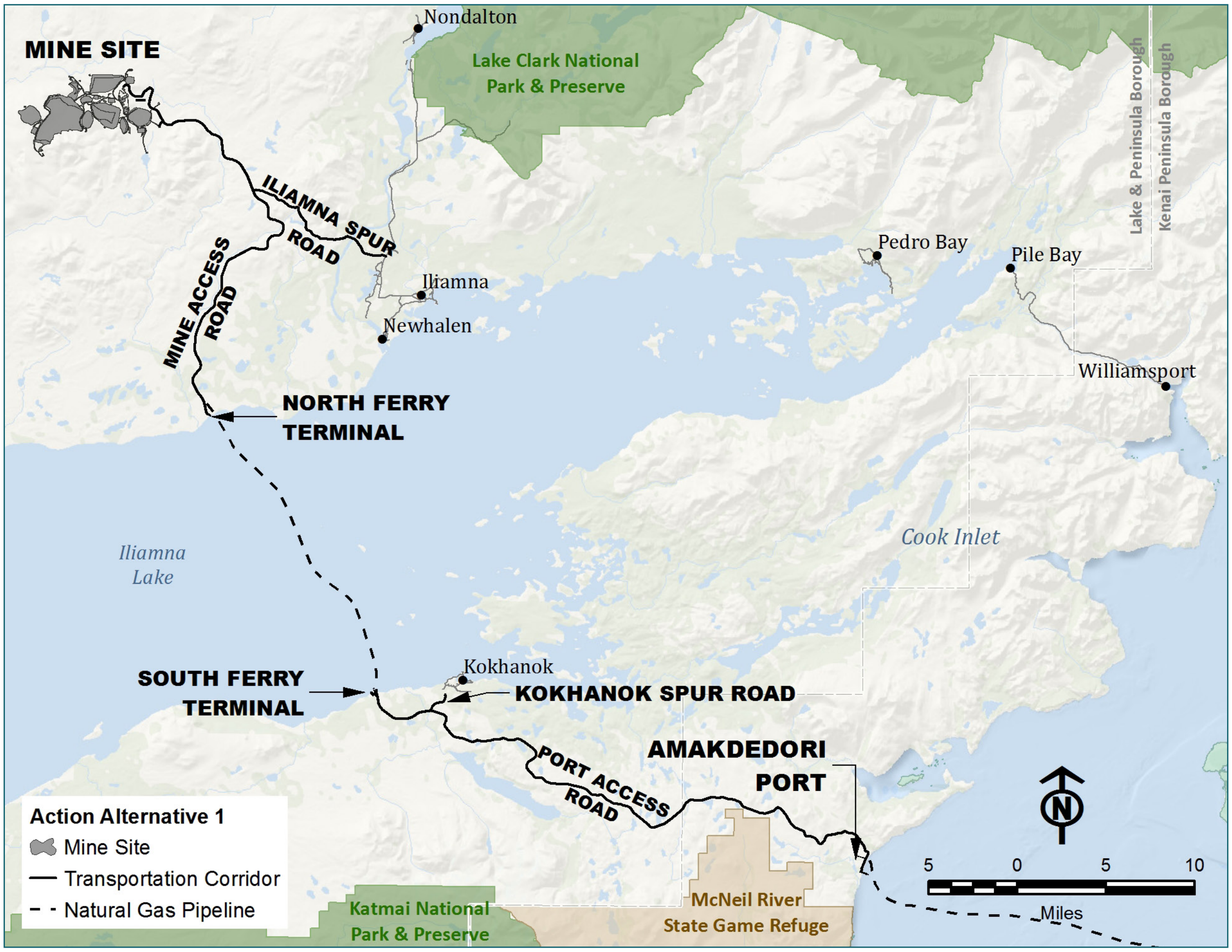


Figure ES-3: Action Alternative 1 – Transportation Facilities Overview

Transportation Corridor

The transportation corridor would connect the mine site to Amakdedori port on Cook Inlet, and consist of a mine access road (29 miles with a footprint of 346 acres), ferry crossing (18 miles), and port access road (37 miles with a footprint of 408 acres). Separate spur roads, approximately 134 acres and 11 miles in total length, would connect the transportation corridor to the communities of Iliamna, Newhalen, and Kokhanok (Figure ES-3).

The main access roads would be designed as private gravel roads with a 30-foot-wide driving surface to enable two-way traffic, and would be capable of supporting anticipated development and operational activities during construction and truck haulage of concentrate from the mine to the port. The road system would include nine bridges, six of which would be single-span, two-lane bridges that range in length from approximately 30 to 125 feet. Culverts at streams without fish would be designed and sized for drainage only, and culverts at streams with fish would be designed and sized for fish passage in accordance with regulatory standards. The Action Alternative 1 design currently estimates 86 culverts; of these, 41 would be designed as fish passage culverts. The exact number and design of waterbody crossings would be determined during final design and permitting. During project operations, daily transportation of materials (concentrate, fuel, reagents, and consumables) would require up to 39 truck round trips per day for each leg of the road, including three loads of fuel per day.

PLP's proposed alternative includes use of an all-season ice-breaking ferry (see illustration), which would transit Iliamna Lake, carrying inbound supplies from Amakdedori port, and returning with copper-gold and molybdenum concentrates, backhauled waste, and empty shipping containers. On average, one round-trip per day across the lake would be required. Ferry terminals would be constructed and operated on the southern and northern shores of Iliamna Lake. The south ferry terminal would

Digital Simulation of South Ferry Terminal

include a ferry assembly site. The ferry would be assembled from pre-fabricated components barged to Amakdedori port, and then transported across the road. The assembly site would remain intact to enable regular vessel surveys and maintenance as required.

A pioneer road would be constructed in the permanent road alignment to access material sites and support construction. Once access is gained to Iliamna Lake, small barging equipment would be used on the lake to establish beachheads at the two ferry terminal sites. Temporary bridges would be used at the smaller crossings.

A temporary camp would be established at each of the ferry landings to support road construction. At the south ferry landing the camp would also support assembly of the ferry. These camps would be constructed within the area proposed for the permanent footprint, and would remain in place until the permanent facilities are established. Until the access road crossing at the Newhalen River was completed, the crews would be shuttled to their workplaces by boat or by helicopter.

All temporary construction facilities would be removed after construction, and the sites would be reclaimed, unless converted for permanent facilities.

The road system would be retained if required for the transport of bulk supplies needed for long-term post-closure water treatment and monitoring. Once the roads were no longer needed, the alignments would be recontoured if required, stabilized, and overburden would be placed as appropriate.

The Iliamna Lake ferry facilities would be reclaimed after closure activities are completed. At that time, the Iliamna Lake ferry facilities would be removed, and all supplies would be transported across the lake utilizing a summer barging operation.

A detailed reclamation plan would be prepared in compliance with State requirements during the State permitting and right-of-way (ROW) lease processes prior to construction.

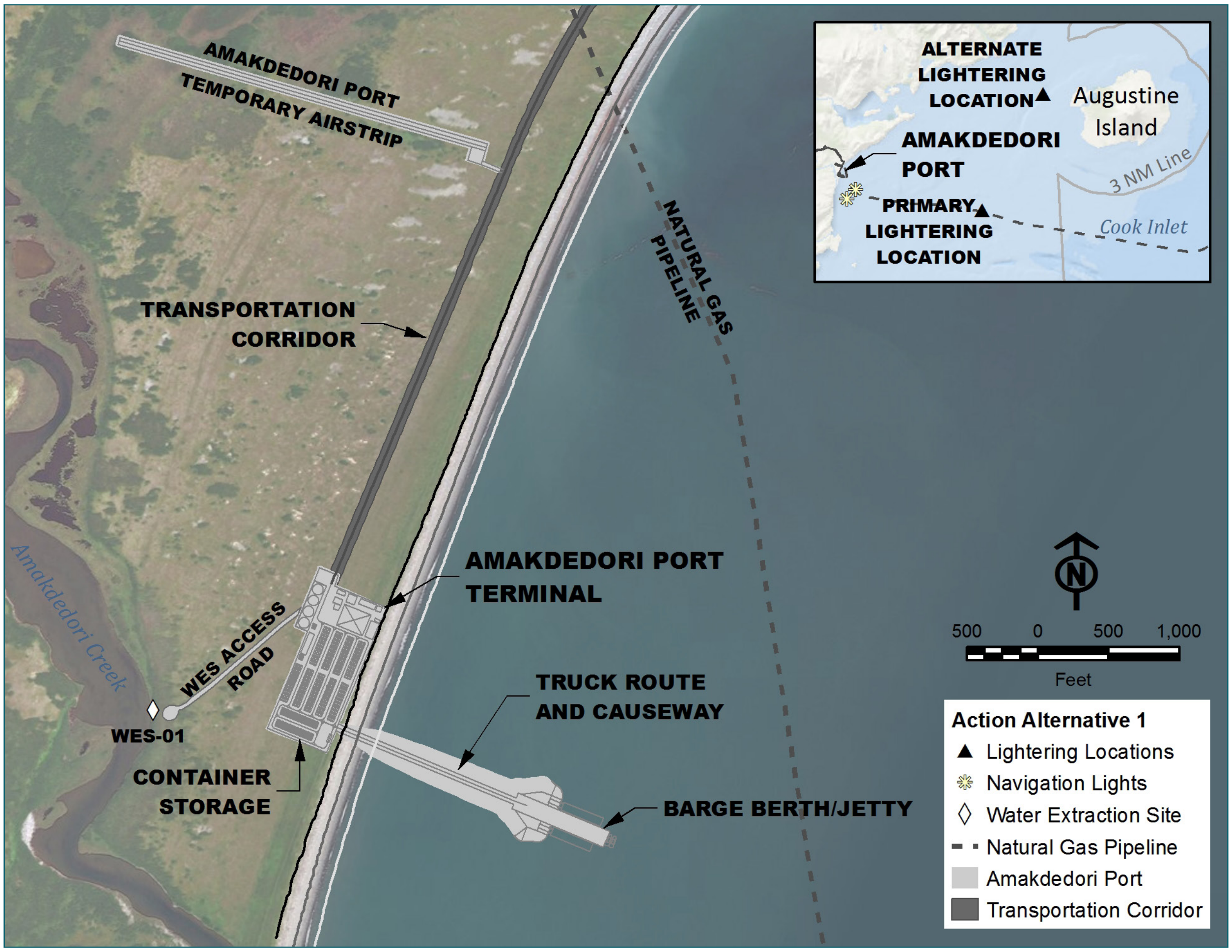


Figure ES-4: Action Alternative 1 – Amakdedori Port and Lightering Locations

Amakdedori Port and Lightering Locations

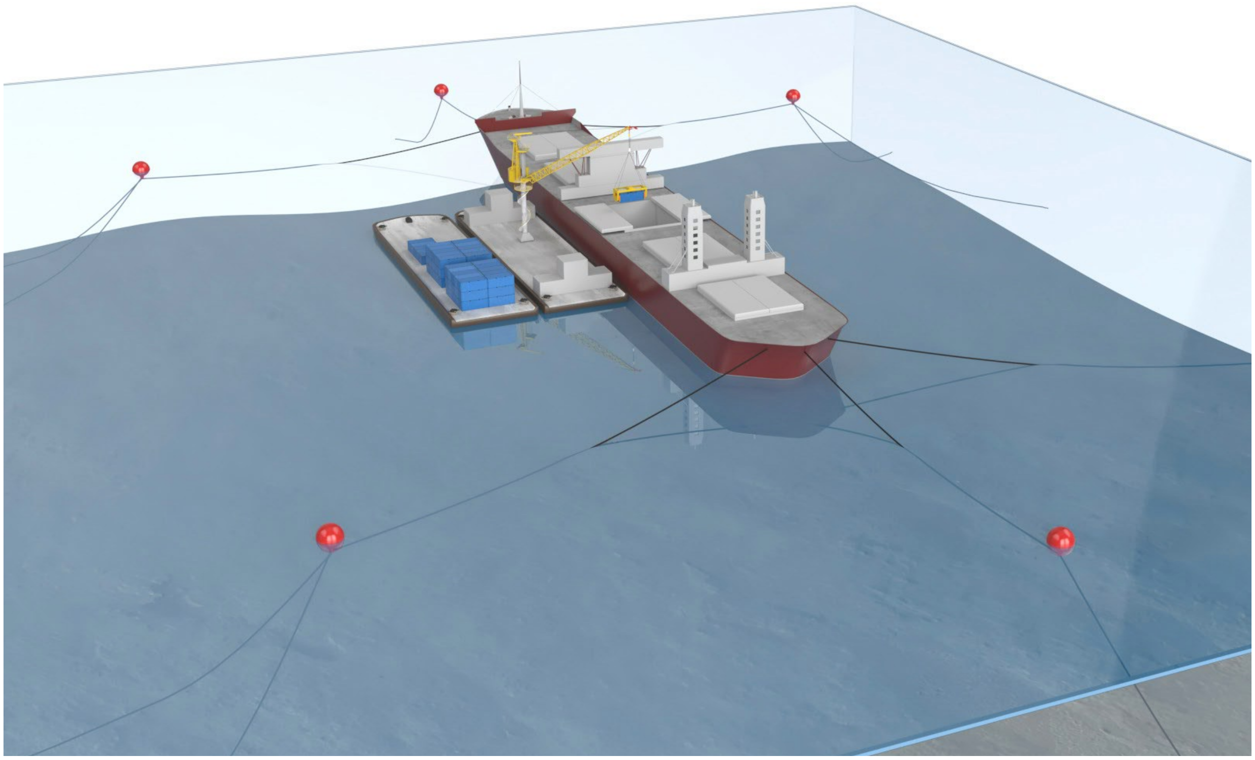
The proposed project includes construction of Amakdedori port, a year-round port east of Amakdedori Creek on the western shore of Cook Inlet. The port site is currently undeveloped and not served by any transportation or utility infrastructure.

The proposed port site (30 acres) would include a permanent port site airstrip, as well as shore-based and marine facilities for the shipment of concentrate, freight, and fuel for the project, including storage tanks (Figure ES-4). The shore-based facilities would include a container storage area for receipt and storage of containers for concentrate and freight.

Marine facilities would include an earthen access causeway extending out to a marine jetty in -15 feet mean lower low water (MLLW).

Copper-gold concentrate containers would be loaded onto lightering barges (see simulation on next page) at Amakdedori port, then transported to one of two lightering locations for transfer to bulk carriers. The primary lightering location is approximately 12 miles offshore east of the proposed Amakdedori port; an alternate lightering location is approximately 18 miles east-northeast of the proposed Amakdedori port between Augustine Island and the mainland.

Copper-gold concentrate would be transported from the mine site to Amakdedori port by truck and ferry



Copper-gold concentrate containers would be lightered to bulk carriers moored offshore

in covered bulk cargo containers and stored between vessel sailings on a dedicated laydown pad adjacent to the jetty.

Up to 27 Handysize ships (i.e., bulk cargo ships) would be required annually to transport concentrate. Up to 33 marine linehaul barge loads of supplies and consumables would be required annually. Two ice-breaking tug boats would be used to assist the Handysize ships and barges with mooring and approach/departing the barge berths.

During the initial construction effort at Amakdedori port, temporary facilities (i.e., camp and service facilities) would be sited in the area that would be used for port operations. Temporary diesel generators would be used for power supply. While the initial site access work is under way, crews would be housed on vessels moored near the site. The airstrip at Amakdedori would be used primarily through the first year of construction until the road connection to the Kokhanok airstrip is completed. Following this, the airstrip would only be used for incidental/emergency access.

Physical site closure work would commence as operations end. At that time, the Amakdedori port facilities would be removed, except for those required to support shallow draft tug and barge access to the dock for the transfer of bulk supplies. The marine port facilities would be removed and reclaimed after closure activities are completed.

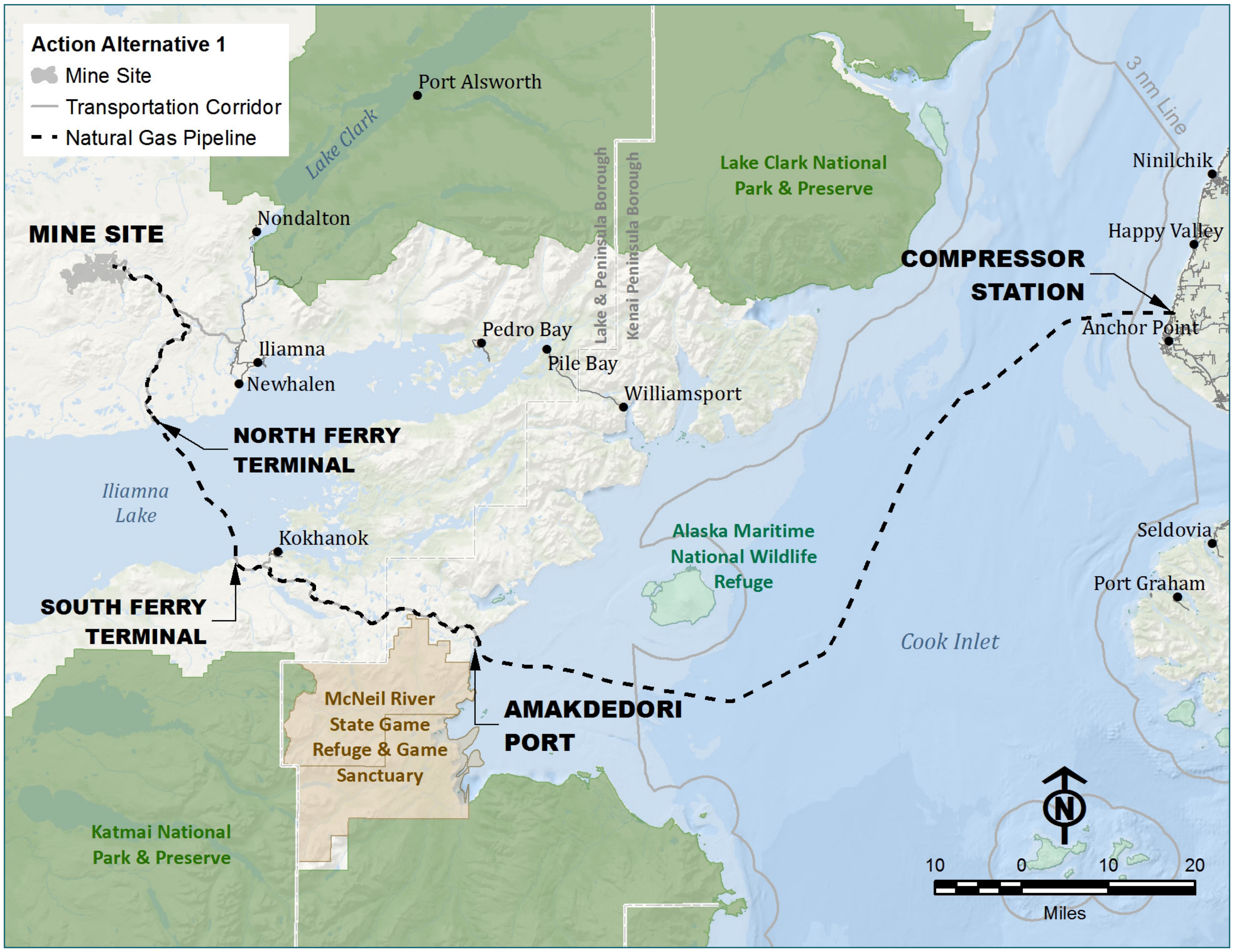


Figure ES-5: Action Alternative 1 – Natural Gas Pipeline Alignment

Natural Gas Pipeline

Natural gas, sourced through the existing natural gas supply infrastructure for the Cook Inlet area, would be the primary energy source for the project. As required for the granting of both a state and federal ROW, the pipeline would be open access; more specifically, a contract carrier. PLP has committed to providing community access to the gas line.

The natural gas would be supplied to Amakdedori port and the mine site by pipeline (Figure ES-5). The pipeline would connect to the existing gas pipeline infrastructure north of Anchor Point on the Kenai Peninsula. A fiber-optic cable would be buried in the pipeline trench or ploughed in adjacent to the pipeline. The pipeline and fiber-optic cable corridor from the Kenai Peninsula has four main segments: 1) a 104-mile subsea pipeline across the Cook Inlet coming ashore at Amakdedori port; 2) a segment from the Amakdedori port to the south ferry terminal buried in a trench adjacent to the port access road; 3) an 18-mile lakebed crossing of Iliamna Lake, coming ashore at the north ferry terminal; and 4) a segment from the north ferry terminal to the mine site buried in a trench adjacent to the mine access road. Horizontal directional drilling (HDD) or trenching would be used at the Cook Inlet and Iliamna Lake shore transitions. At bridged crossings, the pipeline would be attached to the bridge structures; otherwise, the pipeline would use trenching or HDD to cross streams.

On completion of construction, the natural gas pipeline would be pressure-tested, and all mechanical, civil, structural, and electrical installations would be checked to ensure that they are installed according to design and can operate safely.

The natural gas pipeline would be maintained through operations to provide energy to the project site. If no longer required at closure, the pipeline would be cleaned and either abandoned in place or removed, subject to state and federal regulatory review and approval at the decommissioning stage of the project. Surface utilities associated with the pipeline would be removed and reclaimed.

Action Alternative 1 – Summer-Only Ferry Operations Variant

An option to restrict ferry operations to the open water season was suggested during scoping due to concerns with use of an ice-breaking ferry. With this variant, concentrate shipping at the Amakdedori port using lightering and bulk freighters would continue per the year-round schedule even though the ferry operations would be restricted to the open water season. Therefore, additional storage of containers would be needed at the mine site, to facilitate year-round processing operations; and at the port site, to accommodate the additional containers trucked when the ferry is operating. This variant would not involve changes to the natural gas pipeline component.

Storage of concentrate at the mine site would be needed during the non-operating months, until Iliamna Lake is free of ice and can resume the movement of cargo. Storage would be through a container-based system with an additional laydown area at the mine site (container yard: 38 acres).

To transport annual quantities of concentrate, fuel, and consumables during the open water months, a larger non–ice-breaking vessel making two trips per day on average would be necessary; or possibly two ferries making one trip per day each on average.

With this variant, the ferry or ferries would be pulled out of the water at freeze-up and launched at break-up. The ferry crew jobs would be seasonal only. During the non-operating months, the ferry or ferries would be over-wintered in cradles onshore in the ferry terminal construction area. The ferry or ferries would be winterized, and any required maintenance would be completed while the ferry or ferries were out of the water.

Trucks would also only operate when the ferry or ferries are running, which would double the number of round-trip truck moves to 78 per day each side of the ferry terminals. The fleet size of truck and trailer units would also double.

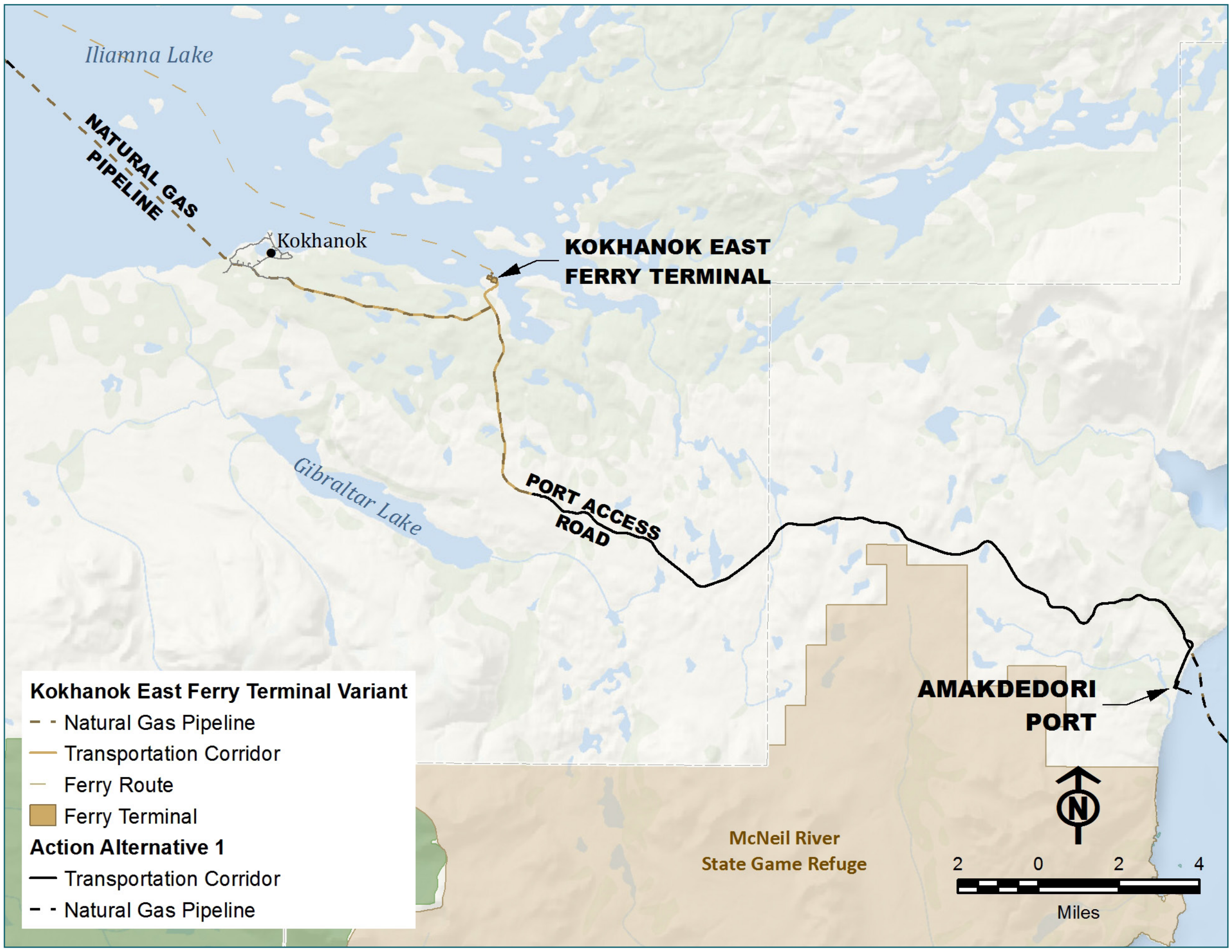


Figure ES-6: Action Alternative 1 – Kokhanok East Ferry Terminal Variant

Action Alternative 1 – Kokhanok East Ferry Terminal Variant

This variant considers an alternate south ferry terminal site: the Kokhanok east ferry terminal site (Figure ES-6). The transportation corridor and natural gas pipeline components would change with incorporation of this variant. This variant does not involve changes to the mine site or port components.

Under this variant, the ferry would cross Iliamna Lake from the proposed north ferry terminal to the Kokhanok east ferry terminal site (15 acres). The layout of Kokhanok east ferry terminal would be similar to the Kokhanok west ferry terminal. The one-way ferry trip would be about 27 miles, and would take approximately 4.5 hours to complete in ice conditions, or 2.25 hours in open water. On average, one round trip per day across the lake would be required.

The port access road (298 acres) would extend 27 miles southeast from the Kokhanok east ferry terminal to Amakdedori port. A separate spur road (5 miles with a footprint of 66 acres) would connect the port access road to the community of Kokhanok. All other road segments would be the same as described for Action Alternative 1. The Action Alternative 1 road system with incorporation of this variant would include seven bridges; five of which would be single-span, two-lane bridges that range in length from approximately 40 to 125 feet. There would be approximately 78 culverts; of these, 33 would be designated as fish passage culverts.

The natural gas pipeline alignment from the Amakdedori port would follow the port access road towards the Kokhanok east ferry terminal and the spur road into Kokhanok. From Kokhanok, it would follow an existing road alignment to the point, where it would depart the shoreline to tie into the proposed route from the Kokhanok west ferry terminal site. The total pipeline length with this variant would be 185 miles. The pipeline design and all other segments of the pipeline would be the same as described for Action Alternative 1.

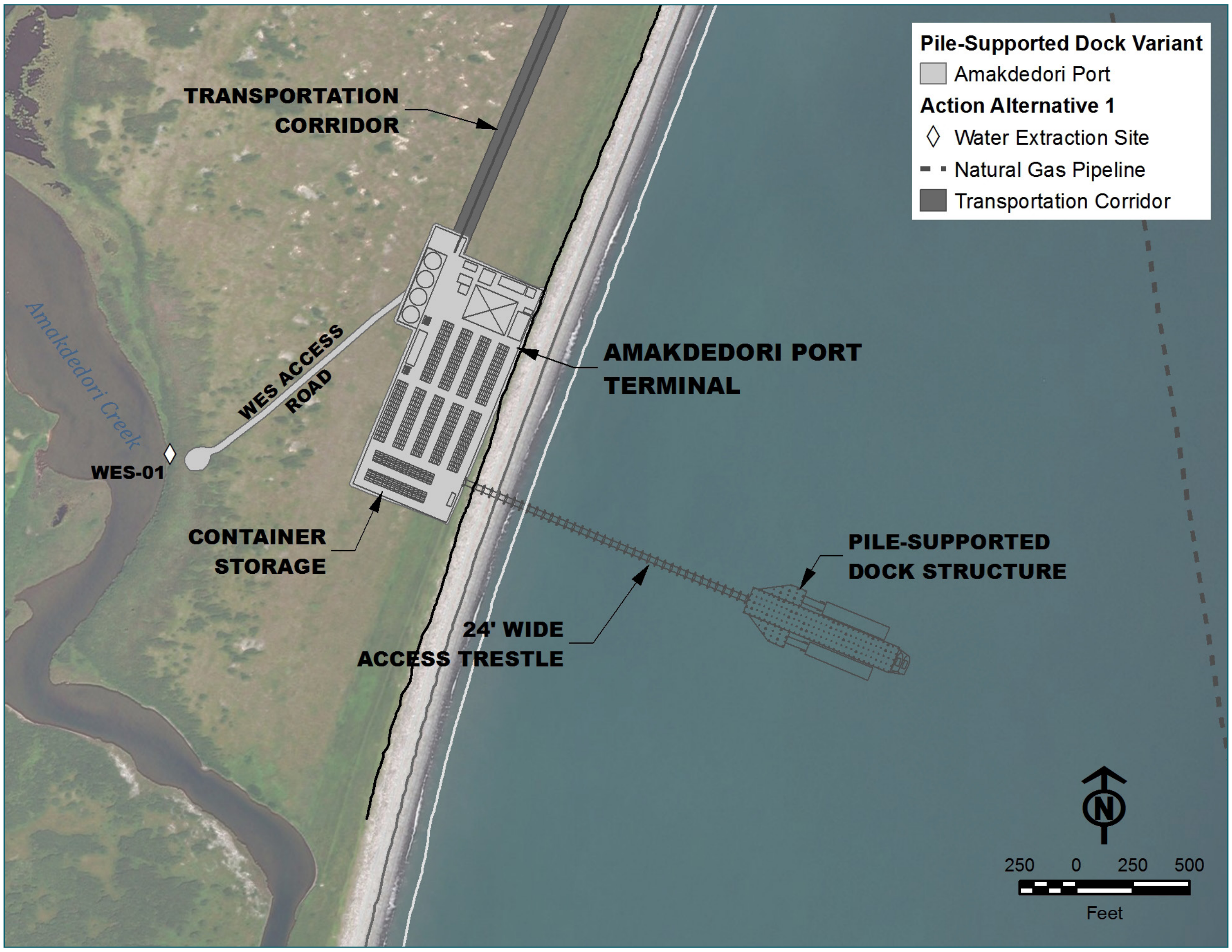


Figure ES-7: Action Alternative 1 – Amakdedori Port Pile-Supported Dock Variant

Action Alternative 1 - Pile-Supported Dock Variant

This variant considers construction of an access trestle and pile-supported dock at Amakdedori port, instead of an earthen access causeway and jetty, to minimize in-water impacts (Figure ES-7). The conceptual structure would consist of 76 trestle piles and 177 dock piles, for a total of 253 piles. All piles would be 48 inches in diameter, with a 1.5-inch wall thickness. The piles would be vibrated into place and then driven to refusal with an impact hammer. The total dock footprint would be approximately 19 acres, and the footprint of pilings would be approximately 3,200 square feet. Other than pilings, no in-water fill would be placed below mean high water of Cook Inlet with this variant. All other facilities and operations at the port would be the same as described for Action Alternative 1. This variant does not involve changes to the mine site, transportation corridor, or natural gas pipeline components.

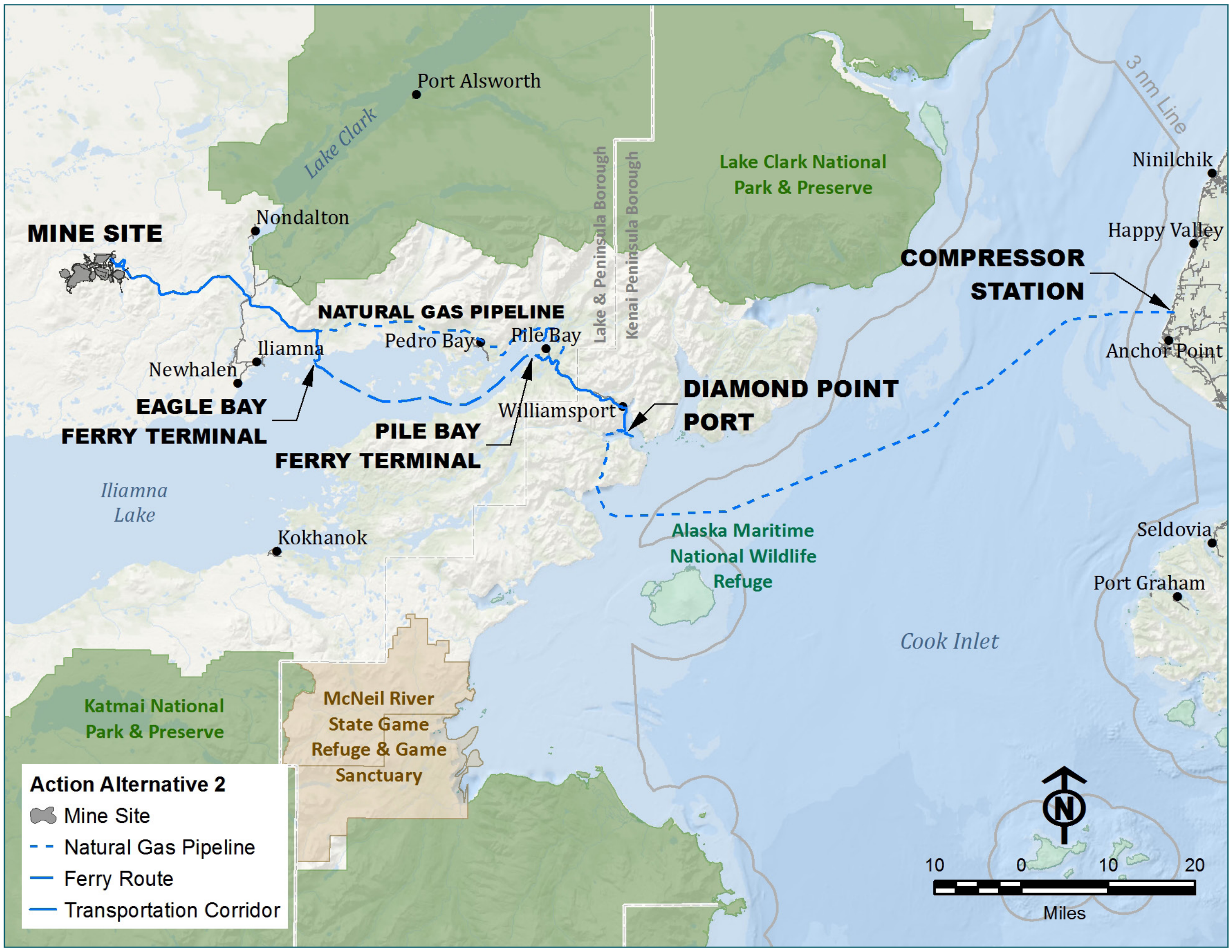


Figure ES-8: Action Alternative 2 – General Project Layout

AA2 2.3 Action Alternative 2 - North Road and Ferry with Downstream Dams

Action Alternative 2 – North Road and Ferry with Downstream Dams was developed primarily to address scoping comments suggesting that the EIS analyze alternative road corridors, ferry terminal, and port locations due to concerns expressed about the stability of tailings facilities.

Action Alternative 2 considers: 1) downstream construction methods for the north bulk TSF embankment; 2) an alternate transportation corridor route (access roads and ferry) on the northern end of Iliamna Lake; 3) an alternate port site at Diamond Point; and 4) an alternate natural gas pipeline alignment on the northern end of Iliamna Lake (Figure ES-8).

The mine site layout and processes under Action Alternative 2 would be the same as Action Alternative 1, except for the construction methods for the north embankment of the bulk TSF. Under Action Alternative 2, the north bulk TSF embankment would be constructed using the downstream method with buttresses, instead of the centerline method proposed under Action Alternative 1. There would also be minor adjustments to the infield access roads to accommodate the bulk TSF design. The overall mine site footprint for Action Alternative 2 would be 8,241 acres.

The transportation corridor under Action Alternative 2 would connect the mine site to the Diamond Point port in Iliamna Bay. It has three main components: mine access road (35 miles with a footprint of 505 acres), ferry crossing (29 miles), and port access road (18 miles with a footprint of 209 acres). This corridor would act as the main access route to and from the mine for the transportation of materials, equipment, and concentrate. The ferry, truck transportation, and the Diamond Point port would operate year-round. Under Action Alternative 2, a temporary airstrip would not be constructed at the port site; however, improvements to the existing airstrip near Pile Bay may be necessary for limited use during construction.

Although the access road routes would be different, the road design (e.g., width, driving surface) would be the same as Action Alternative 1. The corridor would be north of Iliamna Lake, where it would connect with the existing Williamsport-Pile Bay Road near Pile Bay, and then continue to the Diamond Point port site on Cook Inlet. The road would bypass all but 5 miles of the existing Williamsport-Pile Bay Road. Action Alternative 2 access roads would include seven bridges that range in length from approximately 55 to 625 feet, and approximately 39 culverts (18 of which would be designed as fish passage culverts).

The ferry vessel design and operations would be year-round, the same as Action Alternative 1, but would have different ferry terminals. The north shore ferry terminal (7 acres) would be at Eagle Bay (Eagle Bay ferry terminal), and would have a similar layout, facilities, and operations as Action Alternative 1. The south shore ferry terminal (18 acres) would be south of the start of the Williamsport-Pile Bay Road on the eastern shore of Iliamna Lake (Pile Bay ferry terminal). The one-way ferry trip is about 29 miles, and would take approximately 5 hours to complete in ice conditions, or 2.5 hours in open water. On average, one round trip per day across the lake would be required, the same as Action Alternative 1.

The general descriptions for temporary facilities, transportation corridor traffic, material transport, and physical reclamation and closure, would be the same as Action Alternative 1, but would occur at the locations described under this alternative, with the exception of the Diamond Point port, discussed below.

Action Alternative 2 includes construction of Diamond Point port (112 acres), a year-round port at Iliamna Bay. The Amakdedori port would not be constructed under this alternative. The port site would include shore-based and marine facilities for the shipment of concentrate, freight, and fuel for the project. The shore-based facilities would include separate facilities for the receipt and storage of containers for concentrate and freight. The marine facilities would be similar to the Amakdedori port design under Action Alternative 1; consisting of an earthen access causeway extending out to a marine jetty. The jetty is expected to be constructed as a sheet pile cell structure filled with granular material. The shallow approach at this port site would require dredging to a -20 feet MLLW to ensure year-round access by vessels requiring 15-foot water depth. Dredged material would either be used in construction of the causeway and dock or disposed of onshore. The dredge area would be approximately 58 acres. The total volume of dredged material for the 20-foot deep channel would be 650,000 cubic yards, of which a minimum of 50 percent is estimated to be used in the barge dock construction, and the remainder would be placed in an onshore fill.

Two offshore lightering stations would be used to lighter the ore concentrate to moored bulk carriers. The primary location in Iniskin Bay would be used unless weather, waves, ice, or other factors preclude its use. If the primary location is not suitable under given conditions, the alternate location, approximately 18 miles east-northeast of the proposed Amakdedori port between Augustine Island and the mainland would be used if conditions there are more favorable. The proposed mooring system would be the same as described for Action Alternative 1.

Natural gas would be supplied to Diamond Point port and the mine site by pipeline (164 miles). As with Action Alternative 1, the pipeline would connect to the existing gas pipeline infrastructure near Anchor Point on the Kenai Peninsula. The pipeline across Cook Inlet (75 miles) would be constructed as described for Action Alternative 1, but the alignment would come ashore at Ursus Cove. From Ursus Cove, the pipeline would be routed overland, northward to Cottonwood Bay. A 150-foot temporary construction ROW is proposed to allow for adjustment of the final route to accommodate variations in terrain. Access for construction would be by barge landings from each end of the ROW. The ROW would be reduced to a 50 foot permanent operations ROW following completion of pipeline construction.

The pipeline would come ashore at Diamond Point port, where natural gas would be fed to the port site power station and used for site heating. From Diamond Point port, the pipeline would be buried in a trench following the general Action Alternative 3 north access road alignment (see Action Alternative 3 description below), with minor deviations. For segments that follow the Action Alternative 2 access road alignment, the pipeline would be buried in a trench adjacent to the road bed shoulder.

Digital Simulation of Action Alternatives 2 / 3 Diamond Point Port

Action Alternative 2 – Summer-Only Ferry Operations Variant

An option to restrict ferry operations to the open water season was suggested during scoping due to concerns with use of an ice-breaking ferry. With this variant, concentrate shipping at the Diamond Point port using lightering and bulk freighters would continue per the year-round schedule even though the ferry operations would be restricted to the open water season. Therefore, additional storage of concentrate containers would be needed at the mine site, to facilitate year-round processing operations, and along the Williamsport-Pile Bay Road due to limited available space at Diamond Point port, to accommodate the additional containers trucked when the ferry is operating. This variant does not involve changes to the port or natural gas pipeline components.

Changes at the mine site with incorporation of this variant would be the same as described for the Action Alternative 1 – Summer-Only Ferry Operations Variant. Additional storage during the non-operating months of the ferry would be needed for concentrate, consumables, reagents, and diesel. The Action Alternative 2 mine site footprint would increase primarily as a result of an additional container yard (38 acres). Changes associated with the transportation corridor with incorporation of this variant would be similar to those described for the Action Alternative 1 – Summer-Only Ferry Operations Variant. The only difference is that the Action Alternative 2 – Summer-Only Ferry Variant would require an additional laydown area (container yard: 22 acres) along the Williamsport-Pile Bay Road, instead of at the port, due to limited available space at the Diamond Point port site. Concentrate would be transported to the container yard during the ferry operating months, where it is accessible for year-round shipment through the Diamond Point port.

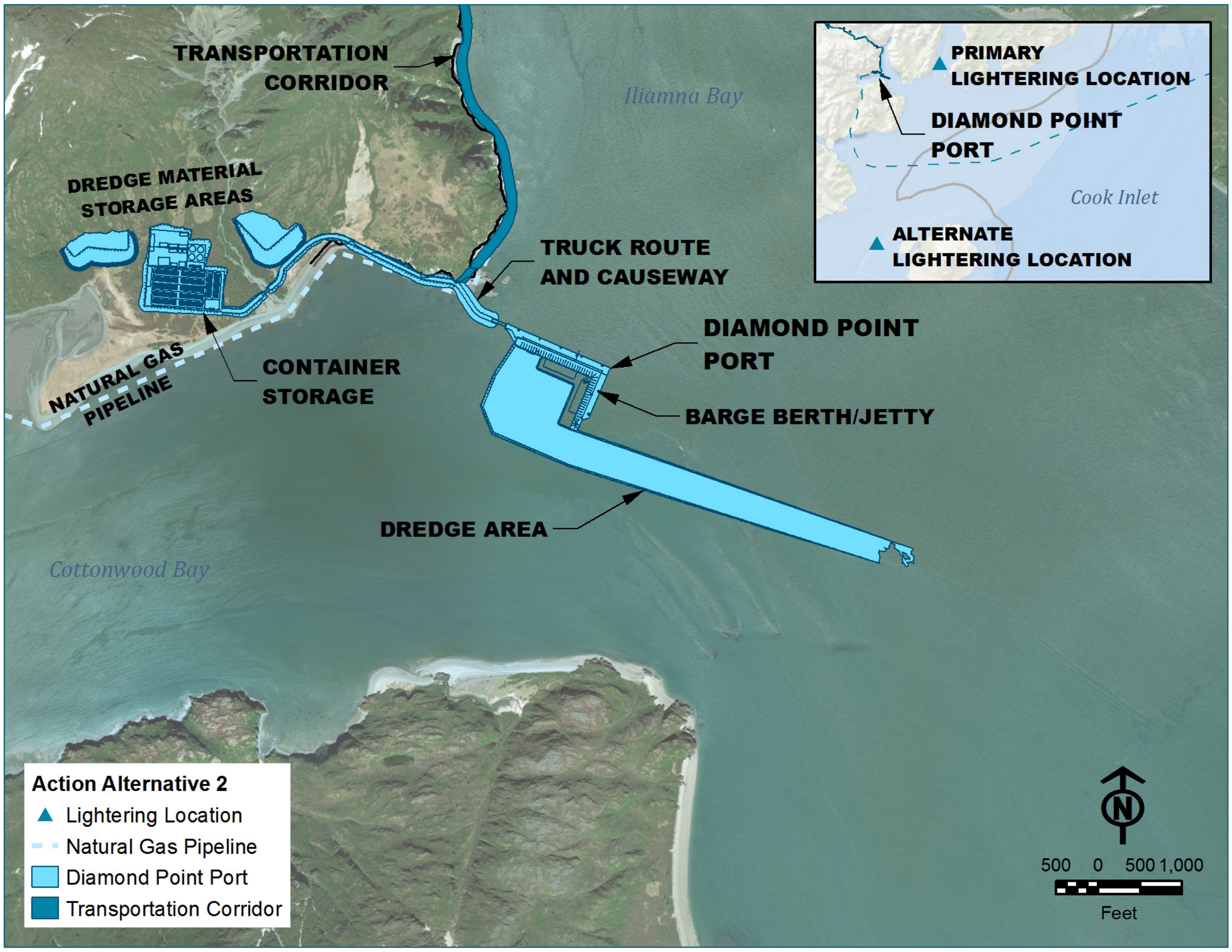


Figure ES-9: Action Alternative 2 – Diamond Point Port Pile-Supported Dock Variant

Action Alternative 2 – Pile-Supported Dock Variant

This variant would construct an access trestle and pile-supported dock at Diamond Point, instead of an earthen access causeway and jetty (Figure ES-9). The conceptual structure would consist of 44 trestle piles and 474 dock piles, for a total of 518 piles. All piles would be 48 inches in diameter, with a 1.5 inch wall thickness. The piles would be vibrated into place and then driven to refusal with an impact hammer.

Dredging would be the same as described for Action Alternative 2. The total port footprint with this variant would be approximately 101 acres, including the dredge area and onshore dredge material storage area. The footprint of pilings would be approximately 6,500 square feet. Fill placed below mean high water of Cook Inlet would be reduced with this variant. This variant does not involve changes to the mine site, transportation corridor, or natural gas pipeline components.

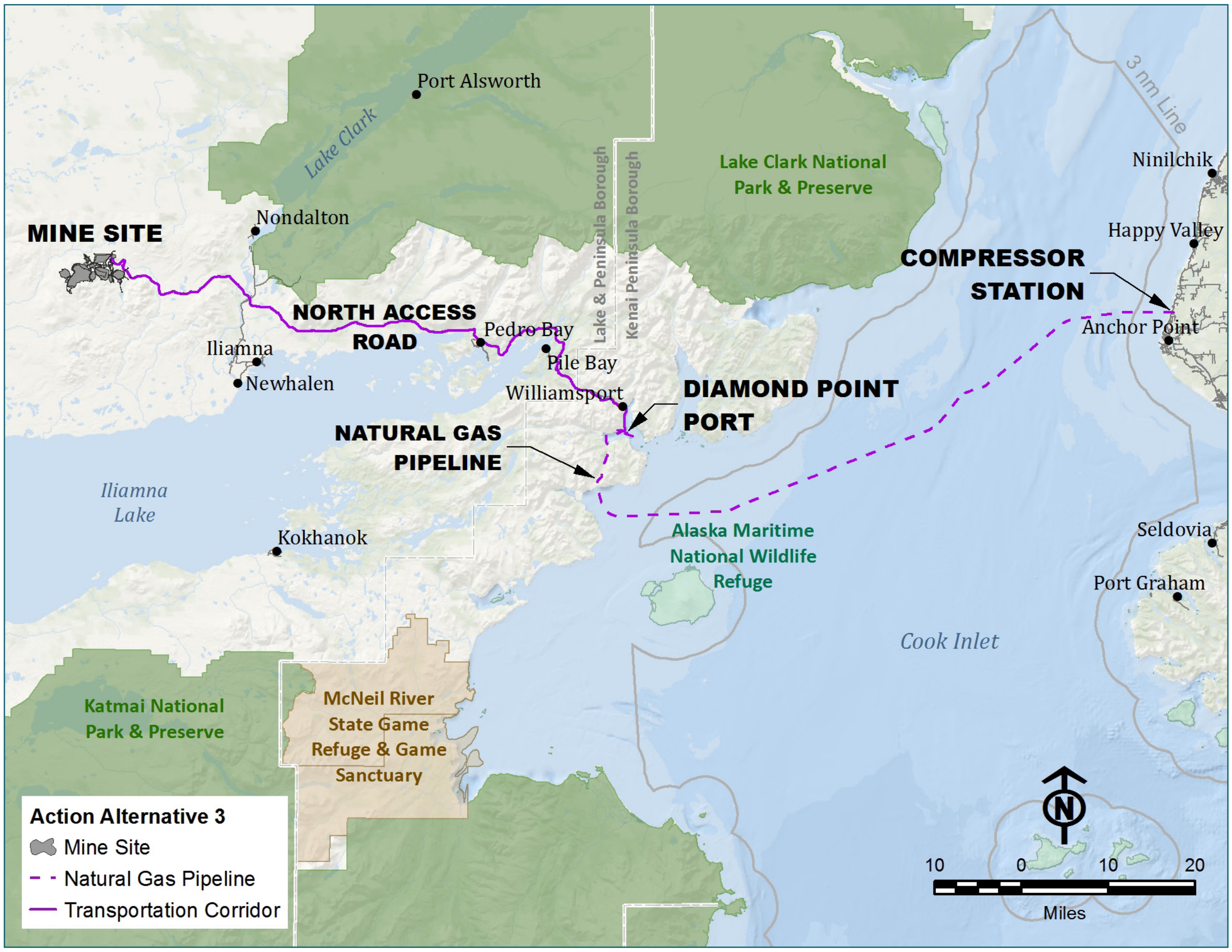


Figure ES-10: Action Alternative 3 – General Project Layout

AA3 2.4 Action Alternative 3 - North Road Only

Action Alternative 3 - North Road Only was developed to address scoping comments suggesting that the EIS evaluate an access road alignment north of Iliamna Lake to eliminate the need for a lake (ferry) crossing (Figure ES-10). EIS Appendix K2 provides a summary of the Action Alternative 3 permanent footprint for each project component (mine site, transportation corridor, port, and natural gas pipeline). Action Alternative 3 considers: 1) the same mine site layout and processes as Action Alternative 1; 2) an alternate transportation corridor route on the northern end of Iliamna Lake that does not require a ferry crossing of the lake; 3) the same port site and facilities as Action Alternative 2 (Diamond Point Port); and 4) an alternate natural gas pipeline alignment on the northern end of Iliamna Lake that follows the north access road corridor.

The transportation corridor under Action Alternative 3 would connect the mine site to Diamond Point port in Iliamna Bay. The project transportation corridor would consist of a double-lane road north of Iliamna Lake—the north access road (approximately 82 miles and 1,036 acres), which would act as the main access route to and from the mine for the transportation of materials, equipment, and concentrate. There would be no ferry transportation across Iliamna Lake. The truck transportation and Diamond Point port would operate year-round.

The north access road design would be the same as Action Alternative 1—a private 30-foot-wide gravel road to enable two-way traffic, and capable of supporting anticipated development and operational activities during construction and truck haulage of concentrate from the mine to the port. The Action Alternative 3 road system would include 17 bridges that range in length from approximately 40 to 625 feet, and approximately 105 culverts (37 of which would be designed for fish passage).

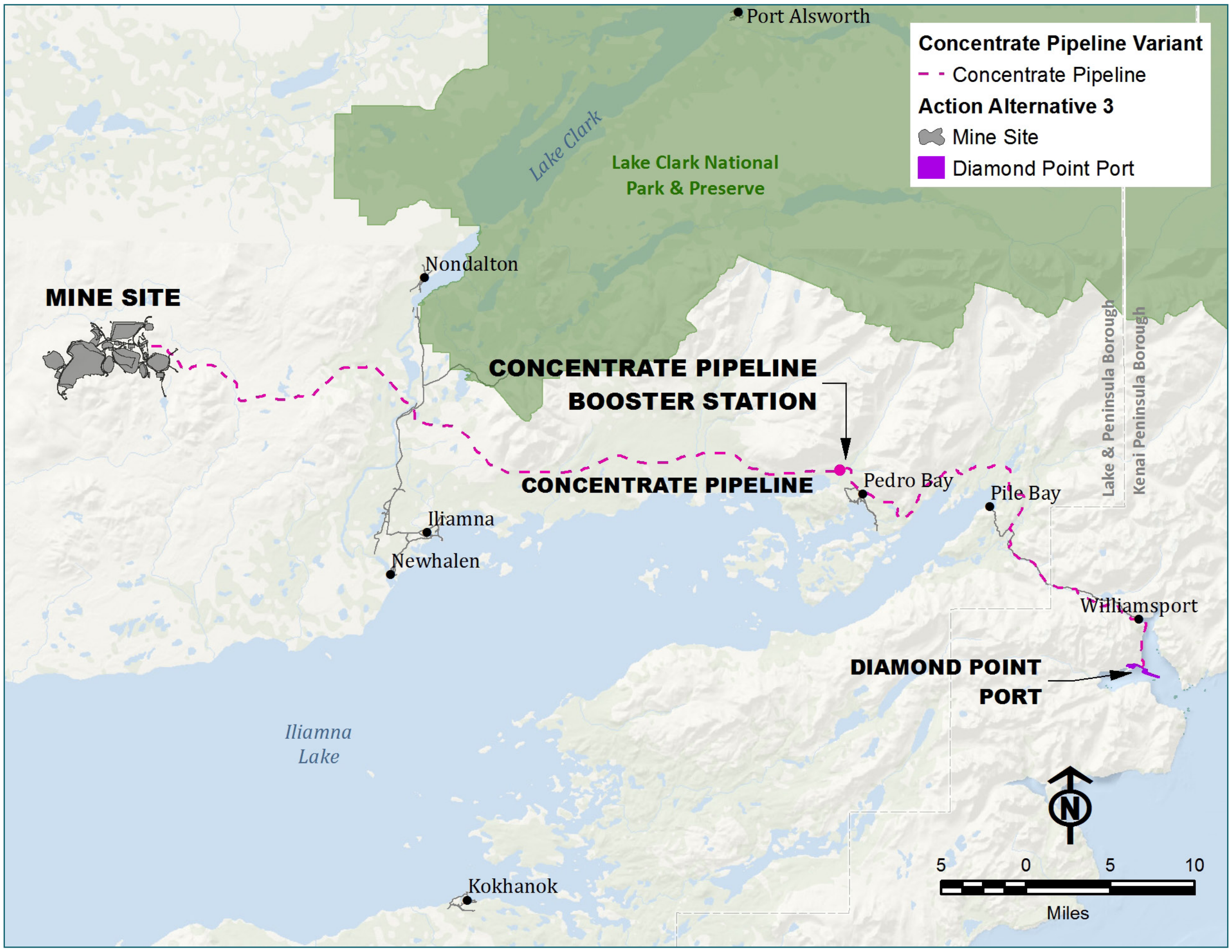


Figure ES-11: Action Alternative 3 – Concentrate Pipeline Variant

Temporary facilities associated with Action Alternative 3 would be like those described for Action Alternative 1 for access roads. There would not be a ferry, so temporary facilities or traffic associated with ferry terminals would not apply. Physical reclamation and closure would be the same as described for Action Alternative 2.

Action Alternative 3 includes construction of Diamond Point port, marine components, and lightering locations, as described for Action Alternative 2. The Amakdedori port would not be constructed under this alternative.

The natural gas pipeline component would be approximately 1 mile longer than the Action Alternative 2 natural gas pipeline corridor because it would follow the entire north road access route from Diamond Point to the mine site; buried in a trench adjacent to the road.

Action Alternative 3- Concentrate Pipeline Variant

This variant evaluates the concept of delivering copper-gold concentrate from the mine site to Diamond Point port as a slurry, using a pipeline instead of trucking along the north access road (Figure ES–11). Two options are addressed under this variant: concentrate slurry pipeline with water removal, treatment, and discharge at Diamond Point; and an option to return the water to the mine site using a second pipeline to allow reuse of water from the slurry instead of discharging at Diamond Point. This variant does not involve changes to the natural gas pipeline component or the trucking of molybdenum concentrate. This variant is being considered under Action Alternative 3 only because the concentrate pipeline would need to be co-located with a road to allow inspections and response actions in the event of a pipeline leak/rupture.

With this variant, an electric pump station would be constructed at the mine site and an intermediate booster station would be sited along the road/pipeline alignment. With incorporation of a concentrate pipeline only (no return water pipeline) and the corresponding treatment and discharge of the filtrate at the port site (discussed below), the amount of water available for release to surrounding drainages at the mine site would be reduced by approximately 1 to 2 percent, on average.

The concentrate pipeline would follow the Action Alternative 3 north access road route and would be co-located in the same trench with the natural gas pipeline at the toe of the road embankment. The length would be the same as the natural gas pipeline (164 miles). Construction of the concentrate pipeline adjacent to the north access road corridor would increase the road corridor width by less than 10 percent under most construction conditions.

Truck transport of copper-gold concentrate would be eliminated with this variant, and daily truck traffic would be reduced to 18 round trips per day for transportation of molybdenum concentrate, fuel, reagents, and consumables. Transportation of personnel would be the same as described for Action Alternative 2, except the Pedro Bay Airport would also be used by inspection crews, approximately once per month. No modifications to the airport are expected.

Use of a concentrate pipeline would require concentrate handling, dewatering, and depending on the option, treatment facilities at Diamond Point port. Port operations would change due to the requirements of dewatering the concentrate, storing water and concentrate, and treating and discharging the filtrate water; however, the overall footprint of the port is not expected to increase.

Changes from the concentrate pipeline variant described above, with incorporation of a return water pipeline, are as follows:

- The return water pipeline would be placed in the same trench as the slurry and natural gas lines, adjacent to the road, which would increase the average width of the road corridor by approximately 3 feet. This pipeline would need to be sized to accommodate water from flushing operations, resulting in a return water size of approximately 8 inches.
- The Diamond Point Port footprint would not change. The WTP would be removed, but other process and storage infrastructure would remain, and a return water pump station and associated generation capacity would be required at the port site. The return water line would not require an intermediate pump station.

3.0 ENVIRONMENTAL ANALYSIS

An area of analysis (the EIS analysis area) was established based on the potential direct and indirect impacts that would result from construction, operations, and closure of the Pebble Project for each of the 25 resource topics listed in Section 1.4 above. For those resources that would be potentially affected by a release described in the evaluation of spill events, an additional area of potential effects was identified. The resources are also described in terms of the project area, or the exact project footprint for each of the action alternatives and associated variants.

The environmental impacts of the project alternatives on resources plus spills were analyzed by first describing existing conditions, also called the affected environment, and then analyzing potential effects that could occur because of the proposed alternatives. Three types of effects were considered: direct effects, indirect effects, and cumulative effects. The direct and indirect effects for each resource or resource use were analyzed based on the factors of intensity (magnitude), duration, extent, and potential (likelihood) of the impact to occur. For this analysis, in terms of potential or likelihood, impacts would be expected to occur as described if the project (with the defined alternative and/or variant as applicable) is permitted and constructed. Cumulative effects are interactive, synergistic, or additive effects that would result from the incremental impact of the proposed alternative when added to other past, present, and reasonably foreseeable future actions (RFFAs) regardless of what agency (federal or non-federal) or person were to undertake such other actions. A summary of existing environment and potential consequences of development is presented below for key resources.

3.1 Needs and Welfare of the People

The analysis of the needs and welfare of the people includes the monetized and non-monetized economies of the communities potentially affected by development of the project. The monetized economy includes economic sectors, such as tourism, and jobs involving labor for wages; and the non-monetized economy includes subsistence hunting and fishing, which is an important component of the socioeconomic and sociocultural system of rural Alaska communities. The subsistence way of life is a significant contributor to household and community welfare, social relationships, and cultural importance of the people who live or use subsistence resources near the project area (the 417-square-mile claim block held by subsidiaries of PLP and by a subsidiary of PLP's parent company, Northern Dynasty). The associated topics addressed in the EIS related to socioeconomics, cultural resources, subsistence, and environmental justice (all relevant to the analysis of needs and welfare of the people) are summarized below.

Society has demands and uses for copper, gold, and molybdenum, and for the mining of these resources. PLP presented information related to the role that these minerals play worldwide for electronics, jewelry, currency/bullion, and medical purposes. The proposed project would ultimately result in production of an average copper-gold concentrate (dry concentrate) of 613,000 tons and molybdenum concentrate production (dry concentrate) of 15,000 tons, to help meet global demand. The proposed project would result in an increase in the availability of these metals to the market and for use in manufacturing goods. The proposed project would result in a 20-year beneficial effect on the public's mineral needs.

3.1.1 Existing Conditions (Affected Environment) Summary

3.1.1.1 Socioeconomics

The EIS analysis area for this section includes the regions and communities where aspects of the monetized economy would be impacted by the construction, operation, and closure of all components of each alternative and variants of the proposed project.

Employment in the region and throughout Alaska can vary greatly through the year, because many jobs are seasonal, leading to a large fluctuation in employment between the summertime peaks and the wintertime lows. Much of the seasonal employment is related to the commercial fishing and tourism industries, and varies geographically within the region.

In some communities in the LPB nearest to the project site that would be potentially affected by the project, the employment of residents relies heavily on the local government, education, and health services industry sectors. The local government industry sector accounted for the greatest percentage of employees for all the communities in the LPB.

The top five performing industries by total employment in the region are health care and social services, local government, retail trade, accommodations and food services, and commercial fishing. The lower area of the Dillingham Census Area and coastal portions of the LPB are dominated by the commercial salmon fishery and the economic activity it generates. Although communities around Iliamna Lake have less participation in commercial salmon fishing, they are more typical of small roadless rural Alaskan communities, with economic activities limited to local government, Native Alaskan organizations, and some support of commercial recreation and tourism.

Although the cost of living can be high in rural communities, subsistence hunting and fishing supplements the needs of families and communities. Of the boroughs reviewed for the EIS, the Bristol Bay Borough had the highest median household income at $79,500, while the Lake and Peninsula Borough had the lowest at $45,200.

3.1.1.2 Cultural Resources

The EIS analysis area for cultural resources is the project footprint for direct effects, and lands within 3 miles of the mine site and within 1 mile of the other project components (e.g., port sites, transportation corridors, and ferry terminals) for indirect impacts.

Cultural context covers a broad and complex range of prehistoric traditions, ethnographic regions, land uses, and historic-era themes. Cultural relationships with the wild animals and fish are of primary importance, and some places have taken on special importance as sacred sites and landscapes, including known travel routes and traditional use areas.

Culturally important places have been identified through interviews with members of communities potentially affected by the project and through review of the Alaska Heritage Resources Survey (AHRS), which is a database of potential cultural resource features managed by the State of Alaska Office of History and Archeology. Place names are places known to have been named in a Native Alaskan language. Place names and the presence of known AHRS locations, in combination with community interviews and subsistence data, suggest the potential for cultural resources throughout the locations of all three action alternatives and associated variants. There are currently several types of cultural resources sites with AHRS designation or identified during interviews within the EIS analysis area. These include archeological sites, historic village sites, cemeteries and burials, cabins, camps, trails, traplines, battle sites, and shipwrecks. Cultural resources with an AHRS designation are protected by state law to prevent unwarranted destruction. Interview-identified sites may go through a process to identify them for the AHRS, or determine if they are eligible for inclusion in the National Register of Historic Places (National Register). Place names contribute to the understanding of a resource when considering them for eligibility in the National Register.

3.1.1.3 Subsistence

The EIS analysis area includes habitat and migration routes for subsistence resources, community subsistence search and harvest areas, and areas used by harvesters to access resources that could be affected by activities at the proposed mine site, port, and transportation and natural gas pipeline corridors.

Subsistence is fundamental to the language, spirituality, and social relationships of the culture and is the way of life for cultural groups in Alaska, including the Dena'ina Athabascan of Southcentral Alaska, the Central Yup'ik of Southwest Alaska, and the Sugpiaq-Alutiiq of lower Cook Inlet and Alaska Peninsula. Subsistence encompasses hunting, fishing, trapping, gathering, camping, and ceremonial activities, as well as the processing, sharing, use, consumption, trade, and barter of wild resources. Subsistence resources include fish, wildlife, plants, and firewood. These renewable resources provide food, fuel, and materials to make clothing, shelter, tools, and art. Subsistence and customary practices are the foundation of culture, maintain the connection of people to their land and environment, and support healthy diet and nutrition.

With complex roots in traditional Alaska Native culture, subsistence is integral to the contemporary mixed economic system in rural Alaska. Cash incomes typically supplement and support subsistence activities, which for generations have provided considerable nutritional and economic value for rural households. Sharing of subsistence foods in and between communities reinforces social bonds and helps the recipients meet economic, material, and nutritional needs.

In general, communities in southwest Alaska share a similar seasonal round, with some variations depending on the area, available resources, and applicable hunting regulations. In this region, salmon is the most important subsistence food, and ranges up to 82 percent of the subsistence diet, with land mammals (moose and caribou) and non-salmon fish (northern pike, Dolly Varden/char, whitefish, and trout) comprising the second and third most important type of subsistence resources. Within the region, the majority of subsistence-harvested food is shared, which in turn accounts for high numbers of per capita harvest, because the people harvest and gather large volumes of wild food and subsistence resources, forming the basis of the culture.

Iliamna Lake, rivers, and streams, and the coastal areas are used for resource harvests of freshwater seals, salmon, and other aquatic resources; and the upland areas are used for hunting upland game birds, waterfowl, caribou, moose, and other small mammals; and harvesting berries, wood, and other plant resources.

Kokhanok

3.1.1.4 Environmental Justice

Executive Order 12898 (1994) requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority communities and low-income populations. Under Executive Order 12898, demographic information is used to determine whether minority populations or low-income populations are present in the areas potentially affected by a project. If so, a determination must be made as to whether implementation of the project may cause disproportionately high and adverse human health or environmental effects on those populations. The EIS analysis area for Environmental Justice impacts includes the EIS analysis areas described above for socioeconomics and subsistence, and for Health and Safety in the EIS.

For the purposes of this analysis, a minority community is defined as a community with a majority (i.e., 50 percent or greater) minority population, and a low-income community is defined as having a greater percentage of the population living in households below the poverty threshold than the percentage of the population in the state living below that level, as defined by the US Census Bureau. Communities in the EIS analysis area were assessed to determine whether they meet the CEQ definitions of minority and low-income communities. Igiugig, Iliamna, Kokhanok, Levelock, Newhalen, Nondalton, and Pedro Bay in the LPB; Dillingham, Ekwok, Koliganek, and New Stuyahok in the Dillingham Census Area; and the Dillingham Census Area meet the CEQ definition of minority and/or low-income communities.

3.1.2 Expected Effects (Environmental Consequences) of Alternatives

3.1.2.1 Socioeconomics

Scoping comments focused on the economic feasibility of the project, beneficial impacts of additional employment opportunities, economic impacts to recreation and commercial fisheries, impacts on the use of Iliamna Lake for sport fishing and recreation, impacts on the bear viewing industry near the Amakdedori Port, economic benefits to the State of Alaska, and how risks to the environment could outweigh short-term benefits.

NA **No Action Alternative**

Under the No Action Alternative, the development of the Pebble Project as proposed would not be undertaken, and construction, operations, or closure activities would not occur. PLP would still be permitted to perform exploratory activities and research at the site under the State's authorization process, and would be expected to continue at levels similar to recent post-exploration activity. The current number of direct and indirect jobs created during exploration and permitting would remain roughly the same, and there would be no impact to the regional economy, the cost of living in the potentially affected communities, or regional infrastructure.

AAV **Action Alternatives and Variants**

The action alternatives and variants have very similar socioeconomic effects. The primary differences would be that under Action Alternative 1, Kokhanok would realize more potential benefits than Pedro Bay, and under Action Alternatives 2 and 3, Pedro Bay would realize more potential benefits than Kokhanok. PLP has stated that its objective is to maximize opportunities for local hire; first, directly to residents of the project area, or those with close ties to the area, then to Alaska residents in general. In terms of magnitude, non-Alaskan labor would likely be required to fill the anticipated 2,000 construction jobs, potentially as high as 50 percent of hires. It is estimated that during operations, 250 employees would come from surrounding communities, and approximately 600 would be flown to the project area from Anchorage or Kenai, for a total of 850 anticipated jobs. Communities near the mine site and ferry/port terminals would likely see a beneficial impact of higher employment rates lasting over the long-term life of the project.

This beneficial impact would be greater for the nearby communities as compared to communities farther away, such those in the lower Bristol Bay watershed.

Under Action Alternative 1, and Action Alternative 2 - Summer-Only Ferry Operations Variant, employment for truck drivers would be seasonal only, which creates less stable annual income in the region.

Under Action Alternative 3 - Concentrate Pipeline Variant, there would be decreased employment of truck operators and increased employment at the dewatering facility. Overall, the total number of employees needed during operations would likely decrease, which would decrease overall income and employment in the region.

Although the project is not anticipated to result in an increased number of schools in the region, it may benefit the educational opportunities of some communities through PLP-sponsored programs and an increased revenue stream to the LPB, which could help keep enrollment numbers high enough to avoid school closures. This beneficial impact would remain though the life of the project.

Workers would be transported from multiple locations, including from local communities, to the mine site via aircraft, and they would stay in work camps. As a result, the local communities would not be anticipated to see a large increase in population from the project, particularly from in-migration. In terms of extent, the largest impacts could occur in Iliamna, Kokhanok, Newhalen, and potentially Nondalton, which may see a slight increase in population related to any service-oriented businesses that are developed to support the project.

The project could reduce or eliminate the current local population decline, because of the increase in employment opportunities and indirect effects on education and infrastructure; it could also result in some past residents returning to communities.

Conversely, steady employment and income may provide some families the ability to move to other areas, which may decrease the population of some communities. Therefore, the magnitude and extent of impacts on population are difficult to anticipate.

The project is likely to reduce transportation costs (and thereby reducing the cost of living) to the potentially affected communities near the transportation corridor should arrangements be made between PLP, the State, and LPB to allow some public use of the road in coordination with PLP operations. This beneficial effect would be long term, and could help reduce the cost of living to some communities over the long term, throughout mine operations.

CE

Cumulative Effects

The cumulative effects analysis area includes the region around the potentially affected communities, and to a lesser extent, the state of Alaska. Past and present actions having a contribution to cumulative effects with regard to employment, revenue generation, cost of living, and social characteristics include commercial and subsistence harvest of fish and wildlife, commercial recreation and tourism, community development and infrastructure, mining exploration activities, and construction of the Williamsport-Pile Bay Road. RFFAs include expansion of the Pebble project, continued exploration at other mineral deposits, oil and gas activities that would increase exploration activities and vessel traffic in Cook Inlet, commercial and residential development in regional communities, and continued commercial and subsistence harvest of fish and wildlife.

Expansion of the Pebble mine would extend the life of the project, along with beneficial effects from employment, generation of State and LPB revenue, and potential reduction in cost of living due to lower transportation costs. Continued local employment could help stabilize populations and maintain school enrollment. Oil and gas activities would have a minimal contribution to cumulative effects, potentially providing some employment opportunities. Local transportation and community development projects would result in improvements in local services and facilities, potentially reduce cost of living, and benefit from extended revenue generation associated with Pebble mine expansion.

3.1.2.2 Cultural Resources

Scoping comments expressed concern regarding impacts to historical and prehistorical sites and the confidentiality of information shared on culturally and religiously significant properties. The comments also requested that traditional knowledge from residents inform the effects analysis and resolution of adverse effects.

Kokhanok

NA No Action Alternative

Because construction, operations, or closure activities would not occur, no additional future direct or indirect effects on cultural resources would be expected. Permitted resource exploration by PLP or new permitted exploration activities by other claim holders would be likely to occur at current levels. There would likely be no new adverse impacts to known AHRS sites, and existing activities that impact place names or cultural resources would continue at their current intensity.

AA1 Action Alternative 1 and Variants

All action alternatives and associated variants have the potential to have adverse direct impacts to cultural resources from the construction, operations, closure, and reclamation of the project. Necessary ground-disturbing actions involved with constructing and operating the mine and its facilities (i.e., transportation corridor, natural gas pipeline, and port facilities) can destroy, remove, or otherwise damage cultural resources. These types of direct effects can be irreversible.

The magnitude of indirect impacts may include visual, olfactory, and audible intrusions, as well as degraded air and water quality at culturally sensitive areas, because of construction and operations activities, or disruptions to the subsistence lifestyle and increased presence of people and equipment in culturally sensitive areas. These changes result in alterations to the character and setting of a cultural resource from which they derive their significance.

At the mine site, there would be two known AHRS sites in the footprint. No locations with place names are the footprint, but five known place names are in the analysis area. There are 40 interview–identified cultural resources in the mine site analysis area.

In the transportation corridor, there are no known AHRS sites in the footprint, and 9 known sites in the analysis area. The Kokhanok East Ferry Terminal Variant has three known sites in the analysis area. There are two place names in the footprint and four place names in the analysis area. There are 190 interview-identified cultural features that would be subject to direct and indirect impacts, including 69 features that would be subject to direct impacts

At Amakdedori port, there are three known AHRS sites in the analysis area, and none in the footprint. There are no identified place names at the port site outside of those identified for the transportation corridor. There would be 5 interview-identified features in the footprint.

The natural gas pipeline would be the same as the transportation corridor, except for the pipeline crossing Cook Inlet, where there would be one known AHRS site in the footprint and three sites in the analysis area. Place names and interview-identified cultural resources would be the same as the transportation corridor, except for the pipeline crossing Cook Inlet, and no investigations have occurred for this portion of the pipeline.

During the NEPA public process, additional information would be collected on cultural resources, including identification of additional cultural resources, and perspectives on potential mitigation measures. These would be incorporated into the FEIS.

The NHPA Section 106 process, including identification of potentially eligible properties, evaluation of the eligibility of properties, and identifying measures to resolve adverse effects to historic properties is proceeding parallel to the NEPA process. The information gathered as part of the Section 106 process would inform the FEIS.

AA2

Action Alternative 2 and Variants

The types of effects described in Action Alternative 1 would be the same for all action alternatives.

Impacts at the mine site and the natural gas pipeline across Cook Inlet would be the same as Action Alternative 1. The natural gas pipeline outside of the transportation corridor would be the same as the transportation corridor for Action Alternative 3.

In the transportation corridor, there are two known AHRS sites in the footprint, and 19 known sites in the analysis area. There are 23 place names in the footprint and 12 place names in the analysis area. There are 169 interview-identified cultural features that would be subject to direct and indirect impacts, including 84 features that would be subject to direct impacts

At Diamond Point port, there are no known AHRS sites in the analysis area or footprint. There are no identified place names at the port site outside of those identified for the transportation corridor. There would be one interview-identified feature in the footprint.

AA3

Action Alternative 3 and Variant

The types of effects described in Action Alternative 1 would be the same for all action alternatives.

Impacts at the mine site and the natural gas pipeline across Cook Inlet would be the same as Action Alternative 1. Impacts at Diamond Point port would be the same as Action Alternative 2.

In the transportation corridor, there are two known AHRS sites in the footprint, and 17 known sites in the analysis area. There are 23 place names in the footprint and 12 place names in the analysis area. There are 153 interview-identified cultural features that would be subject to direct and indirect impacts, including 78 features that would be subject to direct impacts.

CE

Cumulative Effects

The cumulative effects analysis area for cultural resources encompasses the EIS analysis area. Past and present actions that have, or are currently, affecting cultural resources within the EIS analysis area are minimal, having resulted in some site-specific loss and alteration of the character of cultural resources. These include primarily mining exploration, and community development and transportation infrastructure. RFFAs that could contribute to the cumulative impacts of cultural resources include expansion of the Pebble mine, other mineral exploration, and road improvement and community development projects.

The Pebble mine expanded development scenario would contribute to landscape-level effects, where there is continuous introduction of intrusive visual elements, increased noise and atmospheric pollution, and an increased volume of people. It would also extend potential impacts on the context of and character of cultural resources over 78 years. Road and community infrastructure in existing communities may encounter cultural resources, depending on the history of occupation of the community, and there is potential for damage to sites and cultural context, but would be subject to cultural clearance and mitigation.

3.1.2.3 Subsistence

Scoping comments not only requested that all subsistence hunting practices be considered in the analysis of effects, but also to consider the heavy reliance on fish for all users in the area. Specific impacts due to disturbance from mine transportation needs and potential effects of contaminants from the project on substance resources were also noted.

NA

No Action Alternative

Under the No Action Alternative, the mine would not be constructed; however, PLP and other entities could still be permitted to perform exploratory activities and research at their mining claims. Although no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue. Therefore, no additional future direct or indirect effects to subsistence resources or access to subsistence resources would be expected, and existing habitat and resource trends would continue. It should be noted that exploration activities associated with the project provided some local employment and income; the latter could contribute to pursuit of subsistence activities.

AAV

Action Alternatives and Variants

In terms of magnitude and extent, construction and operations would primarily affect the subsistence areas of six Iliamna Lake communities closest to project infrastructure and transportation activities, including the mine site, transportation corridor, the ferry and terminals, port, and airports. The communities would be affected by changes in resource availability, access to resources, competition for resources, and sociocultural dimensions. These communities include Nondalton, Iliamna, Newhalen, Pedro Bay, Igiugig, and Kokhanok for all alternatives. Many project features would be removed or reclaimed, or both, during closure. In terms of duration, once reclamation activities have been completed, impacts on the availability of subsistence resources would be reduced as these areas become revegetated and return to a more natural state than their condition during operations.

During construction and operations, project activities would, in varying degrees, affect the availability and abundance of traditional and subsistence resources through habitat loss; behavioral disturbance and displacement resulting from increased noise, vehicle/aircraft/ferry traffic, and human activity; fugitive dust deposits on vegetation; concerns about contamination of resources; avoidance of traditional use areas; and increased costs and times for traveling to more distant areas. In terms of magnitude and duration, impacts would occur with more intensity along the transportation corridor during construction because activities would be more disruptive. At the mine site, effects could occur with more intensity during operations, associated with mining activity, noise, and expansion of the open pit and the waste rock and tailings storage. These impacts would be greater during construction, but would continue during the life of the project.

Impacts to fish and wildlife would not be expected to impact harvest levels, because there would be no decrease in resources and abundance. There would be some localized site-specific habitat fragmentation from project facilities, causing possible long-term (lasting for the life of the project) behavioral disturbance to terrestrial wildlife and birds and localized changes in distribution.

In terms of extent of impacts, project facilities and transportation corridors may change access to subsistence resources by opening or removing areas for subsistence activities. In addition to physical access, project activity may change the character of the subsistence activities. During construction, access to the area in the immediate vicinity of the project components would be impaired or restricted. In terms of duration, such restrictions would, over the long term, adversely affect communities located near project infrastructure that use this land for or to access subsistence fishing, hunting, gathering, education of youth on subsistence traditions, and other customary practices. Construction of linear features, such as the roads and pipeline, has the potential to interrupt travel to resources or communities on the other side of the ROW. In terms of magnitude and duration, during operations, there would be minimal impact on access to subsistence resources because these project components would occupy a relatively small portion of the nearby communities' harvest areas, and because mitigating measures would be in place to minimize or avoid impact, such as providing marked crossing points across the transportation corridor and around the ferry terminals.

The impacts to the availability of subsistence resources would be similar across all action alternatives, affecting resources nearest to the project area. Access to subsistence resources would be similar across all action alternatives except that Action Alternative 1 would impact routes in the mid lake area, and Action Alternatives 2 and 3 would impact routes around Pedro Bay and the north end of the lake. There would be no impact to access during the winter under the Summer-Only Ferry Operations Variants under Action Alternatives 1 and 2. Impacts to sociocultural dimensions of subsistence would be the same across all alternatives.

CE Cumulative Effects

The cumulative effects analysis area for subsistence encompasses the EIS analysis area. Past and present actions have, or are currently, affecting subsistence activities and resources within the EIS analysis area. These include primarily mining exploration, oil and gas exploration, and community development and transportation infrastructure. With the exception of past Cook Inlet beluga whale subsistence overharvest effects on population levels, effects of past and present commercial fishing and recreational harvest of fish and wildlife have been minimal.

The Pebble mine expanded development scenario would increase the geographic area affected and duration of effects of the project by combining project elements of Action Alternative 1 and 3 under Action Alternative 1, affecting the six communities listed above. For Action Alternatives 2 and 3 mine expansion, the Amakdedori port and transportation corridor would not be developed, reducing potential effects on Kokhanok and Igiugig, but increasing effects on Pedro Bay and Nondalton. A new deep-water port and condensate and diesel pipelines would be constructed. Overall, this scenario would extend potential impacts to subsistence resources, access to subsistence areas, and the character of subsistence harvest activities over 78 years through the end of operations of the expanded development scenario. Cumulative effects from continuing mineral and oil and gas exploration would depend on the location, resulting in disturbance from associated aircraft noise, and potentially interfering with access where exploratory activities are being conducted. Road and community infrastructure in existing communities may have some site-specific effects on stationary subsistence resources such as berry patches, result in disturbance to subsistence resources/activities, and temporarily restrict access during construction. Finally, real and perceived conflicts between subsistence activities and commercial fishing and recreational activities may continue to occur in specific areas, but are limited geographically.

3.1.2.4 Environmental Justice

Scoping comments requested that low income, minority, and Alaska Native communities that may be impacted by the project be identified. Comments also expressed concern for food security, and exposure to hazardous materials and increased noise.

NA No Action Alternative

The No Action Alternative assumes that the mining operations at the Pebble deposit would not be undertaken; no construction, operations, or closure activities would occur. However, PLP and potentially other entities holding mining claims in the region would have the same options for exploration activities that currently exist, and current trends relating to Environmental Justice would continue. Therefore, it is anticipated that PLP would continue some activity to identify future opportunities.

PLP has employed local community members at the site during the exploratory phase of the project. The communities closest to the exploration area in the LPB, likely including Nondalton, Iliamna, and Newhalen, provide the greatest proportion of the local workforce. These communities are identified as minority and/or low-income communities. Similarly, these communities and others harvest caribou, large land mammals, and other subsistence resources near project components. Scoping comments suggested that exploration activities have affected wildlife populations (caribou) used for subsistence.

AAV Action Alternatives and Variants

The magnitude, extent, duration, and likelihood of impacts to minority and/or low-income communities would be similar for all three action alternatives and variants, with slight differences to impacts, such as by location or subsistence resource. The communities closest to the mine site and/or transportation corridor include Nondalton, Iliamna, Newhalen, and Kokhanok. These communities are minority and low-income communities, and have a lower median household income and a higher unemployment rate than Anchorage, as well as Alaska as a whole. Although PLP has generated exploration- related employment for residents of villages throughout the LPB and broader Bristol Bay region over the past decade, the communities surrounding Iliamna Lake and connected by road have provided the greatest proportion of the local workforce. It is anticipated that residents of the communities surrounding Iliamna Lake would continue to provide most of the local workforce for construction and operations of the project. Therefore, employment through the project would have beneficial economic effects on minority and low-income communities lasting for the life of the project. The primary differences between alternatives would be that under Action Alternative 1, Kokhanok would be more impacted than Pedro Bay, and under Action Alternatives 2 and 3, Pedro Bay would be more impacted than Kokhanok.

The higher cost of living in rural areas is primarily associated with high transportation cost of food, fuel, and other supplies. All alternatives are likely to slightly reduce transportation costs of materials and goods to the transportation corridor area's potentially affected communities (Kokhanok, Iliamna, Newhalen, and potentially Nondalton). Reduced transportation costs would lower the cost of living for these communities, all of which are minority and low income.

Per regulation from the Federal Energy Regulatory Commission, communities adjacent to the natural gas pipeline would have the opportunity to use it to deliver natural gas to their communities, as an open access pipeline. Natural gas would likely be less expensive than diesel heating oil, which could lower the cost of living once equipment (e.g., furnace, water heater) is converted to natural gas.

The Summer-Only Ferry Variant under Action Alternatives 1 and 2 would likely shift some of the positions held by community members from year-round to seasonal, which would also lower the overall income earned by community members that stay in the region compared to year-round ferry operations.

In terms of magnitude and extent, the increase in job opportunities, year-round or seasonal employment, steady income, and lower cost of living described above would have noticeable beneficial impacts on the EIS analysis area, especially for communities in the LPB, during construction and operations of the project. These beneficial impacts would be long term, lasting through mine closure. Therefore, the effects of all alternatives on the needs and welfare of the people would not be "high and adverse." The duration of impacts would be long term, lasting thorough the life of the project.

If high-harvesting households leave the community or reduce their production, it could have an impact on the rest of the community and nearby communities from sharing. The loss of high-harvesting households and a reduction in sharing could result in long-term adverse impacts on minority and low-income communities. However, the effects could be reduced with planned periods of leave options during subsistence harvest periods, and PLP has stated they are willing to accommodate this with 2-week on, 2-week off work schedules.

Impacts on access to and quantity of subsistence resources could be both adverse and positive to health and safety; and in terms of magnitude and extent, many of these effects would be disproportional to minority and low-income communities in close proximity to the mine site and transportation corridor. Potential negative impacts could be from actual or perceived decreases in access to, availability, and/or quality of subsistence recourses, which could also adversely impact community health/well-being and cultural identity. Subsistence users would likely adjust the seasonal round, resource use areas, and species composition of harvest resources to target resources that would be less affected by project activities. However, positive benefits may also occur, because increased incomes and employment can positively affect subsistence harvest levels and participation, including making procurement of hunting and fishing equipment more affordable. The duration of impacts would be long term.

Impacts on psychosocial health, family stress, and unintentional and intentional injuries would be both beneficial and adverse. The magnitude of beneficial effects could include increased funding from the borough to maintain or improve community health services, and additional disposable income for project employees. Adverse health consequences may be related to fear of changes in lifestyle and cultural practices, land encroachment, impacts to the environment, and real or perceived impacts on food security and quality associated with both commercial and recreational fishing, and with subsistence activities. Other adverse key health outcomes considered are the potential for increased risk of exposure to hazardous chemicals in air, soil, groundwater, surface water, and sediment. These impacts could last through the life of the mine and beyond closure.

CE Cumulative Effects

The cumulative effects analysis area for Environmental Justice encompasses the EIS analysis area. Past and present actions that have, or are currently, affecting Environmental Justice are a combination of socioeconomic, subsistence, and human health factors. The remote nature and small size of communities in the EIS analysis area have limited the availability of employment and increased the cost of living, but are offset by a traditional cultural way of life and subsistence resources that are valued by local residents. Past and present mineral exploration and community/infrastructure development activities have provided short-term construction employment, and in some instances, reduced cost of living. Historically, local concerns have been expressed on the effects of mineral exploration activities on subsistence resource availability and subsistence harvest experience.

The effects of the Pebble mine expanded development scenario on socioeconomic characteristics and subsistence are described above. Potential human health impacts include adverse effects associated with stress over the presence of mining activities and potential for contamination, but also include beneficial effects from employment opportunities, potentially maintaining school-age populations, increased local revenue to continue and expand health and social services, and potential reduction in the cost of living. These effects would be extended over the 78 years of operational life, and would vary by alternative, with Action Alternative 1 having a larger geographic footprint for adverse and beneficial impacts. Potential effects from continued mining and oil/gas exploration have also been discussed above for socioeconomic characteristics and subsistence. Opportunities for local employment would be offset by concerns over future development of mineral resources in the region, and potential effects on social fabric and commercial and subsistence fish and wildlife resources. Future community and infrastructure development may provide beneficial effects associated with employment opportunities and improved services and quality of life.

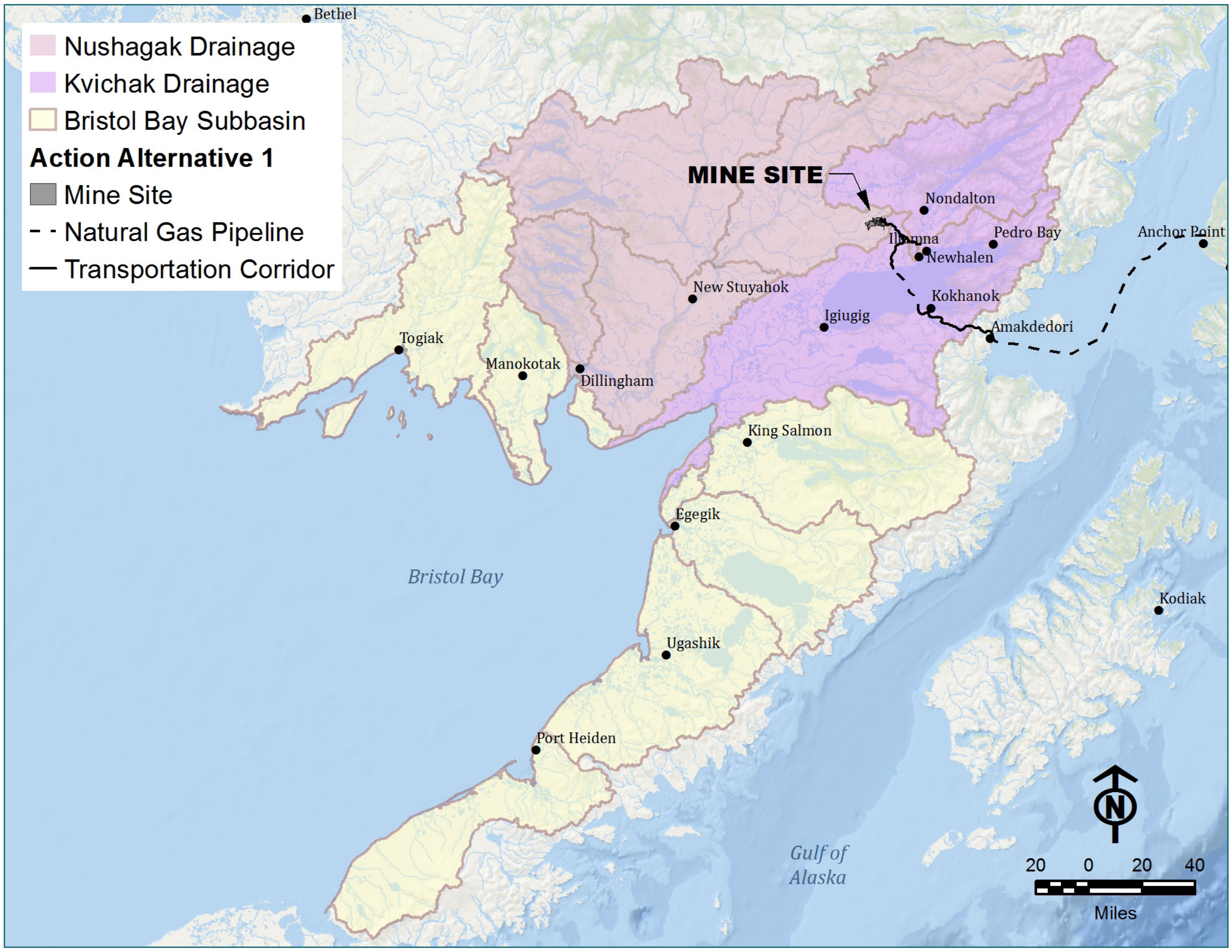


Figure ES-12: Bristol Bay Watershed

3.2 Water

3.2.1 Existing Conditions (Affected Environment) Summary

Scoping comments related to water and water quality were extensive. Specific concerns included pit water and tailings management, changes in downstream nutrients and other water quality parameters, risks associated with acid rock drainage (ARD), and discharge locations. Commenters also requested that an evaluation of surface water and groundwater use be provided.

3.2.1.1 Surface Water Hydrology

The EIS analysis area for surface water includes watersheds with numerous streams lakes (including Iliamna Lake), marine water (Cook Inlet), and wetlands that have the potential to be impacted by the project. Surface waterbodies in the project area (areas of the components: mine site, transportation corridor, port, and pipeline corridor) include numerous streams, lakes (including Iliamna Lake), marine water (Cook Inlet), and wetlands.

The EIS analysis area for surface water includes watersheds with numerous streams lakes (including Iliamna Lake), marine water (Cook Inlet), and wetlands that have the potential to be impacted by the project. Surface waterbodies in the project area (areas of the components: mine site, transportation corridor, port, and pipeline corridor) include numerous streams, lakes (including Iliamna Lake), marine water (Cook Inlet), and wetlands. The mine site is hydrologically connected to Bristol Bay (Figure ES 12). Most of the mine site features are in the NFK and SFK rivers, which join to form the Koktuli River. From the confluence of the NFK and SFK, the Koktuli River flows 39 miles

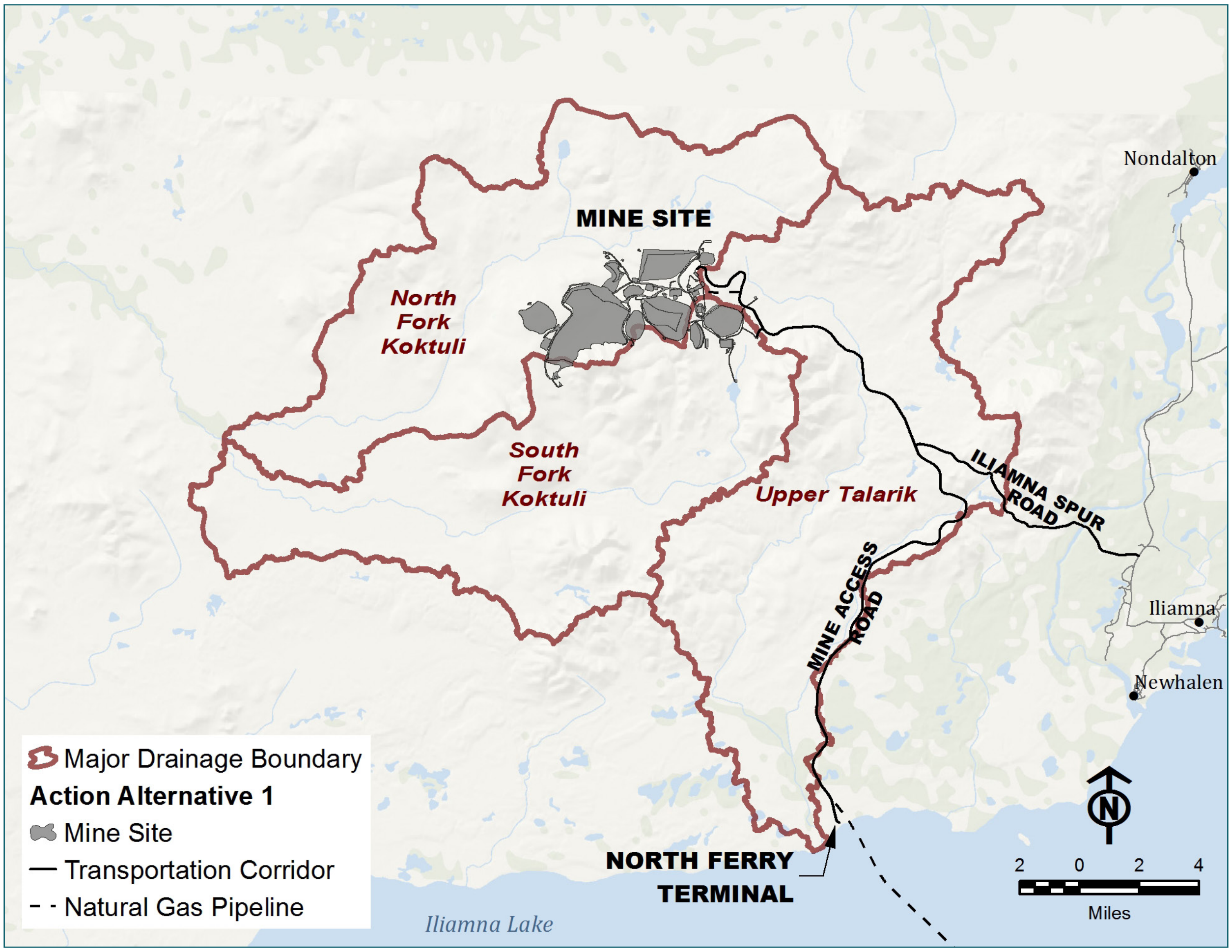


Figure ES-13: Watersheds in the Mine Study Area

downstream to the Mulchatna River, which then flows 44 miles to the Nashagak River, which then flows 109 miles into Bristol Bay. The only mine site features in the Upper Talarik Creek (UTC) watershed would be the WTP#1 discharge-east and a short section of the mine access road. UTC flows into Iliamna Lake, which then drains via the Kvichak River into Bristol Bay, about 70 miles downstream.

General characteristics common to the NFK, SFK, and UTC watersheds (Figure ES-13) include:

- Main streams occupy valley bottoms 0.5 to 2 miles wide.
- Tributaries to the main streams are incised into the hilly terrain and typically occupy narrow valleys with bottom widths of only 0.1 to 0.2 mile.
- The three main stream channels are highly sinuous and flow within floodplains containing wetlands and oxbow lakes.
- The upper parts of the three main drainages are represented by flat, poorly drained terrain.
- Areas of glacial drift (sediment of glacial origin) deposits occur along lower hillslopes and near the headwaters of the main stream valleys, characterized by undulating terrain and numerous kettle lakes.

The mine site watersheds are undisturbed and thus, baseline conditions represent natural conditions. Streamflow is generated primarily from spring snowmelt-runoff and fall rainfall-runoff. The annual pattern of streamflow is characterized by high spring flows, lower early to mid-summer flows, high flows during late summer, and low flows during winter and early spring. During winter and early spring, some streams have very low or no measurable flow except where recharged by groundwater (described in more detail under "Groundwater Hydrology").

Surface waterbodies in the proposed transportation and pipeline corridors are mostly within the Kvichak River watershed, which is hydrologically connected to Bristol Bay. The remaining portions of the onshore transportation and pipeline corridors and port sites are in the Cook Inlet watershed.

Differences between the three action alternatives include a different number of stream crossings and whether there is an Iliamna Lake crossing or not. The Action Alternative 1 transportation corridor crosses approximately 95 streams and Iliamna Lake. The Action Alternative 2 transportation corridor crosses approximately 46 streams and Iliamna Lake. The Action Alternative 3 transportation corridor crosses approximately 122 streams and does not cross Iliamna Lake.

Iliamna Lake is the largest lake in Alaska, approximately 75 miles long by 22 miles wide, with surface area of about 1,000 square miles. The ice-covered season at Iliamna Lake is highly variable. Complete freeze-over occurs between late October and mid-March, and can last for 2 to 5 months before break-up. The average length of the ice-covered season is expected to be about 115 days, based on 15 years of data collected in several southwestern Alaska lakes.

3.2.1.2 Groundwater Hydrology

The EIS analysis area for groundwater hydrology is the geographic area in the near vicinity of all project components (i.e., within 0.5 mile to several miles of each component), where project activities could be expected to affect groundwater flow patterns.

The mine site is generally characterized by surficial sedimentary materials (e.g., silts, sands, and gravels) occurring in valleys and low slopes, and permeable weathered and fractured bedrock exposed in the upland areas and hilltops. Most of the groundwater storage and flow occurs in the sedimentary materials (overburden). Studies in the mine site suggest that groundwater discharge to streams or rivers prevails; and that where it is occurring, groundwater base flow is highest in the winter, and lowest (on a percent volume basis) during the spring and summer runoff events. This is also described above as related to surface water hydrology.

The weathered and fractured bedrock, which is up to 50 feet thick, provides a pathway for elevated rates of groundwater recharge beneath the bedrock ridges. The upland weathered bedrock areas have limited groundwater storage capacity, which results in flashy streamflows and low groundwater baseflows. Below the weathered bedrock, bedrock permeability generally decreases with depth, but includes some higher-permeability zones associated with faults. Some faults act as flow barriers, while others appear as flow conduits, resulting in the potential for compartmentalized groundwater flow with the bedrock at depth. Regional groundwater flow within the deep bedrock is a very small portion of the overall groundwater budget of the area. Local and intermediate groundwater flow systems dominate the overall groundwater regime, with most flow occurring in shallow levels within overburden and shallow bedrock.

Three groundwater divides are indicated in the project footprint area as follows:

1. Between the UTC Creek drainage and the NFK drainage.
2. Near the Pebble deposit between the SFK River drainage and the UTC drainage.
3. Between the SFK River drainage and the tributary UT1.190 drainage.

Although the groundwater divides generally align with surface water drainage divides, there is evidence of some groundwater exchange between drainage basins from the SFK River drainage to the UTC Tributary UT1.190 drainage area.

The northern half of the mine access road under Action Alternative 1, and the western part of the mine access road under Action Alternatives 2 and 3, are mostly in the UTC drainage, where groundwater occurs in surficial aquifers of glacial sediment and in weathered and fractured shallow bedrock. The southern half of the mine access road under Action Alternative 1 parallels First Creek (west of the road route), a tributary basin that drains southward into the main UTC drainage about 4 miles upgradient of Iliamna Lake. Hydrogeologic data for this area are limited. Bedrock and surficial geology along this stretch of the mine access road are similar to the corridor to the north, with Tertiary-age volcanic bedrock and thick deposits of surficial glacial sediments. Based on the similar geologic setting and topography across the mine access road, hydrostratigraphic units, or the structure of subsurface porous materials related to groundwater flow, in the transportation corridor are likely similar. Permeable sands and gravels, which make up the abundant glacial till and outwash across this stretch of the mine access road, as well as lake terrace and beach deposits within 1 to 2 miles of the north ferry terminal, likely host surficial and/or intermediate aquifers. It is possible that weathered and/or fractured bedrock stores additional groundwater at depth.

The mine access road under Action Alternatives 2 and 3, and the western part of the north access road under Action Alternative 3, cross mostly glacial and alluvial deposits in the UTC, Newhalen River, Eagle Bay Creek, Chekok Creek, and Canyon Creek drainages.

East of Knutson Mountain, groundwater-bearing surficial deposits are more limited in extent due to steep, narrow drainages with large areas of exposed bedrock in between. Alluvium, alluvial fan, and mass wasting deposits in Knutson Creek, Pile River, Iliamna River, and Chinkelyes and Williams creeks may host surficial aquifers. Small areas of ground moraine and lake terrace deposits in the Pile and Iliamna river valleys may also contain shallow groundwater. It is possible that groundwater may be present near surface along steep slopes in weathered or fractured bedrock in this area. At the Diamond Point port site, shallow groundwater may be present in alluvial fan material in the small drainage on the northern side of Cottonwood Bay.

3.2.1.3 Water and Sediment Quality

The EIS analysis area for water and sediment quality includes the proposed mine footprint, and areas adjacent to or downstream of, and potentially affected by proposed project elements and alternatives.

Water quality studies were analyzed to quantify chemical and physical parameters of the existing quality of the water at the mine site and surrounding areas that would potentially be impacted. Baseline surface water resources can generally be characterized as cool, clear waters with near-neutral pH that are well-oxygenated, low in alkalinity, and generally low in nutrients and other trace elements. Sediment from ponds and minor drainages in the mine site area show higher concentrations of anions and cations such as sulfate, ammonia, and sodium than do other waterbodies in the vicinity.

Groundwater samples indicate a composition that ranges from calcium-bicarbonate to calcium-magnesium-bicarbonate and calcium-sodium-bicarbonate. Some samples from relatively close to the deposit area indicate a higher proportion of sulfate, suggesting that the groundwater in this area is influenced by oxidation of the sulfide minerals that are associated with the deposit. Of the 26 trace elements for which samples were analyzed, all were present above laboratory analysis detection limits in at least some of the samples, with aluminum, iron, calcium, and magnesium present at substantially higher concentrations than the other elements.

Mercury content of sediment samples from the mine site was the lowest level detected, at a mean concentration of 0.040 milligrams per kilogram (mg/kg). Comparing sediment from the major drainages, copper was the only element showing significant variation, likely caused by the difference in bedrock composition across drainages. Copper concentrations were particularly high in SFK sediment, likely due to copper-rich bedrock at the headwaters. In comparison to sediment quality guidelines, the highest detected concentrations of four metals (arsenic, chromium, copper, and nickel) exceeded concentrations that may have an adverse effect on benthic organisms (both the threshold effects level and higher probable effects level). These samples were from sediment in the SFK drainage (for arsenic and copper) and UTC drainage (for chromium and nickel). The mean concentration of arsenic exceeded the threshold effects level across the project footprint area.

3.2.2 Expected Effects (Environmental Consequences) of Alternatives

3.2.2.1 Surface Water Hydrology

NA

No Action Alternative

The Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Therefore, no additional future direct or indirect effects on surface water hydrology would be expected. Because PLP or other entities may operate under State permits, exploratory actions could continue, and current trends relating to surface water hydrology would be expected to continue.

AA1

Action Alternative 1 and Variants

During construction, for all the action alternatives and variants, the primary goal of water management would be to manage runoff and minimize surface water contact with disturbed surfaces. Water management structures would be among the first permanent facilities to be constructed. The mine would be designed for zero-discharge of untreated contact water. Where water cannot be diverted, it would be collected, treated and discharged. Surface water quantity and distribution in the NFK, SFK and possibly UTC watersheds would be affected during construction through diversion and collection of surface water, initial drawdown of groundwater in preparation for mining activities, and water treatment and discharge. The magnitude of the impact on average monthly flow in the NFK, SFK and UTC would be somewhat less than that during operations (described below). The one exception is NFK Tributary 1.19. NFK Tributary 1.19 is within the mine site footprint, would be removed during construction, and would not be replaced. The duration of the impact to streamflow in the NFK, SFK and UTC would be long term, lasting beyond the construction phase and into closure and post-closure for some reaches and/or tributaries. The geographic extent of the impact on the NFK and the SFK during construction would extend below the confluence of the two rivers, but would not be anticipated to extend past the Koktuli River. The impact on the UTC would not be anticipated to extend beyond the mouth of the river at Iliamna Lake.

During operations, for all action alternatives and associated variants, the primary goal of water management would be to minimize the generation of contact water. Other objectives include managing fresh water, stormwater runoff, mine drainage, process water, and inflow to and discharge from the water treatment plants. Water not diverted before becoming contact water would be collected and used as process water or treated and discharged to the environment. No additional water sources outside the mine site would be needed for operations, except potable water for camp personnel that would be obtained from groundwater wells about 0.5 miles northeast of the main WMP. Erosion and sediment control BMPs, including routine maintenance of drainage ditches and stream crossings, would be implemented and maintained during the mine operation period.

During operations, water available to discharge to the environment after treatment would be less than the baseline flows because of the water lost in tailings voids, evaporation, and other minor uses; possibly on the order of 22 to 28 cfs annually. The magnitude of the average monthly streamflow in the NFK, SFK and UTC has been predicted to be on the order of the following. In the main stem of the UTC, along its entire length, the magnitude of the average monthly streamflow with a 50th percentile probability of occurrence is predicted to be within 1 percent (plus or minus) of baseline streamflow. In the main stem of the NFK, in the reach closest to the mine, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 20 percent less to 23 percent more than the baseline streamflow, depending upon the month. In the reach closest to the confluence with the SFK, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 10 percent less to 14 percent more than the baseline streamflow, depending upon the month. In the main stem of the SFK, in the reach closest to the mine, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 97 percent less to 37 percent less than the baseline streamflow, depending upon the month. In the reach closest to the confluence with the NFK, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 4 percent less to 1 percent less than the baseline streamflow, depending upon the month. The accuracy of these predictions may be related in large part to the predictions associated with groundwater flow within and adjacent to the mine site.

For analysis of surface water quality, the closure phase was analyzed in several "Phases" termed Phase 1 through 5. During closure and post-closure, discharge from the WTPs is an important element in maintaining streamflow within the NFK, SFK and UTC. On average, the WTP discharge is anticipated to be highest during Phase 1, less in Phase 3, and less than Phase 3 in Phase 4. It is anticipated that there would be no WTP discharge during the 5 years of Phase 2. However, if during Phase 2 it becomes necessary to discharge water to maintain streamflows, water would be directed to WTP #3 for treatment and release. During post-closure (Phase 4) the magnitude of the average monthly streamflow in the NFK, SFK and UTC has been predicted to be on the order of the following. In the main stem of the UTC, within the reach closest to the mine, the magnitude of the average monthly streamflow with a 50th percentile probability of occurrence is predicted to vary from 1 percent less to 3 percent more than the baseline streamflow, depending upon the month. In the reach closest to the mouth of the UTC at Iliamna Lake, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from less than 1 percent less to less than 1 percent more than the baseline streamflow, depending upon the month. In the main stem of the NFK, in the reach closest to the mine, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 16 percent less to 9 percent more than the baseline streamflow, depending upon the month. In the reach closest to the confluence with the SFK, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 7 percent less to 6 percent more than the baseline streamflow, depending upon the month. In the main stem of the SFK, in the reach closest to the mine, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 100 percent less to 54 percent more than the baseline streamflow, depending upon the month. In the reach closest to the confluence with the NFK, the magnitude of the average monthly streamflow with a 50th percentile probability is predicted to vary from 4 percent less to 1 percent less than the baseline streamflow, depending upon the month.

Bridges and culverts would be constructed along the transportation corridor. Stream crossings for action alternatives and associated variants associated with the roads and pipelines would be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. Road and pad maintenance BMPs, including application of dust suppressants during dry periods, routine grading, and routine maintenance of drainage ditches and stream crossings, would be implemented and maintained during operations. The duration of the impact would vary from a couple of months to the life of the road, depending upon the type and magnitude of the impact. The geographic extent of the impact would vary from hundreds of feet upstream to miles downstream, depending upon the type and magnitude of the impact.

Where the natural gas pipeline follows the roads, it would be located in a trench adjacent to the driving surface of the roads. It is anticipated that the stream crossings would be constructed by a combination of: placing the pipeline in a trench dug across the stream (open cut), boring the pipeline under the stream (HDD), or hanging the pipeline on a bridge structure. The duration would be short term, primarily through the construction period. The geographic extent of the impact would be expected to be on the order of miles.

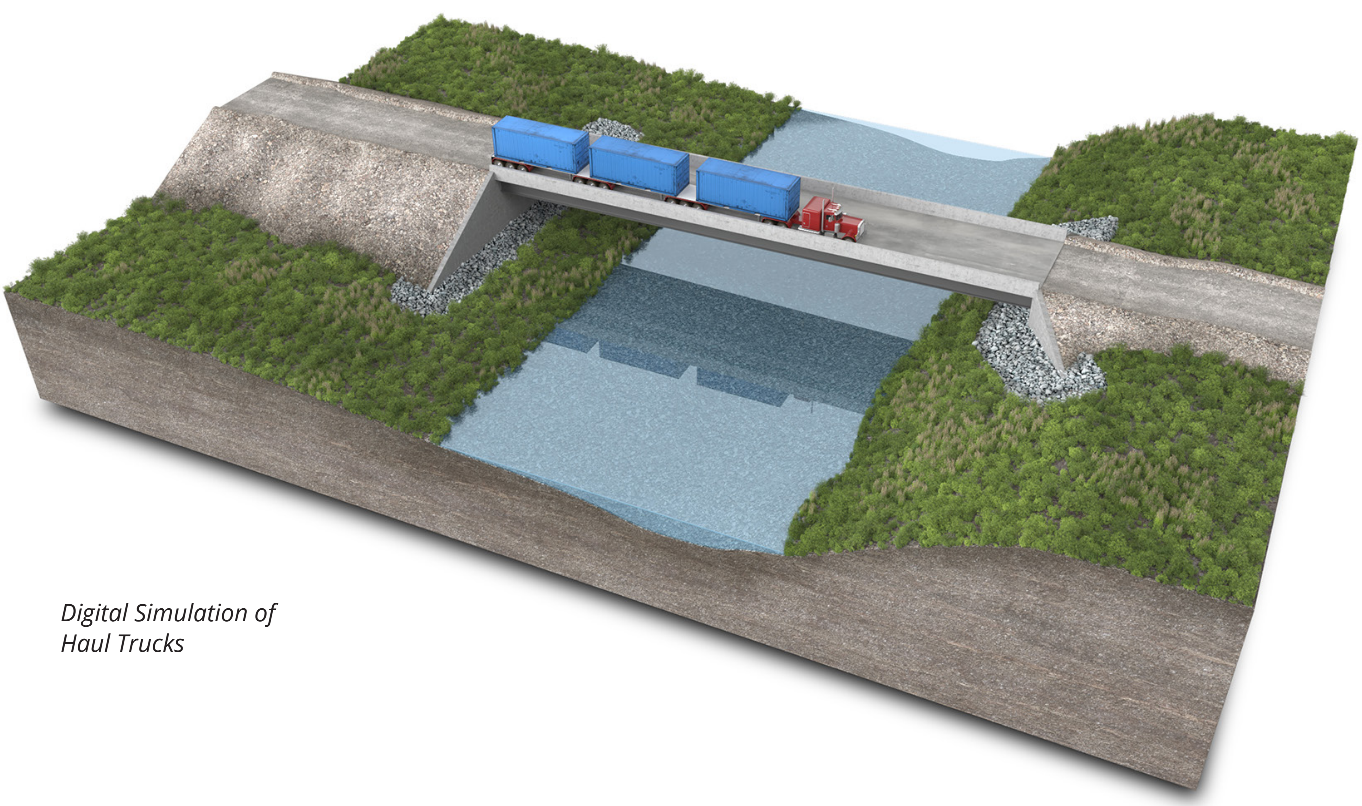
Surface water withdrawal would be conducted at 20 designated sites along the transportation corridor. Water extraction activities would be required to meet the requirements of the Alaska Department of Natural Resources for temporary water use authorizations, and the Alaska Department of Fish and Game (ADF&G) for fish habitat permits (if issued). The rate and volume of water withdrawals would be monitored at each source to ensure permit requirements are met (as per permit stipulations). Therefore, the magnitude of the impacts to surface water resources is generally expected to result in changes in water quantity likely within the limits of historic and seasonal variation. The duration of the impacts is likely to be the life of the road, and the geographic extent of the impacts is likely to be relatively close to the road.

Impacts to surface water for the Summer-Only Ferry Operations and Kokhanok East Ferry Terminal Variants would be similar to Action Alternative 1. The proposed Amakdedori Port would be a solid fill dock extending 1,900 feet into Cook Inlet and would alter marine water circulation. The Pile Supported Dock variant would reduce impacts to circulation.

AA2 Action Alternative 2 and Variants

Potential impacts from construction through post-closure of the mine site would be the same as those described for Action Alternative 1. The road segments for Action Alternative 2 would result in fewer stream crossings than Alternative 1: two fewer bridges (7) and 47 fewer culvert crossings (39) than Action Alternative 1. The pipeline corridor under Action Alternative 2 would have more waterbody crossings than Action Alternative 1, requiring 17 bridges and 105 culvert crossings, and the additional trenching required for installation of the Cottonwood Bay segment.

Impacts at the Diamond Point port would be similar to those described for Amakdedori port under Action Alternative 1. Ferry terminal construction and operations at Eagle Bay and Pile Bay would have similar impacts as those for the north and south ferry terminals in Action Alternative 1. The Summer-Only Ferry Operations Variant would have similar impacts to Action Alternative 2 while the Pile-Supported Dock Variant would reduce impact on marine water circulation in Iliamna Bay.



Digital Simulation of Haul Trucks

AA3

Action Alternative 3 and Variant

Potential impacts from construction through post-closure of the mine site would be the same as those described for Action Alternative 1. The transportation corridor (road and pipeline) under Action Alternative 3 would have more waterbody crossings than Action Alternative 1, requiring 17 bridges and 105 culvert crossings, and the additional trenching required for installation of the Cottonwood Bay pipeline segment. The concentrate pipeline variant would increase the Action Alternative 3 project footprint as compared to Action Alternative 1, because the road corridor would be wider to accommodate pipeline construction and installation, and thus increase disturbance during construction at waterbody crossings. The concentrate pipeline variant would reduce the amount of treated water discharged from the mine site by approximately 1 to 2 percent, which could cause increased reduction in streamflow downstream of the mine site.

CE

Cumulative Effects

The cumulative effect analysis area for surface water hydrology includes the watersheds in which project-related activity would occur, and the watersheds where direct and indirect effects on surface water hydrology could reasonably be expected to contribute to cumulative effects.

Past and present actions affecting surface water conditions in the EIS analysis area are minimal.

Current development consists of a small number of towns, villages and roads with existing stream crossing structures such as culverts and bridges.

Other activities include mining exploration and non-mining-related projects such as transportation oil and gas exploration, or community development actions.

These actions have resulted in little to no regional impacts to surface water, including streamflow, lakes, and surface water/groundwater interaction.

The Pebble mine expanded development scenario project footprint would impact a much larger area than the proposed Action Alternative 1; with an expansion into the UTC watershed.

The expanded development would contribute to cumulative effects on surface water hydrology through increased capture of surface water flow, increased groundwater pumping to facilitate required pit dewatering, and an extended duration of these effects during operations. The magnitude of the cumulative impacts would vary from temporary to permanent, increasing potential streamflow reductions in the NFK, SFK and UTC watersheds beyond those described for Action Alternative 1.

An access road, concentrate pipeline, and a diesel pipeline from the mine site to Iniskin Bay would also be constructed as part of the expanded development. The impacts associated with these activities are expected to be similar in nature to those associated with Action Alternative 1 pipeline and road construction activities. The magnitude and extent of the impacts are expected to be low and limited as long as they are properly designed, constructed, and maintained.

3.2.2.2 Groundwater Hydrogeology

NA

No Action Alternative

Under the No Action Alternative, the project would not be undertaken; there would be no mine site, transportation corridor, port development, or natural gas pipeline corridor. In the event PLP concludes their exploration program, or in the event of revocation or termination of the associated state permits, PLP would be would be required to reclaim any remaining sites at the conclusion of their exploration program. If reclamation approval is not granted immediately after the cessation of reclamation activities, the State may require continued authorization for ongoing monitoring and reclamation work. Groundwater along the transportation corridor, pipeline corridor, and at the Amakdedori and Diamond Point ports would remain in its current state. There would be no effects on existing private wells. There would no direct or indirect impacts on baseline groundwater conditions from implementation of the No Action Alternative.

AA1

Action Alternative 1 and Variants

The action alternatives and variants would have similar magnitude, extent, duration, and likelihood as the effects described for groundwater hydrology. In terms of extent of impacts, groundwater dewatering impacts related to the proposed project are expected to be largely confined in the upper reaches of the SFK watershed, but may locally adversely impact groundwater flow across the divide in the bedrock aquifer from the headwaters of the UTC watershed , depending on the extent of the cone of depression around the pit. The magnitude and extent of impacts would be to groundwater flow in the alluvial and glacial (overburden) and bedrock aquifers in the open pit footprint and cone of depression. This effect would be long term, lasting beyond the life of the project.

Dewatering results in a groundwater "cone of depression" because the water table is lowered in the pit, and the effect extends laterally beyond the pit area into the adjacent overburden and bedrock aquifers. The cone of depression would deepen and widen as pit area dewatering continues, and would last as long as the dewatering system is operated during construction and operation of the mine and the early closure period. Once mining ceases, dewatering would be gradually discontinued and groundwater in the open pit would be allowed to rise to a maximum management (MM) level that would be managed through pumping, storage, and water treatment. It is estimated it would take 19 to 21 years for the groundwater in the pit to reach the MM level. This would result in a permanent pit lake. In terms of magnitude, the maximum area of the capture zone at the end of operations would be about 2,700 acres.

The magnitude of impacts would be that natural groundwater discharge to seeps, wetlands, streams, ponds, or lakes in or adjacent to the proposed pit could cease or be reduced, resulting in adverse impacts such as lower surface water base flows or reduced wetland, pond, or lake levels. In terms of extent, some wetlands, stream segments, ponds, or lakes in the immediate pit area may be eliminated as the water table is lowered in the immediate pit area during construction and operations, and through closure. Impacts would be permanent, lasting beyond the life of the project. Some of this reduction is expected to be mitigated by releases from the WTP#1 discharge – east, such that groundwater flow would not change relative to natural conditions and surface flows would increase slightly. Overall, downstream impacts from pit lake level management during post-closure would not be expected.

Construction of the bulk TSF would locally impact surface water features at the site, and potentially impact groundwater/surface water interactions; this impact is expected to be small in magnitude, could extend beyond the mine facility area, and be permanent. The grout curtain would impact groundwater flow in the overburden and shallow bedrock in the vicinity of the mine site, but would not affect regional flow patterns. In terms of extent, tailings seepage that is not captured could create a local groundwater mound beneath the TSF that could have a local or larger influence on groundwater flow.

Groundwater flow would be impacted by the construction of the pyritic TSF and main WMP through local reduction in recharge cause by the presence of liners. These impacts would be long term, and could slightly exceed historical variation. These facilities would be removed at closure, and the sites reclaimed. Therefore, groundwater flow in these tributary drainages to NFK is expected to essentially return to baseline conditions post-closure (after Closure Year 50).

Due to the likelihood of shallow groundwater being present across the road corridor, it is possible that road cuts could intersect groundwater in some areas and cause a local adverse effect on groundwater flow as drainage controls (construction BMPs) direct potential seepage away from the road. The magnitude and extent of potential impacts to groundwater in the transportation corridor would likely involve interception of shallow groundwater during pipeline trenching activities, which could be captured and routed along the trench backfill. In terms of extent and duration, shallow groundwater interception impacts would be limited to within the port footprint or material sites for dock construction and would occur only during construction.

Dewatering, if required, during horizontal directional drilling at the eastern pipeline terminus during construction, could draw down the local water table, potentially changing local flow patterns and affecting other uses. These effects are expected to be short-term in duration, and would recover days or weeks after construction. In terms of extent, they would also limited to the near vicinity of the footprint, depending on drawdown extent and potential discharge location.

Impacts from pumping at the potable water supply well wells at the mine site and Amakdedori port are not expected to impact local groundwater flow beyond the immediate vicinity of the wells , based on expected aquifer conditions.

The Summer-Only Ferry Operations Variant would cause additional reduction in groundwater recharge within the footprint of the additional storage facilities at the mine site and Amakdedori port, which would last through the operations phase and slightly exceed historical variation. There would also be an increased likelihood of intersecting shallow groundwater along Amakdedori Creek floodplain due to the larger storage footprint. The Kokhanok East Ferry Terminal Variant would have slightly less shallow groundwater interception during road construction due to the 15% shorter route, but slightly more during material extraction due to the larger material sites footprint. The Pile-Supported Dock Variant would cause slightly less shallow groundwater interception at borrow sites due to less fill needs.

AA2 Action Alternative 2 and Variants

Potential impacts to groundwater hydrology at the mine site would be the same as those described for Action Alternative 1 except at the bulk TSF. The higher maximum crest elevations under the downstream dam configuration would cause water table elevations to be higher in late operations and more likely to create potential seepage through topographic saddles on eastern and western sides of the bulk TSF. Impacts to the transportation and pipeline corridors would be similar to Action Alternative 1, although slightly more shallow groundwater interception is anticipated under Action Alternative 2 due to greater route length through areas of groundwater-bearing surficial deposits and steep cut slopes. Under the Summer-Only Ferry Operations Variant, there would be slightly more groundwater diversion along the cut slopes adjacent to the Williamsport container storage area. The types of impacts at the Diamond Point port site would be similar to Action Alternative 1, although construction excavations at the Diamond Point terminal site are more likely to intersect shallow groundwater-bearing deposits than at Amakdedori. Impacts for the Pile-Supported Dock Variant would be the same as Action Alternative 1.

AA3

Action Alternative 3 and Variant

Potential impacts to groundwater hydrology at the mine site would be the same as those described for Action Alternative 1. Under the Concentrate Pipeline Variant, there would be slightly decreased groundwater recharge at mine site due to diversion of 1 to 2% of mine site groundwater for use in the slurry concentrate. Impacts to the transportation and pipeline corridors would be similar to Action Alternatives 1 and 2, although there would be slightly more shallow groundwater interception under Action Alternative 3 due to greater route length through areas of groundwater-bearing surficial deposits and steep cut slopes, and a 10% longer pipeline trench footprint. Impacts to groundwater hydrology at the Diamond Point port site under both Action Alternative 3 and the Concentrate Pipeline Variant would be the same as Action Alternative 2.

CE

Cumulative Effects

The geographic area considered in the cumulative effects analysis for groundwater hydrology is the near vicinity (i.e., within 0.5 mile to several miles) of all project components where project related effects on groundwater flow patterns and use could overlap with other surface and groundwater uses. Past and present activities that have, or are currently, affecting groundwater hydrology in the EIS analysis area include water supply wells in communities around Iliamna Lake and the Kenai Peninsula, small-scale wells or seeps associated with cabins and camps along the transportation route, and mining exploration near the project area (e.g., pump tests, camp water use), that create localized changes in groundwater flow patterns, reductions in groundwater in aquifers, and use of streams or lakes that are hydraulically connected with groundwater.

The Pebble mine expanded development scenario would correspond to roughly a five-fold increase in the size of the pit capture zone straddling the SFK and UTC drainages. There would be a similar increase in the amount of groundwater needing to be dewatered and treated during operations, and the amount pumped and treated throughout post-closure to maintain hydraulic containment in the pit lake. Streamflow reductions in SFK and UTC due to the expanded pit capture zone are expected to be somewhat mitigated by treated water being returned to these watersheds. The extent of the pit capture zone would not affect community water supplies in Newhalen, Iliamna, or Nondalton, which are located about 10 to 12 miles away from the expanded pit capture zone, and in a different drainage on the other side of the UTC-Newhalen River watershed divide. Diverted runoff and collected seepage from other unlined project facilities, such as the expanded bulk TSF and WRFs, would also alter local groundwater flow patterns and natural discharge to streams over a wider area than under Action Alternative 1, from groundwater flow being captured in downstream SCPs and treated and discharged to downstream areas. The potential for shallow groundwater interception along the transportation, pipeline, and port components would increase under Action Alternative 1 expanded mine scenario with both the north and south access corridors being used, as well as where future LPB road projects are co-located or close to the Pebble project. While cumulative effects at the mine site under the expanded mine scenario would be the same under all action alternatives, overall cumulative effects under Action Alternatives 2 and 3 would be less than that of Action Alternative 1, because there would be no effects on groundwater along the south access corridor or Amakdedori port site.

3.2.2.3 Water and Sediment Quality

NA

No Action Alternative

Because the Pebble Project would not be undertaken and construction, operations, or closure activities would not occur, background water and sediment quality in the mine site vicinity would not change. Certain constituents would still be present in amounts exceeding regulatory levels because of natural mineralization and geochemical weathering processes. Water quality along the transportation and pipeline corridors would continue to reflect the presence of elevated levels of some constituents as described. No project-related geochemical processes or impacts on surface water, groundwater, or sediment quality would occur under this alternative. Consequently, under the No Action Alternative, the project would not be constructed and no new effects on water and sediment quality would occur. Any continued exploration by PLP or other entities would not be expected to affect current water and sediment quality trends.

AA1 Action Alternative 1 and Variants

At the mine site, contact water would be largely captured, treated, and discharged to the environment during construction, operations, and closure. Under Action Alternative 1, impacts to water quality would generally be limited to the mine site area, within the zone of contact water capture and treatment, with potential minor exceptions of temperature and turbidity effects. Potential effects of contact and runoff water during construction of downstream water and sediment quality would be minimized through treatment prior to discharge, and would be expected to be minor, generally limited to temperature effects and temporary turbidity during construction. Temperature effects ranging from about -1 to +3.6 degrees Celsius could occur up to 0.5 to 3 miles downstream of the mine site, depending on seasonal factors.

Runoff water collected in mine facilities (e.g., bulk TSF, pyritic TSF) would be expected to require treatment prior to discharge to meet State of Alaska water quality criteria. PLP would be required to monitor treated water quality, in accordance with expected Alaska Pollutant Discharge Elimination System (APDES) permit stipulations, to ensure discharged water meets applicable water quality criteria.

Treated water from the WTPs during operations would be used to supply process needs, and the remainder would be discharged to the environment downstream of the mine site. All WTP#1 treated water and most WTP#2 treated water during operations would be discharged, and a small portion of the WTP#2 treated water would be used for process and power plant needs. In closure, all treated water would be discharged to the environment. Water from treatment plants would be discharged in a manner that would optimize downstream aquatic habitat, based on modeling and monitoring during discharge.

Water from the open pit and runoff from other mine site facilities would be managed using a water management pond (WMP) and runoff controls. Groundwater inflows to the open pit would be pumped to the WMP for storage and treatment prior to discharge. Once mining ceases, dewatering would be discontinued and groundwater in the open pit would be allowed to rise. It is estimated it would take 20 years for the groundwater in the pit to reach the maximum management (MM) level (890 feet above mean sea level [amsl]). The groundwater level in the pit would be maintained during closure and post-closure to create a permanent groundwater sink to prevent pit lake contact water from discharging to the environment. This would result in a permanent pit lake that would be pumped to maintain the MM level.

Within the Action Alternative 1 transportation and natural pipeline corridors, impacts to water and sediment quality would be expected to be mostly limited to temporary impacts to turbidity during construction. Those impacts would be limited by BMPs and erosion controls. Containment and treatment of surface water runoff at major transportation corridor facilities, including ferry terminals and the port site, would minimize effects on adjacent surface water and sediment.

AA2 Action Alternative 2 and Variants

Potential impacts at the mine site during construction, operations, and closure phases would be the same as those described for Action Alternative 1. Impacts to the transportation and natural gas pipeline corridors would vary somewhat from Action Alternative 1. The road segments for Action Alternative 2 would have fewer stream crossings than Action Alternative 1, and would therefore have less potential for surface water and sediment quality impacts during construction and operations phases. The pipeline corridor under Action Alternative 2 would have more waterbody crossings than Action Alternative 1, which would increase impacts to surface water and sediment quality during construction. The additional trenching required for installation of the Cottonwood Bay segment would result in increased surface water and sediment quality impacts during construction, and would also have a potential impact on groundwater quality in areas of shallow groundwater.

The Diamond Point port would require dredging, which would result in temporary impacts to marine water and sediment quality during construction. Impacts at the Diamond Point port during operations would be similar as those described for Amakdedori port, except that maintenance dredging that would result in temporary localized impacts to water and sediment quality when those activities occur. Ferry terminal construction and operations at Eagle Bay and Pile Bay would have the similar impacts as those for the north and south ferry terminals under Action Alternative 1. Under the Summer-Only Ferry Operations Variant, impacts to water and sediment quality would be very similar to those under this variant under Action Alternative 1. The Pile-Supported Dock Variant would result in less impact on marine sediment than the main Action Alternative 2.

AA3 Action Alternative 3 and Variant

Potential impacts to water and sediment quality at the mine site during construction, operation and closure phases would be the same as those described for Action Alternative 1. The transportation and natural gas pipeline corridors under Action Alternative 3 would have more waterbody crossings than Action Alternative 1, and would therefore result in greater impacts to surface water and sediment quality during construction and operations. The additional trenching required for installation of the Cottonwood Bay segment would result in increased surface water and sediment quality impacts during construction, and would also have a potential impact on groundwater quality in areas of shallow groundwater. The impacts associated with the ferry terminals and ferry operations on Iliamna Lake would be eliminated, and impacts to water and sediment quality would be reduced. The Concentrate Pipeline Variant would increase the Action Alternative 3 project footprint as compared to Action Alternative 1, because the road corridor would be wider to accommodate pipeline construction and installation, and thus increase disturbance during construction at waterbody crossings, thereby potentially increasing sedimentation impacts to surface water. The Concentrate Pipeline Variant would reduce the amount of treated water discharged from the mine site by approximately 1 to 2 percent, which could affect the water surplus discharge, which would reduce chemical and temperature effects on surface water.

CE Cumulative Effects

The cumulative effects analysis area for water and sediment quality includes all watersheds in which project-related activity would occur, where direct and indirect effects on surface water, groundwater, or substrate could reasonably be expected to contribute to cumulative effects. Past and present actions that have, or are currently, affecting water or sediment quality within the cumulative effects analysis area include boat operations in Iliamna Lake and Cook Inlet used for fishing and tourism; sewage, solid waste, and energy generation by local communities, past mining exploration; and activity along existing roads in the area.

The Pebble mine expanded development project footprint would impact approximately three times the area proposed under Action Alternative 1, with an expansion into the UTC watershed that Action Alternative 1 generally minimizes.

The magnitude of cumulative impacts to water and sediment quality would generally be increased discharges of treated effluent that would be expected to meet permit limits, but the duration of effects would be increased to approximately 98 years. The potential for cumulative impacts on surface water, groundwater, and sediment quality would increase accordingly. Additional design features to capture and treat impacted water and waste streams would be necessary to manage mine site impacts.

An access road, concentrate pipeline, and a diesel pipeline from the mine site to Iniskin Bay would be constructed, all having potential impacts on water and sediment quality because of trenching activities and potentially increased erosion. The increase in diesel fuel use over an extended period of time would also increase the likelihood of hydrocarbon spills and contribute to increased potential cumulative effects.

3.3 Fisheries (Fish Values)

3.3.1 Existing Conditions (Affected Environment) Summary

3.3.1.1 Fish and Aquatic Habitat

The mine site would be in the Koktuli River and UTC watersheds. The 36-mile NFK River and 40-mile SFK River join to form the Koktuli River, which flows 39 miles downstream into the Mulchatna River. The Mulchatna River continues 44 miles before joining the Nushagak River, which then flows another 109 miles into Bristol Bay. UTC flows for approximately 39 miles into Iliamna Lake, which drains into the Kvichak River, which flows 50 miles downstream into Bristol Bay. The two forks of the Koktuli River and the UTC subbasins encompass approximately 355 square miles, representing approximately 0.9 percent of the 39,184-square-mile Bristol Bay watershed.

The EIS analysis area for the mine site includes the NFK, SFK and UTC watersheds and a 1,000-foot buffer around the mine site to account for blasting disturbance. The EIS analysis area for the port, transportation and natural gas pipeline corridors includes all aquatic habitats within 0.25 mile of the proposed infrastructure.

North Fork Koktuli River

The NFK River drains 64.7 miles of currently documented anadromous stream channels, with a total basin area of about 113 square miles, which represents 0.3 percent of Bristol Bay's watershed area (Figure ES-13). Approximately 23 percent of the NFK basin area and 15 miles of main stem channel are upstream of the mine site footprint. There are 12 currently documented anadromous fish-bearing tributaries entering the NFK, including Tributary 1.19, which would contain most of the mine site footprint. Habitat typing shows that the main stem NFK below the mine site is dominated by riffle habitat with few main stem pools. Upstream of the mine site, the NFK contains equal proportions of riffle and run/glide habitats, with increasing frequency of beaver-formed pools. Off-channel habitats, which include side channels, percolation channels, alcoves, isolated ponds, riverine wetlands, and beaver ponds, are hydrologically connected to the NFK via surface flows or groundwater upwelling.

Tributary 1.19 and sub-tributaries to the NFK would contain much of the 10.7-square-mile mine site footprint. It is a first-order stream characterized by flashy runoffs during snowmelt and rainstorm events due to higher precipitation, steep catchment in the surrounding uplands, full exposure to incoming storms, and lack of surface flow losses to groundwater in the lower reaches.

Chinook salmon, coho salmon, sockeye salmon, and chum salmon have been documented in the NFK watershed. Pink salmon (*Oncorhynchus gorbuscha*) are documented in the main stem Koktuli River and the UTC, but do not occur in the NFK. Other species found in the NFK watershed include rainbow trout, Dolly Varden, Arctic grayling, lamprey (*Lempira spp.*), including species such as brook lamprey (*P. planeri*), threespine stickleback (*Gasterosteus aculeatus*), ninespine stickleback (*Pungitius pungitius*), sculpins (*Cottus sp.*), northern pike (*Esox lucius*), and whitefish (various species, including round whitefish [*Pros opium cylindraceum*], humpback whitefish [*Coregonus pidschian*], and least cisco [*Coregonus sardinella*]).

Chinook salmon spawning habitat occurs throughout the lower 20 miles of the NFK below the mine site, and extends into the upper NFK adjacent to Big Wiggly Lake. The majority of spawning habitat occurs in the

first 10 miles of the NFK, approximately 20 miles downstream from the mine site. Juvenile Chinook rearing habitat occurs throughout most of the NFK main stem, as well as several NFK tributaries, including Tributary 1.40, 5 miles above the SFK confluence; Tributary 1.17 below Black Lake; Tributary 1.19 and its primary sub-tributary at the mine site; and Tributary 1.24, which flows through Big Wiggly Lake. Juvenile Chinook were most commonly observed in riffles and other main stem habitats, but were also found to occupy low-velocity off-channel habitats.

Coho salmon spawning and rearing habitat is widely distributed in the NFK basin. Preferred coho spawning habitat appears to be in the 10 miles of main stem immediately downstream of the mine site, based on field observations.

Sockeye salmon spawning habitat primarily occurs in the lower 10 miles of the NFK, but the run extends upstream to the vicinity of Big Wiggly Lake. Although some spawning habitat has been documented in the upper NFK basin, most juvenile rearing habitat occurs downstream of the mine site, based on field observations.

South Fork Koktuli River

The SFK River extends approximately 40 miles upstream from the confluence with the NFK to the headwaters, including over 60 miles of documented anadromous stream habitat and a 107-square-mile drainage area, representing 0.3 percent of the Bristol Bay watershed (Figure ES-13). Approximately 18 percent of the mine site footprint occurs in the headwaters of the SFK basin, including the mine pit, overburden stockpile, pit water management and treatment facilities, and miscellaneous facilities. The mine pit and associated sediment pond embankment are expected to capture or block approximately 1.4 miles of stream channel known to support resident fish habitat. The low-gradient and gravel-dominated substrate of the main stem SFK below the mine site provides spawning and rearing habitat for resident and anadromous salmonids.

Chinook, coho, sockeye, and chum salmon have been documented in the SFK watershed. Pink salmon have not been documented in the SFK. Other fish species documented in the SFK watershed include rainbow trout, Dolly Varden, Arctic grayling, lamprey, threespine and ninespine stickleback, sculpin (may include slimy and/or coast-range sculpin), northern pike, whitefish (round whitefish, humpback whitefish, and/or least cisco), and burbot. Arctic char have also been documented in the SFK; however, fish surveys did not encounter this species.

Chinook salmon spawning habitat has been documented from the SFK/NFK confluence upstream to Frying Pan Lake, although more recent sampling indicated preferred spawning habitat occurs in the lower 20 miles of the SFK. The main stem SFK from SFK Tributary 1.19 to the Frying Pan Lake outlet routinely dries up during base-flow periods; consequently, that reach is not considered quality habitat. Chinook habitat does not extend into the upper SFK basin above Frying Pan Lake or in the footprint of the mine site. However, rearing habitat occurs throughout the main stem below Frying Pan Lake, and in the lower 4 miles of SFK Tributary 1.19, which drains the southern side of Kaskanak Mountain.

Coho spawning habitat in the main stem SFK extends almost up to the outlet of Frying Pan Lake, although spawning habitat is limited in the middle intermittent reach. Most spawning habitat was observed via aerial surveys in the lower 20 miles of the main stem, and in two tributaries: SFK 1.13, and SFK 1.19. Juvenile coho rearing habitat occurs throughout the SFK basin, including the main stem, tributaries, and headwaters upstream of Frying Pan Lake. Juvenile coho in the SFK routinely use off-channel habitats, including beaver ponds, side channels, and alcoves. Juvenile coho overwintering habitat has been documented in the reaches SFK-A and SFK-B.

Sockeye salmon spawning habitat is limited to lower reaches SFK-A, SFK-B, and SFK-C, and rearing habitat occurs throughout the SFK.

Chum spawning habitat is limited to the lower 20 miles of the river, downstream of the seasonally dry channel. Adult chum salmon appear to target areas of rising groundwater during redd (a redd is a fish spawning nest) site selection; consequently, the highest densities of chum salmon redds occurred in the reach immediately downstream of the dry channel, where accretion of groundwater is most evident. Rainbow trout habitat occurs in several reaches of the SFK, including upstream of Frying Pan Lake and tributaries, but densities of this species were lower than for other resident salmonids

Upper Talarik Creek

UTC flows south about 39 miles from its headwaters on the eastern edge of the mine site downstream into Iliamna Lake near the town of Iliamna. The UTC watershed is approximately 135 square miles, representing 0.3 percent of the entire Bristol Bay watershed area (Figure ES-13). Mine site facilities in the UTC basin would be limited to the mine access road and a water treatment discharge pipe, or less than 0.5 percent of the mine site footprint. The eastern edge of the mine pit is at the SFK and UTC watershed boundary; consequently, the mine pit (primarily through pit dewatering) and associated roads and facilities could affect aquatic habitat in the UTC. The UTC main stem contains an abundance of gravel substrate relatively free of fine sediments, and provides spawning habitat.

In addition to the four species of Pacific salmon found in the NFK and SFK, the UTC also contains an intermittent run of pink salmon in the lower reaches. The UTC is also known as quality habitat for rainbow trout. Other resident species found in the UTC include Dolly Varden, Arctic grayling, whitefish (may include round whitefish, humpback whitefish, and/or least cisco), sculpin (*Cottus sp.*) and two species of stickleback (i.e., threespine and ninespine). Arctic char have been documented in the UTC; however, no Arctic char were observed in environmental baseline studies (R2 et al. 2011).

Chinook salmon spawning and rearing habitat is interspersed throughout the entire length of the 39-mile main stem UTC; however, Chinook spawning habitat in UTC tributaries is limited to a very short reach of UTC Tributary 1.41, and in UTC Tributary 1.19, which receives groundwater flow from the SFK. Juvenile Chinook rearing habitat was observed in main stem habitat features such as run/glide, pool, and riffles in reaches UT-C through UT-E; juvenile Chinook overwintering habitat has been documented in reaches UT-C, UT-D, and UT-E of the UTC.

Coho salmon spawning habitat extends almost the entire length of the main stem UTC and into several tributaries (UTC tributaries 1.60, 1.35, 1.31, and 1.41). The distribution of juvenile coho was like that for spawning, with the addition of several minor tributaries. Densities of juvenile coho were generally similar in main stem and off-channel habitat; and maximum densities were observed in UTC Tributary 1.41, which drains the western side of the upper basin immediately proximal to the mine pit. Coho were observed in November, and again the following April, in reaches UT-D through UT-F, suggesting these reaches may provide overwintering habitat.

Sockeye spawning habitat has been documented in most of the main stem UTC up to the headwaters bordering the mine site, and encompassed several tributaries, including 1.60, 1.90, 1.35, 1.39, and 1.41. Although the spawning habitat is widespread in the UTC, preferred spawning habitat occurs in reaches UTC-A; and in Tributary 1.60, where up to 43 percent of the UTC sockeye run spawned in 2008. Sockeye rearing habitat is also widespread in the UTC basin, although field observations indicate habitat is somewhat limited in the main stem and tributaries, likely due to the early migration of juveniles into Iliamna Lake. Rainbow trout use multiple habitats, including riffle, glides, pools, and beaver ponds throughout all reaches of the UTC.

Iliamna Lake

Iliamna Lake is a large lake with a surface area of 1,012 square miles. Iliamna Lake and its numerous tributaries provide spawning and rearing habitat for all five species of Pacific salmon and resident salmonid species, including Dolly Varden and rainbow trout. Juveniles and adults of all five salmon species use the lake habitat as a migration corridor between Bristol Bay and Iliamna Lake, via the Kvichak River. Of the anadromous salmonids, sockeye are the most common species in Iliamna Lake, where they are known to use shoreline habitat for spawning, particularly in the northeastern portion of the lake. Iliamna Lake is also heavily used by rainbow trout, which use a variety of lake habitats for summer foraging. The most common subsistence fishery is for sockeye salmon; but targeted fisheries also include Arctic grayling and whitefish.

Cook Inlet

Cook Inlet is in southcentral Alaska and extends approximately 180 miles from the Gulf of Alaska to Anchorage. The natural areas of Cook Inlet most likely to be affected by the project are the Lower Cook Inlet central zone and Kamishak Bay. The lower central zone is defined as the region north of the Barren Islands between Kamishak and Kachemak bays, and south of a line from Anchor Point to Chinitna Bay.

All five species of Pacific salmon, Pacific herring (*Clupea pallasii*), eulachon (*Thaleichthys pacificus*), Pacific sand lance (*Ammodytes hexapterus*) and pond smelt (*Hypomesus olidus*) are found in the Cook Inlet Management Area. The Cook Inlet area also supports several important groundfish species, including sablefish (*Anoplopoma fimbria*), Pacific cod (*Gadus macrocephalus*), walleye pollock (*G. chalcogrammus*), lingcod (*Ophiodon elongatus*), and pelagic shelf rockfish species (*Sebastes spp.*). Other fish species includes sculpins, skates (*Rajidae*), sharks, commander squid (*Berryteuthis magister*), giant Pacific octopus (*Enteroctopus dofleini*), shortspine thornyhead (*Sebastolobus alascanus*), and numerous other rockfish species. Flatfish species known to occur in the Cook Inlet and/or Kamishak Bay include flathead sole (*Hippoglossoides elassodon*), rock sole (*Lepidopsetta bilineata*), arrowtooth flounder (*Atheresthes stomas*), and Pacific halibut (*H. stenolepis*), the latter of which are highly valued in both commercial and recreational fisheries. Other marine forage species that may occur near the Cook Inlet pipeline route and/or the Amakdedori port include capelin (*Mallotus villosus*), eulachon (*Thaleichthys pacificus*), gunnels (*Pholidae*), Pacific sandfish (*Trichodon trichodon*), pricklebacks (*Stichaeidae*), and lanternfish (*Myctophidae*).

3.3.1.2 Commercial and Recreational Fishing

The ADF&G Commercial Salmon Fishery Area T and Area H, ADF&G Commercial Shellfish Area H, the Cook Inlet Management Area (groundfish) and ADF&G Statewide Harvest Survey (SWHS) areas S, T, N, and P comprise the EIS analysis area for this commercial and recreational fishing.

The inshore waters of Bristol Bay are home to the world's largest sockeye fishery and some of the world's largest natural salmon runs. Between 2000 and 2010, Bristol Bay provided 45 percent of the world's sockeye harvest, 7 percent of the world's wild salmon harvests, and 2 percent of world salmon supply. Each year, roughly 2,840 holders of State of Alaska Area T salmon permits have the opportunity to harvest salmon from five major fishing districts managed by the ADF&G. Bristol Bay's economic ecosystem is driven by the annual return of salmon to the region. Average monthly employment in June, July, and August can be more than double that of the winter months, and the opportunity to harvest salmon generates 60 percent of regional self-employment income.

The Area T Bristol Bay salmon fishery (the fishery) is divided into five districts (Naknek/Kvichak, Egegik, Ugashik, Nushagak, and Togiak) encompassing nine major river systems. Across all five districts, sockeye salmon are the most commonly harvested species, representing 97 percent or more of the harvest in the Naknek/Kvichak district, the Egegik district, and the Ugashik district. On average, the most productive fishing districts are the Naknek/Kvichak district (8.2 million fish annually), followed by the Nushagak (7.3 million), the Egegik (6.8 million), the Ugashik (2.9 million), and the Togiak (0.7 million).

Subsistence users and recreational anglers access the resource after sockeye salmon enter freshwater, and after the fish have escaped the commercial fishery; the ADF&G's escapement goals include a portion expected to be harvested by these users. The number of salmon that are not harvested by the fishery is known as the "escapement number."

The average price per pound that processors pay permit holders for their salmon depends largely on the condition of world salmon markets, including salmon produced by other wild and farmed sources. In 2017, the fishery generated $216.4 million in ex-vessel payments to all Area T permit holders, making that year the second-best year for permit holders collectively since 1997.

The fishery has experienced a gradual out-migration of permits from Alaskans to non-Alaskans; from watershed residents to non-watershed Alaskans and non-Alaskans. The rate of loss of permits is not equally spread across communities in the watershed and is higher amongst communities who were not part of the Bristol Bay Economic Development Corporation (BBEDC) region, and therefore not eligible for BBEDC's permit loan program. The non-BBEDC watershed communities include those that are closest to the proposed project, including Iliamna, Nondalton, Pedro Bay, Port Alsworth, and Newhalen.

Although the Alaska Department of Environmental Conservation documents processing facilities in seven Bristol Bay communities, the center of processing in Bristol Bay is in Naknek. The harvest and processing of salmon in the Bristol Bay region provides millions in tax revenues to federal, state, and local governments. These taxes depend on the long-term value of the fishery, the attractiveness of the fishery to investors who build business around the fishery, and total employment in the fishery, including processing workers.

The proposed natural gas pipeline would originate from just north of Anchor Point, with potential to affect drift net commercial fisheries and saltwater recreational anglers near the proposed natural gas pipeline during construction. Although the Upper Cook Inlet Management Area primarily encompasses salmon fisheries, the ADF&G also manages small commercial herring, smelt, and razor clam fisheries within the area boundaries.

The proposed natural gas pipeline would pass through ADF&G drift gillnet statistical areas 244-63 and 244-70 before passing into the Lower Cook Inlet Management Area. The proposed natural gas pipeline would be located south of any set net fisheries contained in ADF&G statistical area 244-21. The proposed natural gas pipeline would cross waters within the 3 nautical miles of shore managed by the State for groundfish fisheries for Pacific cod, sablefish, rockfish, and walleye pollock. Much of this harvest takes place inside Kachemak Bay, south and east of the proposed natural gas pipeline. Limited fishing occurs near the proposed natural gas pipeline's western terminus.

The project footprint area hosts numerous freshwater fishing resources that anglers use primarily to target Chinook salmon, sockeye salmon, rainbow trout, and other salmonid species. These well-known fisheries resources support sport fishing lodges, fishing guides, and related services such as air taxis; and generate revenue for the State of Alaska and local municipal governments.

3.3.2 Expected Effects (Environmental Consequences) of Alternatives

3.3.2.1 Fish and Aquatic Habitat

Scoping comments expressed concern regarding potential impacts to fish populations, abundance, diversity, migratory patterns, contamination, and potential for displacement due to project components. Comments were received regarding the impacts of the mine access road crossing streams and anadromous waters, and the impacts of those stream crossings on fish. Concerns about the impacts to aquatic resources and introduction of invasive species were also expressed. Economic effects due to potential disruption of the commercial and recreational fisheries in the region were also noted.

NA No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Therefore, no additional future direct or indirect effects on fish and aquatic habitat would be expected. PLP would be able to apply for authority from the State to continue mineral exploration activities, and the many valid mining claims in the area would remain open to potential mineral entry and exploration by other entities. Existing trends related to fish and aquatic habitat would be expected to continue.

AA1 Action Alternative 1 and Variants

Potential direct and indirect impacts to fish and aquatic habitat and aquatic invertebrates for all proposed action alternative and variants include:

- Physical loss of stream, lake, estuarine, and marine habitat
- Blockage of stream channels preventing fish or other aquatic species passage
- Aquatic habitat effects due to instream flow reductions from mine water withdrawal or capture, and redirection of groundwater
- Sedimentation of aquatic habitat due to surface erosion of mine and port access roads, stockpiles, or other activities
- Erosion from vegetation removal; shoreline erosion associated with ship or ferry wakes; benthos disturbance/mortality from docks and pipelines
- Changes of freshwater and marine water quality such as temperature, turbidity, pH, dissolved oxygen, and metal or chemical contaminants
- Injury or mortality of fish or other aquatic species.

Permit compliance requirements, including standard and special terms and conditions, BMPs, and environmental monitoring would be established by regulatory agencies and landowners with permitting authority. These requirements would be implemented as part of construction management and facility operations to avoid, minimize, and mitigate risks to fish and aquatic habitat in the project area.

In terms of magnitude and extent, approximately 82 percent of the 10.7-square-mile mine site footprint would occur in the NFK River basin. Tributary 1.19 would be blocked to anadromous and resident fish by the bulk TSF sedimentation pond and dam immediately above the tributary's confluence with the NFK. This anadromous tributary and its sub tributaries provide spawning and rearing habitat for Chinook and coho salmon and resident fish species, including rainbow trout, Dolly Varden, and Arctic grayling. This direct loss of habitat would occur during project construction, and would be permanent, although a sub-tributary of Tributary 1.19 would remain free-flowing and may provide habitat for resident species.

The magnitude and extent of impacts, when compared to the total mileage of currently documented anadromous waters in the three tributaries associated with the mine site (i.e., the NFK, SFK, and the UTC), the loss of Tributary 1.19 habitat would represent 4 percent and 3 percent of spawning and rearing habitat for coho salmon, respectively; and 3 percent of Chinook salmon rearing habitat in these tributaries. In the context of the entire Bristol Bay drainage, with its 9,816 miles of currently documented anadromous waters, the loss of Tributary 1.19 represents an 0.08 percent reduction of documented anadromous stream habitat. This habitat would not be accessible to anadromous fish due to blockage by downstream dams, but may continue to provide spawning and rearing habitat for resident species. In terms of extent and duration, impacts to migrant and resident fish populations due to fill, excavation, inundation, and blockage would be local (in the immediate vicinity of the disturbance).

In terms of magnitude and extent, the open pit and related mine facilities are expected to directly and permanently impact approximately 2.0 miles of fish habitat in the upper main stem SFK and a headwater tributary. In terms of magnitude and duration, approximately 0.75 mile of low-density coho and sockeye salmon rearing habitat would be permanently removed within the mine site footprint upstream from Frying Pan Lake. The affected stream channels also provide habitat for populations of resident fish, including sculpin, Arctic grayling, and stickleback (Buell 1991). The extent of these impacts would be limited to waters in the footprint of the mine site.

The open mine pit and perimeter road are expected to extend to the western edge of the UTC drainage; the only mine site components that would occur in the UTC drainage are the transportation corridor road, the buried natural gas pipeline, and the eastern water treatment plant discharge pipe and facility. No aquatic habitat would be directly lost in the UTC due to mine construction, operations, or closure.

Bridge and culvert crossings would be required to be designed and installed in accordance with established Alaska Department of Transportation and Public Facilities and ADF&G standards to provide fish passage for all life stages resulting in minimal loss of aquatic habitat. In terms of duration and extent, riparian habitat within the footprint of bridge and stream crossings would be permanently removed or altered; however, effects to downstream stream functions would not be expected.

HDD and trenching from lay barges would be used to install the pipeline segments from the lakeshore into waters deep enough to avoid navigational hazards. The duration of impacts to nearshore benthic habitats would be short term, lasting during construction; but permanent impacts to benthic habitat beneath the footprint of the pipeline in deeper waters would occur. There would be a permanent, direct loss of benthic habitat beneath the pipeline footprint on the bottom of Cook Inlet. Habitat alteration would be limited over time, and would not have quantifiable effects to populations of fish and shellfish.

Fish displacement, injury, and mortality of fish would occur during project construction in the NFK and SFK. Direct mortality of fish would be most likely in streams removed during mine site construction. Timing of construction in anadromous fish streams would greatly determine the magnitude of fish mortality. ADF&G Fish Habitat Permit stipulations would be designed to minimize impacts to fish life stages, including eggs, juveniles, and adults. Fish capture and relocation would be implemented according to ADF&G Aquatic Resource Permit (if issued) requirements to reduce impacts to resident fish. Stipulations contained in the Aquatic Resource Permit would determine timing, capture methods, and relocation protocols. In terms of the magnitude of impacts, regardless of the scope of the capture and relocation effort, some fish would be displaced and experience injury or mortality. The extent or scope of these impacts would be limited to waters near the mine site footprint, and may not be measurable or detectable downstream from the affected stream channel.

The magnitude and extent of effects could include direct and localized mortality of fish from construction activities at stream crossings and the ferry terminals. Temporary water diversions or dewatering of stream reaches during construction could result in direct mortality due to fish stranding and desiccation. Fish entrainment or impingement at screens during pumping could result in direct mortality or injury. Fish passage may be temporarily impeded during construction; and fish disturbance is likely, and would be temporary in duration, returning to normal after construction is completed.

Timing and capture/relocation would be conducted according to established ADF&G practices and permit conditions to reduce impacts. Water pump intake screens used for dewatering and water withdrawal would be designed, constructed, and certified according to ADF&G standards to prevent fish impingement to reduce impacts. Permit stipulations could include seasonal restrictions on instream activities to reduce or avoid impacts during species sensitive life stages (e.g., spawning and egg development periods).

Operation of the mine site is expected to result in an overall net reduction in available water for release into downstream channels. Reductions of instream flows in the main stem and select tributary reaches of the NFK, SFK, and the UTC, due to filling of stream channels by the TSF or other stockpiles; excavation of channels and capture of groundwater at the mine pit, or the retention of surface runoff from mine facilities would result in direct and long-term impacts to aquatic habitat and fish species.

In terms of magnitude and extent, reduction in streamflows could directly impact the quantity and quality of instream habitat for upstream migration of adult salmonids, spawning and egg incubation, and rearing habitat for juvenile fish. Reductions in flows could also directly impact available habitat for benthic macroinvertebrate production, which is critical for fish growth and survival. The magnitude and extent of impact would vary among the three principal tributaries, according to the degree of surface water and groundwater capture, the location of impacts in the basin, the proximity and size of downstream tributaries, and the level of flow augmentation at the water release facilities.

Throughout the mine site area in average precipitation years, Chinook and coho spawning habitat would be reduced; while chum, sockeye, rainbow, Dolly Varden, and Arctic grayling spawning habitat generally would be increased (Table ES-1). In wet years, the decreases in habitat would be lower, and the increases greater; in dry years, the habitat decreases would be greater, and the increases would be lower. In terms of magnitude and duration, post-closure, flow reductions would be lower than during mining, resulting in smaller reductions and increases in habitat.

All work in fish-bearing streams would be subject to design considerations, restoration requirements, and timing windows, as specified by ADF&G Title 16 Fish Habitat Permits (AS 16.05.841-871). In accordance with ADF&G criteria, bridge and culvert construction activities in anadromous waters would occur from May 15 to June 15, to avoid impacts to migrating salmon. Infrequent barriers to fish passage could occur at stream crossings using culverts due to temporary blockage. The extent and duration of impact is expected to be limited to the immediate vicinity of the culvert and temporary, because barriers would be removed. Routine inspection and maintenance of culverts, bridges, and roads would be regularly conducted in compliance with ROW and ADF&G permit conditions, to ensure that culvert-related erosion, wash-out, or debris blockage would not result in permanent impacts to fish passage or downstream habitat. More stringent monitoring and maintenance standards may be required by ROW lease stipulations from respective landowners.

AA2 Action Alternative 2 and Variants

Potential impacts from construction and operations of the mine site would be the same as those described for Action Alternative 1. The Action Alternative 2 transportation and natural gas pipeline corridor has a larger geographic extent and increases the number of anadromous fish stream crossings from 16 to 24 compared to Action Alternative 1. The increased number of crossings would result in a higher magnitude loss of anadromous stream habitat compared to Action Alternative 1. Resident fish stream crossings compared to Action Alternative 1 would remain the same. The duration and likelihood of impacts would be the same as Action Alternative 1. Diamond Point port would have a greater spatial and temporal direct impact on marine fisheries and benthic invertebrates than Action Alternative 1 since the footprint of these structures would cover roughly 58 more acres of benthic habitat than the Amakdedori port. Maintenance dredging is anticipated to be ongoing during operations on a 5-year recurrence interval. This would result in a reoccurring impact to 58 acres of benthic habitat for the life of the project, compared to Action Alternative 1. Potential impacts from the natural gas pipeline crossing Cook Inlet would be similar to those described for Action Alternative 1 except the proposed route under Action Alternative 2 avoids 6.8 acres of direct impacts to Weathervane Scallop essential fish habitat. Ferry operations from Eagle Bay to Pile Bay under the Summer-Only Operations Variant would have similar magnitude, extent, duration, and likelihood of impacts to fish and fish habitat as ferry operations described under Action Alternative 1. The Pile-Supported Dock Variant would result in less direct impact to benthic habitat and organisms than a fill causeway, because piles would be driven through vibratory and hammer methods, and require no fill. Noise impacts from pile installation during construction could cause injury or mortality to fish and benthic organisms.

Species	Habitat Available			Change in Available Habitat			
	Pre-Mine	During Operations	Post Closure	During Operations		Post Closure	
	(acres)	*(acres)*	*(acres)*	*(acres)*	*(% diff)*	*(acres)*	*(% diff)*
Chinook	82.54	79.51	81.14	-3.02	-3.7%	-1.40	-1.7%
Coho	105.56	102.87	104.21	-2.69	-2.6%	-1.34	-1.3%
Chum	180.10	181.07	180.84	0.97	0.5%	0.74	0.4%
Sockeye	133.00	133.73	133.65	0.73	0.5%	0.65	0.5%
Rainbow	98.46	101.40	100.01	2.94	3.0%	1.55	1.6%
Dolly Varden	203.58	204.02	203.90	0.44	0.2%	0.32	0.2%
Arctic Grayling	132.24	135.59	133.10	3.34	2.5%	0.86	0.7%

Table ES-1: Average Precipitation Year Spawning Habitat for All Streams and Species in the Mine Site Area Pre-mine, During Operations, and Post-closure (All Alternatives)

AA3

Action Alternative 3 and Variant

Potential impacts from construction and operations of the mine site would be the same as those described for Action Alternative 1. Although Action Alternative 3 would increase the transportation corridor geographic extent compared to Action Alternatives 1 and 2, fisheries impacts associated with the ferry crossing of Iliamna Lake under Action Alternatives 1 and 2 would be eliminated. The Action Alternative 3 transportation corridor would increase the anadromous stream crossings from 16 to 31 compared to the Action Alternative 1 transportation corridor and reduce the resident stream crossings by four. The magnitude, extent, duration, and likelihood of impacts to fish along the natural gas pipeline corridor and the Diamond Point port would be the same as those described under Action Alternative 2. The concentrate pipeline variant from the mine to the port under Action Alternative 3 would require an electric pump station at the mine site, which would require a small increase in fill placement over stream substrate in an NFK east tributary. This variant would reduce the amount water treatment plant water released at discharge locations at the mine site by approximately 1 to 2 percent, which could result in slight reductions of temperature effects, aquatic habitat availability, and turbidity or erosional effects at treated water discharge locations compared to Action Alternative 1.

CE

Cumulative Effects

The cumulative effects analysis area for fish and aquatic habitats includes the project footprint for each alternative and the extended geographic area where direct and indirect effects to fish and habitat can be expected from project construction and operations. Past and present actions that have, or are currently, affecting fish and habitat in the EIS analysis area include infrastructure development, marine transport, gas and mineral exploration, residential activities, and sport, subsistence, and commercial fishing. Most of the EIS analysis area is undisturbed by human activity, with only a few small villages and roads. There are currently no major development projects under way. With the exception of commercial and recreational fishing, these activities have, and are having, minimal impacts on fish and fish habitat. Although there have been strong returns of sockeye in recent years to Bristol Bay, variability of the returns of specific salmon species to individual drainages is common.

The effects of the Pebble mine expanded development scenario on fish and fish habitat would result from expansion of the mine site, and depending on the alternative and variant, build additional road transportation corridors, cease ferry operations, and develop a new deep-water port facility with connected concentrate and diesel pipelines. This would result in some additional direct habitat loss or modification in the upper NFK and SFK watersheds and along new road transportation and pipeline corridors. It would also have the potential to contribute to adverse effects on aquatic resources by altering flow regimes and drainage patterns; diminishing water quality from riverbank erosion, turbidity, and sedimentation; changes in water chemistry; fish displacement and injury; and degrading the extent of productive habitat conditions. Because mine expansion under Action Alternative 1 would result in the construction and operations of ports and associated transportation corridors at both Amakdedori and Diamond Point, there would be a greater amount of acreage and stream crossings affected compared to Action Alternatives 2 and 3. However, population-level effects on fish and fish habitat are not projected, given the limited abundance of fish and productivity of habitat affected by expansion of the mine site, and permit requirements for anadromous stream crossings by roads and pipelines. Continued and future mineral exploration activities could have some limited aquatic resource impacts, primarily water quality, in watersheds common to the project (e.g., drill pads, camps); however, they would be seasonally sporadic, temporary, and localized, based on remoteness. Activities associated with additional oil and gas exploration and ship traffic in Cook Inlet would result in temporary disturbance to aquatic resources, and there could be some direct loss of habitat associated with development of new ports and placement of drill rigs, although they would be dispersed geographically. There could be the potential for some site-specific impacts to fish and fish habitat associated with community facility and infrastructure development, but these would be mitigated by permit requirements for anadromous stream crossings.

3.3.2.2 Commercial and Recreational Fisheries

NA

No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur at the mine site, port site, transportation corridor, or the natural gas pipeline corridor. Although no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project or with other entities exploring exiting mining claims, may continue. The value of the fishery earned by permit holders and wages paid to crew members would continue to be affected by the broader drivers of the value of the Bristol Bay salmon fishery. Recreational fishing would continue under current conditions and trends. There would be no effect on the processing sector.

AAV Action Alternatives and Variants

Project construction and operations of the proposed alternatives and variants could have an impact on both the commercial fishing community from crew members to the processing sector; on the recreational sector via recreational fishing; and on revenue generated to state and local government. Potential impacts are influenced by project-related effects on fish populations, habitat, and runs, as well as on real and perceived effects on the quality of the fish, environment, and fishing experience.

Crew members, permit holders, processors, and local municipalities are all dependent on the total value of the Bristol Bay fishery, which is a function of market price and harvested volume. In terms of the magnitude of the impact, when permit holders harvest fewer fish, the net result is that permit holders receive less net income, crew members are paid less, processors have less product to sell, and municipalities have less economic activity to tax. The ADF&G manages for the long-term health of the fishery by ensuring that a minimum, but preferably optimal, number of spawners reach their home rivers. It largely manages the number of returning spawners by adjusting commercial and recreational fishing harvest via effort. The ADF&G restricts effort when the strength of the returning run requires less harvest to meet the escapement goals, and liberalizes harvest opportunity when run strength threatens to exceed optimal escapement maximums goals.

Commercial Fishing

The commercial fishing sector is concerned that the existence of the project could lower the perceived quality of Bristol Bay salmon, and therefore lower price. Prices paid in Bristol Bay are nearly always lower than those paid in other Alaska salmon fisheries producing similar products, which reflects the higher transportation expense associated with Bristol Bay's geographic location. Other salmon fisheries in Alaska exist in conjunction with non-renewable resource extraction industries. For example, the Cook Inlet salmon fisheries exist in an active oil and gas basin and have developed headwaters of Anchorage and the Matanuska-Susitna areas. The Copper River salmon fishery exists in the remains of the historic Kennecott Copper Mine and the Trans Alaska Pipeline System in the headwaters of portions of the fishery. Both fisheries average higher prices per pound than the Bristol Bay Salmon Fishery.

The Amakdedori port site is located in the Chenik sub-district of the Kamishak Bay District. Commercial fishermen may have to change fishing patterns or could experience losses if port operations affected salmon returns. The Diamond Point port site is located near a chum fishery that does not experience harvest every year.

The natural gas pipeline would follow the transportation corridor and would not directly interact with the Bristol Bay salmon fishery. The pipeline would cross waters fished by the Cook Inlet salmon fishery and Cook Inlet groundfish fisheries. It would not directly interact with the salmon fishery, given that the salmon fishery occurs in the top 30 feet of the water column. In terms of magnitude and extent of

impacts, groundfish commercial fishermen may need to adjust their gear placement to avoid the natural gas pipeline, but they would have flexibility to do so.

Any reduction in harvest by permit holders is immediately transmitted to the processing sector as fewer fish to be processed and sold into the world sockeye market. The lost harvest results in lower total wholesale value for processors. The magnitude of the financial loss depends on the size of the harvest reduction and individual choices by processor around how to adjust their product mix. Processors make these decisions based on run size, their individual capabilities, and the needs of the world market, which means that any long-term loss in harvest would express itself differently each year based on the aforementioned factors. Based on estimates, and the historical relationship between ex-vessel values and wholesale values, there would be no measurable change to wholesale values or processor operations expected. Action Alternative 1 and variants would not reduce returning adult salmon to the Kvichak and Nushagak river systems as a result of project operations. Therefore, Action Alternative 1 and variants would not be expected to result in a long-term change in the health of the commercial fisheries in Bristol Bay or Cook Inlet.

Recreational Fishing

In terms of extent, mine facilities would directly impact portions of the tributaries of the NFK and SFK watersheds, while support and transportation infrastructure would affect the UTC watershed, the Gibraltar River, and Iliamna Lake. These watersheds account for a small portion of overall recreational fishing effort in SWHS areas S, T, and N. The ADF&G SWHS estimates and Guide Logbook Program data indicate that total fishing effort on the Koktuli River and UTC is less than 100 angling days per year each; while total effort in SWHS areas S and T is estimated at over 40,000 days per year. The two most important fisheries that would interact with Action Alternative 1 are Iliamna Lake and the Gibraltar River. Iliamna Lake and unnamed tributaries host roughly 1,900 to 2,200 angling days per year. In terms of magnitude, this effort is dispersed across the lake and numerous unidentified tributaries without enough SWHS survey responses to allow for individual effort estimates.

Under normal operations, the ferry across the lake would not be expected to limit or affect the quality of these fishing days. The Gibraltar River (approximately 650 angling days per year) primarily hosts fly-in wade and float anglers. The river is currently roadless, and the transportation corridor would create a new road and crossing along the river. The presence of the road and bridge crossing would change the fishing experience on the river, particularly for float anglers who would have to pass the bridge to float the length of the river. Construction activities would be disruptive, but short term; and the road and bridge would be in place through project operations and post-closure until they are no longer needed.

In terms of magnitude and duration, the change in fishing experience could be perceived as a permanent adverse impact for those anglers expecting a wilderness experience. These impacts would not exist under the Kokhanok East Ferry Terminal Variant or other alternatives, which avoid crossing the Gibraltar River.

The waterbodies affected by Action Alternative 1 have fewer total recreational angling days than the waterbodies affected by Action Alternatives 2 or 3. However, the main angling waterbodies affected by Action Alternatives 2 and 3 (the Newhalen, Pile, and Iliamna rivers) already have some minimal road access from local communities. Action Alternative 1 differs from Action Alternatives 2 and 3 in its establishment of new road affecting a waterbody without current road access, and more than 500 recreational fishing days per year; Action Alternatives 2 and 3 would not affect a river with these qualities.

With respect to the magnitude and extent of impacts in Cook Inlet, Action Alternative 2 would avoid the potential effects on the Chenik sub-district salmon fishery, the Kamishak Bay Pacific herring fishery, and the Kamishak Bay Weathervane scallop fishery. However, the presence of the Diamond port location has the potential to interfere with an intermittent chum salmon fishery located around Cottonwood Creek. Long-term adverse impacts to the angling experience would be likely to occur, and the duration would last through closure until the road is no longer used.

CE Cumulative Effects

The cumulative effects analysis area for commercial and recreational fisheries encompasses the EIS analysis area. Past and present actions that have, or are currently, affecting fisheries within the EIS analysis area include mining exploration and non-mining-related projects, such as transportation, oil and gas development, or community development actions. These actions have resulted in a loss of some fish habitat, and aircraft activity associated with mining exploration can degrade the quality of a remote recreational fishing experience.

The Pebble mine expanded development scenario would increase the geographic area affected and duration of effects of the project by combining project elements of Action Alternatives 1 and 3 under Action Alternative 1. For Action Alternatives 2 and 3 mine expansion, the Amakdedori port and transportation corridor would not be developed. A new deep-water port and condensate and diesel pipelines would be constructed. Fisheries could be impacted by direct loss of habitat, fish displacement and injury, habitat degradation, and changes in the natural flow regime. The construction of the south waste rock facility collection pond would affect the SFK and UTC watersheds, affecting sockeye, coho, chum, and possibly Chinook salmon. Any impacts that result in a reduction in the number of returning adult spawners would affect commercial fisheries. Commercial fishing impacts related to expansion of the mine site are limited to the Bristol Bay commercial fishery. However, the construction and operation of a deep-water port in Iniskin Bay would affect the chum and pink salmon fishery in that area, and could affect the recovery of the Pacific herring fishery.

Cumulative effects on recreational fishing would mirror those for commercial fishing, because recreational target species include salmon or species that are dependent on salmon. The desirability and viability of SFK and UTC as recreational fishing locations would follow changes in salmon and salmonid populations.

3.4 Wetlands and Other Waters

The affected environment for wetlands and other waters includes vegetated wetlands, ponds, lakes, streams, rivers, and marine and estuarine waters that may be directly or indirectly affected by all project alternatives and components. The EIS analysis area for the mine site includes a 330-foot buffer around the direct disturbance footprint to capture dust impacts and the potential drawdown zone from the open pit. The EIS analysis area for the transportation corridor and ports includes a 330-foot buffer around the direct disturbance footprint. The EIS analysis area for the stand-alone sections of the natural gas pipeline is a 30-foot corridor through Cook Inlet and Iliamna Lake, and a 100-foot corridor through overland areas.

3.4.1 Existing Conditions (Affected Environment) Summary

AA1 Action Alternative 1

Jurisdictional wetlands and other special aquatic sites are regulated by the USACE under Section 404 of the CWA (33 United States Code [USC] 1344). PLP submitted to the USACE for review a Preliminary Jurisdictional Determination report for part of the project area, identifying wetlands and other waters under the USACE's regulatory jurisdiction, which the USACE has verified.

The EIS analysis area for wetlands includes the area affected by potential direct and indirect impacts from construction and operations. The EIS analysis area collectively includes areas for all four components (mine site, transportation corridor, ports, and natural gas pipeline) and the variants under each component in each alternative.

Mine Site – The analysis area for the mine site includes the direct disturbance footprint; areas of indirect disturbance due to habitat fragmentation; a 330-foot zone around the direct disturbance footprint to account for fugitive dust impacts; and the zone of influence to account for impacts from dewatering.

Transportation Corridor and Ports – The analysis area for the transportation corridor and ports includes a 330-foot zone around the direct disturbance footprint.

Natural Gas Pipeline – The analysis area for the stand-alone sections of the natural gas pipeline is a 30-foot corridor through Cook Inlet and Iliamna Lake, and a 100-foot corridor through overland areas.

Existing Conditions

Over half (59 percent) of the mine site analysis area is composed of uplands, and the remaining (41 percent) is composed of wetlands and other waters. Wetlands represent 39 percent of the analysis area. The dominant National Wetlands Inventory (NWI) wetland type is Palustrine broad-leaved deciduous scrub-shrub (PSS1) (30 percent). Shrub wetlands also occur along the north and south forks of the Koktuli River and their floodplains, as well as several smaller streams. Although dominated by a deciduous shrub layer (willows, birches (*Betula spp.*), blueberries), they can also include small evergreen shrubs, with or without herbaceous wetland species. Bogs and fens co-dominated by ericaceous shrubs occur on slopes and organic flats. Based on project vegetation mapping, these shrub wetlands comprise approximately 5 percent of the analysis area.

Herbaceous wetlands (PEM1) make up approximately 9 percent of the mine site analysis area. These occur in seasonally to semi-permanently flooded depressions and shorelines, and on wetter positions of slopes and flats. Some 30 species of wetland sedges were observed in the mine site area, and provide the dominant cover.

Aquatic bed wetlands occurred in depressions and ponded areas of slopes, accounting for less than 0.1 percent of the mine site analysis area. Forested wetlands are absent at the mine site. Waterbodies make up 2 percent of the mine site analysis area. Waterbodies include both perennial and intermittent stream channels, lakes, and ponds. Most streams at the mine site are perennial. Lakes and ponds combined make up 1 percent of the mine site analysis area.

Uplands dominate the transportation corridor analysis area (87 percent), and the remaining (13 percent) is composed of wetlands and other waters. Wetlands comprise 10 percent of the waters in the transportation corridor analysis area. The dominant NWI wetland type is broad-leaved deciduous shrub (PSS1) (7 percent). Herbaceous wetlands (PEM1) comprise 2 percent of the transportation corridor analysis area. Some 30 species of wetland sedges were observed in the area and provide the dominant cover. Forested wetlands and aquatic bed wetlands each accounted for less than 0.1 percent of the analysis area. Other waters account for approximately 3 percent of the transportation corridor analysis area.

The Amakdedori port analysis area is located on the shore of Kamishak Bay, Cook Inlet, near Amakdedori Creek. Uplands account for over half (66 percent) of the Amakdedori port analysis area, with the remaining area (34 percent) composed of wetlands and other waters. Wetlands comprise 3 percent of the waters in the Amakdedori port analysis area. NWI wetland types include herbaceous (PEM1) (1 percent) and broad-leaved deciduous shrub (PSS1) (2 percent). Both types occur almost exclusively on slopes. Waterbodies comprise 34 percent of the wetlands and other waters in the EIS analysis area. Most of the area (23 percent) is marine subtidal waters (M1). Marine intertidal waters (M2) comprise 5 percent of the area. Most of these intertidal waters have cobble or gravel substrates that are exposed at low tide. Lower perennial streams (R2) comprise approximately 3 percent of the Amakdedori port analysis area. Lakes or ponds are not present in the Amakdedori port analysis area.

Wetlands and other waters dominate the natural gas pipeline analysis area (90 percent), and the remaining 10 percent of the area is composed of uplands. Wetlands account for 1 percent of the waters in the natural gas pipeline analysis area. NWI wetland types include deciduous shrubs (PSS1), evergreen shrubs (PSS3) and herbaceous (PEM) occurring in depressions and on slopes. Waterbodies comprise 91 percent of the waters in the analysis area. Most of the natural gas pipeline analysis area (80 percent) is marine subtidal waters (M1) in Cook Inlet, with marine intertidal waters (M2) accounting for less than 1 percent. The natural gas pipeline corridor area occurs predominantly in subtidal waters with an unconsolidated cobble-gravel bottom (M1UBL).

Iliamna Lake accounts for 11 percent of the waters in the natural gas pipeline analysis area. This is almost entirely deep-water habitat with an unconsolidated bottom (L1UBH). The natural gas pipeline corridor across the lake is approximately 18 miles long.

AA2 Action Alternative 2 – North Road and Ferry with Downstream Dams

Wetlands and other waters comprise 32 percent of the Action Alternative 2 analysis area. The transportation corridor analysis area is characterized by uplands (84 percent). Approximately 16 percent of the transportation corridor analysis area is wetlands and other waters. Wetlands comprise 11 percent of the transportation corridor analysis area. The dominant NWI wetland type is broad-leaved deciduous shrub (PSS1) (7 percent). Evergreen shrub wetlands (PSS4) account for less than 1 percent of the analysis area. Herbaceous wetlands (PEM1) comprise 2 percent of the analysis area. Deciduous forested wetlands (PFO1) comprise 1 percent of the analysis area. Aquatic bed wetlands account for less than 0.1 percent of the transportation corridor analysis area. Waterbodies account for 5 percent of the transportation corridor analysis area. Lakes and ponds combined account for approximately 1 percent of the transportation corridor analysis area.

The Diamond Point port analysis area is the same for Action Alternatives 2 and 3. Approximately 65 percent of the analysis area is wetlands and other waters. Wetlands account for 1 percent of the Diamond

Point analysis area. The dominant NWI wetland type is broad-leaved deciduous shrub wetlands (PSS1) (1 percent). Evergreen shrub wetlands (PSS3) and herbaceous wetlands (PEM1) each account for less than 1 percent of the Diamond Point analysis area. Coastal habitats in the Action Alternative 2 Diamond Point port analysis area include sand and pebble substrates interspersed by rocky reefs and mudflats.

Approximately 22 percent of the natural gas pipeline analysis area is wetlands and other waters. Wetlands comprise 3 percent of the natural gas pipeline analysis area. The dominant NWI wetland type is broad-leaved deciduous shrub (PSS1) (2 percent). Herbaceous wetlands (PEM1) account for 1 percent of the analysis area. These occur predominantly on slopes with both mineral and organic soils. Deciduous forested wetlands accounted for less than 1 percent of the natural gas pipeline analysis area.

AA3 Action Alternative 3 – North Road Only

Wetlands and other waters comprise 30 percent of the Action Alternative 3 analysis area, 25 percent wetlands and 5 percent other waters.

Uplands are common in the Action Alternative 3 transportation corridor analysis area, comprising 87 percent of the area. Approximately 13 percent of the Action Alternative 3 transportation corridor analysis area are wetlands or other waters. Wetlands comprise 9 percent of the Action Alternative 3 transportation corridor analysis area. The dominant NWI wetland type is broad-leaved deciduous shrub wetlands (PSS1) (6 percent), occurring predominantly on slopes, but also in river valleys and on flats.

Approximately 56 percent of the Action Alternative 3 natural gas pipeline corridor analysis area is wetlands or other waters. Wetlands comprise 1 percent of the Action Alternative 3 natural gas pipeline corridor analysis area. The dominant NWI wetland type is broad- leaved deciduous shrub wetlands (PSS1). Evergreen shrub wetlands (PSS3) and herbaceous wetlands (PEM1) each account for less than 1 percent of the Action Alternative 3 natural gas pipeline corridor analysis area. Other waters make up another 54 percent, almost all of which are marine or estuarine waters.

The Diamond Point port analysis area is the same for Action Alternatives 2 and 3. Approximately 62 percent of the analysis area is wetlands and other waters. Wetlands comprise 1 percent of the analysis area. The dominant NWI wetland type is broad-leaved deciduous shrub wetlands (PSS1) (1 percent). Evergreen shrub wetlands (PSS3) and herbaceous wetlands (PEM1) each account for less than 1 percent of the analysis area.

Estuarine waters are mapped in Cottonwood Bay. These include intertidal (8 percent) and subtidal (1 percent) waters. Marine subtidal waters (51 percent) account for almost all the Cook Inlet crossing. Marine intertidal is less than 1 percent. Ponds and perennial streams each account for less than 1 percent of the analysis area.

3.4.2 Expected Effects (Environmental Consequences) of Alternatives

Scoping comments were received on filling of wetlands and alternations of wetlands habitat, fragmentation, and loss of wetland habitat as a result of project activities. It was requested that all wetlands that could be affected by the project be identified, and all impacts of dewatering and loss of wetlands be addressed.

Impacts to wetlands and other waters are assessed here from a NEPA perspective, which may differ from how they are treated under the 404(b)(1) guidelines. The magnitude of impacts to wetlands and other waters was assessed relative to their perceived importance and extent within a watershed. Impacts to high-value wetlands, such as riverine wetlands, were deemed to be of greater magnitude, even when a relatively small proportion (i.e., greater than 5 percent) of these wetlands would be disturbed within a particular watershed. To assess the relative magnitude and extent of impacts within an ecological context, project impacts were compared to the relative proportion of common wetland types in each watershed. USGS Hydrologic Unit Code Tenth Level (HUC 10) watersheds were used for this purpose. The extent of impacts would be limited to areas of the project area where wetlands or waterbodies would be removed or disturbed, or would affect wetlands outside of the project area in one or more HUC 10 watersheds.

NA No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Therefore, no additional future direct or indirect effects on recreation would be expected. Though no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue. Current state-authorized activities associated with mineral exploration and reclamation and scientific studies would be expected to continue at similar levels. PLP would be required to reclaim any remaining sites at the conclusion of their exploration program. If reclamation approval is not granted immediately after the cessation of reclamation activities, the State may require continued authorization for ongoing monitoring and reclamation work as deemed necessary by the State of Alaska. While these activities would also cause some disturbance, reclamation would benefit the wetlands and other waters.

Impact-Causing Project Component	Action Alternative 1 and Variants	Action Alternative 2 and Variants	Action Alternative 3 and Variant
Total Direct Permanent Wetlands and Other Waters Impacts (excavation, fill, vegetation clearing)	3,560 acres	3,715 acres	3,645 acres
Total Direct Temporary Wetlands and Other Waters Impacts (construction access)	510 acres	399 acres	404 acres
Total Potential Indirect Wetlands and Other Waters Impacts (dust/dewatering)[1]	1,896 acres/ 449 acres	1,987 acres/ 449 acres	2,097 acres/ 449 acres

[1] *There is some overlap at the mine site between wetlands and other waters potentially impacted by dust and those impacted by dewatering.*

Impact-Causing Project Component	Action Alternative 1 and Variants	Action Alternative 2 and Variants	Action Alternative 3 and Variant
Mine Site:			
Direct Impacts to Wetlands and Other Waters	Permanent loss of 3,458 acres of wetlands and other waters and 73.2 miles of streams. Summer-Only Operations Variant: permanent loss of 3,465 acres of wetlands and water-bodies and 73.2 miles of streams.	Permanent loss of 3,518 acres of wetlands and other waters and 73.2 miles of streams. Summer-Only Operations Variant: permanent loss of 3,525 acres of wetlands and water-bodies and 73.2 miles of streams.	Same as Action Alternative 1.
Fugitive Dust	Impacts to 957 acres adjacent to the mine site throughout the life of the mine.	Same as Alternative 1.	Same as Action Alternative 1.
Dewatering	Impacts to 448 acres adjacent to the mine site throughout the life of the mine.	Same as Alternative 1.	Same as Action Alternative 1.
Transportation Corridor:			
Direct Impacts to Wetlands and Other Waters	Permanent loss of 86 acres of wetlands and other waters and 7.9 miles of streams. Temporary impacts to 60 acres of wetlands and other waters. Kokhanok East Ferry Terminal Variant: permanent loss of 134 acres of wetlands and other waters.	Permanent loss of 101 acres of wetlands and other waters and 3.7 miles of streams. Temporary impacts to 64 acres of wetlands and other waters. Summer-Only Operations Variant: permanent loss of 110 acres of wetlands and other waters and 3.7 miles of streams.	Permanent loss of 108 acres of wetlands and other waters and 6 miles of streams. Temporary impacts to 68 acres of wetlands and other waters.
Fugitive Dust	Impacts to 892 acres adjacent to the transportation corridor throughout the life of the mine.	Impacts to 883 acres adjacent to the transportation corridor throughout the life of the mine.	Impacts to 1,051 acres adjacent to the transportation corridor throughout the life of the mine.

Table ES-2: Summary of Key Issues for Wetlands and Other Waters

Impact-Causing Project Comp.	Action Alternative 1 and Variants	Action Alternative 2 and Variants	Action Alternative 3 and Variant
Port			
Direct Impacts to Wetlands and Other Waters	Permanent loss of 11 acres of marine waters. Temporary impacts to 4 acres of marine waters. Summer-Only Operations Variant: no additional impacts. Pile-Supported Dock Variant: permanent loss of 1 acre of marine waters.	Permanent loss of 71 acres of estuarine waters. <0.1 miles of streams. Temporary impacts to 15 acres of wetlands and other waters. Pile-Supported Dock Variant: permanent loss of 60 acres of estuarine waters and <0.1 miles of streams.	Same as Action Alternative 2 (but with no Pile-Supported Dock Variant).
Fugitive Dust	Impacts to 3 acres of wetlands and 42 acres of marine waters adjacent to the port mainly during construction. Summer-Only Operations Variant: impacts to 6 acres of wetlands, 5 acres of streams, and 42 acres of marine waters adjacent to the port mainly during construction.	Impacts to 1 acre of streams and 71 acres of estuarine waters. Summer-Only Operations Variant: No additional impacts to wetlands or other waters.	Same as Action Alternative 2.
Natural Gas Pipeline:			
Direct Impacts to Wetlands and Other Waters	Permanent loss of 5 acres of wetlands and other waters Temporary impacts to 446 acres in Cook Inlet and Iliamna Lake. Kokhanok East Ferry Terminal Variant: permanent loss of 16 acres of wetlands and other waters and <0.1 miles of streams.	Permanent loss of 25 acres of wetlands and other waters and 2.8 miles of streams. Temporary impacts to 324 acres of wetlands and other waters.	Permanent loss of 8 acres of wetlands and other waters and 0.1 miles of streams. Temporary impacts to 321 acres of wetlands and other waters.
Fugitive Dust	Onshore section of pipeline is mostly associated with transportation corridor, so few pipeline-only dust impacts.	Impacts to 74 acres of wet-lands and other waters from construction access and material sites mainly during construction.	Impacts to 16 acres of wetlands and other waters from material sites mainly during construction.

Table ES-2: Summary of Key Issues for Wetlands and Other Waters *(continued)*

AA1 Action Alternative 1 and Variants

In terms of magnitude and extent of impacts, Action Alternative 1 would permanently discharge dredged or fill material into 3,560 acres of wetlands and other waters and temporarily discharge dredged or fill material into 510 acres of wetlands and other waters (Table ES-2). An additional 1,896 acres of wetlands and other waters would be indirectly impacted by fugitive dust, and 449 acres of wetlands and other waters would be indirectly impacted by dewatering from the mine pit. The discharge would permanently impact 3,443 acres of wetlands, 55 acres of lakes and ponds, 50 acres of streams in 81 miles of channels, and 11 acres of marine waters. The discharge would temporarily impact 510 acres of wetlands and other waters. In terms of extent of impacts, NWUS permanently affected by Action Alternative 1 include Iliamna Lake and Cook Inlet. Action Alternative 1 includes a port with a causeway and wharf, which combined is 1,900 feet long by a maximum of 500 feet wide, below the high tide line of Cook Inlet. The project would also include two lighted navigation buoys, and two 1,700-foot by 2,300-foot mooring spreads in approximately 80 feet of water, each consisting of 10 anchors and six mooring buoys. A total of approximately 13 acres of navigable waters would be permanently filled for the port and ferry terminals. Although permanent, these impacts are not substantial, given the total area of navigable waters available, especially in Cook Inlet.

Mine Site

The magnitude and extent of effects at the mine site would be a direct and permanent impact on 3,458 acres of wetlands and other waters during construction and operations. During closure, wetlands and other waters would be reestablished wherever practicable. Also in terms of extent, direct and indirect effects would occur in two HUC 10 watersheds. The majority of impacts (3,450 acres) would be in the Headwaters Koktuli River watershed. Most impacts would be to regionally common shrub and herbaceous wetland types. No forested wetlands and less than 0.1 acre of aquatic bed wetlands would be impacted. Approximately 236 acres of riverine wetlands would be directly impacted by the mine site. This represents roughly 7 percent of the riverine wetlands within the watershed. A total of 94 acres of other waters would be directly impacted, including ponds (47 acres), perennial streams (44 acres), and intermittent streams (3 acres). A total of 69.4 miles of perennial stream channel and 3.8 miles of intermittent stream channel would be directly impacted.

The combined direct impacts to wetlands and other waters at the mine site represent the highest magnitude of impacts. The duration of impacts would be considered permanent, because they would last through the end of mining operations. The extent of direct impacts is the mine site disturbance footprint, which is primarily in the Headwaters Koktuli River watershed, but also includes a smaller portion of the UTC watershed.

In terms of magnitude and duration, at the end of operations, approximately 154 acres of wetlands and other waters would be impacted by the groundwater drawdown (wetland hydrology would be lost), including 55 acres of shrub wetlands, 34 acres of herbaceous wetlands, and 65 acres of lakes and ponds. Another 294 acres would be moderately impacted, (hydrology would be altered, but wetland functions would not be eliminated). This includes 187 acres of shrub wetlands, 65 acres of herbaceous wetlands, 41 acres of ponds, and 2 acres of streams.

The duration of all dewatering impacts would be permanent, because they would last at least until the post-closure phase. According to the model, approximately 48 acres of the highly impacted wetlands would be expected to recover wetland hydrology at the post-closure phase. The remaining 106 acres of highly impacted wetlands are not expected to recover. Approximately 121 acres of the moderately impacted wetlands would be expected to recover, leaving 173 acres of wetlands that would remain moderately impacted, so that the hydrology would be changed, but wetland functions would remain.

The Summer-Only Ferry Operations Variant would add to the mine site direct footprint for a container yard and sewage storage tank. The magnitude, extent, and duration of the increased footprint would result in an additional 6 acres of deciduous shrub wetlands and 1 acre of herbaceous wetlands would be directly and permanently impacted.

Digital Simulation of Amakdedori Port

Transportation Corridor

The magnitude and extent of impacts from construction of the transportation corridor from Amakdedori port to the mine site would be to directly and permanently affect 86 acres of wetlands and other waters, including 75 acres of wetlands and 11 acres of other waters. The port access road between the port and the south ferry terminal at Iliamna Lake would affect 41 acres of wetlands and other waters. The mine access road from the north ferry terminal to the mine site would affect 38 acres of wetlands and other waters. The remaining impacts would be from the Iliamna and Kokhanok spur roads (3 acres), material sites (3 acres), and ferry landings (1 acre).

Impacts would be noticeable and permanent in duration because the road would remain to facilitate long-term post-closure water treatment and monitoring.

Also in terms of magnitude, a total of 7.9 miles of streams would be directly affected by construction, including 3.9 miles of perennial streams and 4.0 miles of intermittent streams. The larger streams with a width at ordinary high water of 16 feet or greater would be bridged. Site-specific designs have been developed for bridges. Smaller stream crossings would use a series of standardized, conceptual culvert design categories based on stream width and fish presence. Impacts to wetlands would be long term, but bridges and culverts would be designed to protect habitat and mitigate effects.

The Kokhanok East Ferry Terminal Variant would replace a portion of the main Action Alternative 1 transportation corridor. In terms of magnitude, the net change in direct permanent impacts would be an additional 6 acres of shrub wetlands and 42 acres of herbaceous wetlands. Two acres of lakes and ponds would not be impacted. The net change in temporary impacts would be an additional 3 acres of shrub wetlands and 16 acres of herbaceous wetlands. The net change in indirect impacts from dust would be an additional 5 acres of shrub wetlands and 145 acres of herbaceous wetlands. There would be 79 acres of fewer dust impacts to lakes and ponds. Overall, the magnitude, extent, duration, and likelihood of impacts to wetlands and other waters would be similar to Action Alternative 1 without this variant.

Amakdedori Port

The Amakdedori Creek-Frontal Kamishak Bay watershed has an estimated 77,000 acres of wetlands and other waters (44 percent of the watershed); 6 acres of shrub wetlands and 5 acres of herbaceous wetlands would be directly affected. Construction of Amakdedori port would permanently and directly affect 11 acres of marine waters in the Amakdedori Creek-Frontal Kamishak Bay watershed. The port terminal and associated facilities would be sited and designed to avoid almost all vegetated wetlands and other waters. In terms of magnitude, extent, and duration, temporary construction-related impacts would affect 4 acres of marine waters. Fugitive dust impacts from construction would potentially affect

3 acres of wetlands and 42 acres of marine waters. Previous disturbance to wetlands or waterbodies in this area is minimal, so these effects would be observable and permanent.

The Summer-Only Ferry Operations Variant would have roughly the same area of direct permanent and temporary impacts to wetlands and other waters. In terms of magnitude and extent, the area of wetlands potentially affected by fugitive dust would increase by 9 acres, compared to the year-round use of the port due to the increased disturbance footprint for a container yard.

Under the pile-supported dock variant, the total offshore footprint of the port would be reduced by 11 acres. There would be less than 1 acre of permanent direct impacts to marine waters.

Natural Gas Pipeline Corridor

For onshore sections of the stand-alone natural gas pipeline, a 100-foot-wide impact corridor has been assessed: 40 feet to account for the trench and side-cast material, and 60 feet for construction access. All of this area is being considered as permanent impacts at this time, because a reclamation plan has yet to be developed. The onshore sections of the natural gas pipeline would permanently impact approximately 6 acres of wetlands and other waters.

Approximately 2 acres of wetlands and other waters would be filled for the pipeline. Approximately 5 acres of wetlands and other waters would be impacted. Temporary mats would be placed in wetlands to facilitate construction access. No direct fill in wetlands and other waters would be anticipated in these areas.

In terms of duration, impacts from offshore sections of the pipeline would be considered temporary, lasting only through the construction phase. In terms of magnitude and extent, approximately 378 acres of marine (subtidal) waters in Cook Inlet would be temporarily impacted. Approximately 68 acres of Iliamna Lake would be temporarily impacted.

Changes in the natural gas pipeline corridor for the Kokhanok east ferry terminal variant would result in a net addition of 11 acres of permanent impacts to shrub wetlands, and 6 acres of temporary impacts to Iliamna Lake waters.

AA2 Action Alternative 2 and Variants

In terms of magnitude, extent, and duration of impacts, Action Alternative 2 would permanently discharge dredged or fill material into 3,715 acres of wetlands and other waters, including 3,512 acres of wetlands, 51 acres of lakes and ponds, 55 acres of streams in 77 miles of channels, and 98 acres of estuarine waters. It would temporarily discharge dredged or fill material into 399 acres of wetlands and other waters, including 46 acres of wetlands, 1 acre of lakes and ponds, 4 acres of streams in 1.8 miles of channels, 77 acres of estuarine waters, and 271 acres of marine waters. An additional 1,987 acres of wetlands and other waters would be indirectly impacted by fugitive dust from the mine site, transportation corridor, port, and material sites and access roads for the natural gas pipeline, including 1,528 acres of wetlands and 459 acres of other waters. Dewatering at the mine site would indirectly impact 449 acres of wetlands and other waters, including 341 acres of wetlands, and 108 acres of other waters. Fragmentation would indirectly impact 462 acres of wetlands and other waters, including 449 acres of wetlands and 13 acres of other waters.

In terms of duration and extent, NWUS permanently affected by Action Alternative 2 would include Iliamna Bay and Iliamna Lake. In terms of magnitude, there would be a direct permanent impact to 96 acres of navigable waters, including 95 acres of estuarine waters for the port and transportation corridor, and 1 acre of Iliamna Lake for ferry terminals (described below). There would be a total of 346 acres of temporary impacts, including 271 acres of marine waters, 74 acres of estuarine waters, and 1 acre of Iliamna Lake.

Mudflats occur in the estuarine intertidal waters of Iliamna Bay and Cottonwood Bay (20 acres of permanent and 52 acres of temporary impacts). Vegetated shallows are similar to aquatic bed wetlands (less than 1 acre permanent and temporary impacts). Scattered eelgrass is present along the shoreline between Diamond Point and Williamsport, as well as west of Diamond Point in Cottonwood Bay. More extensive reefs and eelgrass beds are found in the larger Iniskin Bay to the north of Iliamna Bay. Riffle and pool complexes occur in an undetermined portion of the upper perennial and intermittent stream channels. Overall, the magnitude, extent, and duration of impacts to wetlands and other waters from Action Alternative 2 would be similar to Action Alternative 1.

The Summer-Only Ferry Operations Variant would increase direct impacts to wetlands by nine acres. The Pile-Supported Dock Variant would reduce impacts to Cook Inlet marine waters by 11 acres.

AA3

Action Alternative 3 and Variant

The magnitude and extent of impacts from Action Alternative 3 would be the permanent discharge of dredged or fill material into 3,645 acres of wetlands and other waters, including 3,446 acres of wetlands, 50 acres of lakes and ponds, 53 acres of streams in 79.3 miles of channels, and 98 acres of estuarine waters. Short-term duration impacts would include temporarily discharged dredged or fill material into 404 acres of wetlands and other waters, including 50 acres of wetlands, 1 acre of ponds, 4 acres of streams in 3.3 miles of channels, 77 acres of estuarine waters, and 271 acres of marine waters. An additional 2,097 acres of wetlands and other waters would be indirectly impacted by fugitive dust, including 1,617 acres of wetlands and 479 acres of other waters. Dewatering at the mine site would indirectly impact 449 acres of wetlands and other waters, including 341 acres of wetlands, and 108 acres of other waters. Fragmentation would indirectly impact 462 acres of wetlands and other waters, including 449 acres of wetlands and 13 acres of other waters.

Because Action Alternative 3 does not include a ferry crossing of Iliamna Lake, the only NWUS permanently affected by this alternative would be Cook Inlet. Action Alternative 3 includes the same port location (Diamond Point) and design as Action Alternative 2, with a total of approximately 71 acres of NWUS permanently impacted. Another 24 acres of NWUS in Iliamna Bay would be permanently impacted by the Action Alternative 3 transportation corridor. Mudflats occur in the estuarine intertidal waters of Iliamna Bay and Cottonwood Bay (23 acres of permanent and 48 acres of temporary impacts). Vegetated shallows are impacted the same as aquatic bed wetlands (less than 1 acre permanent and temporary impacts). Scattered eelgrass is present along the shoreline between Diamond Point and Williamsport, as well as west of Diamond Point in Cottonwood Bay. More extensive reefs and eelgrass beds are found in the larger Iniskin Bay to the north of Iliamna Bay. Riffle and pool complexes occur in an undetermined portion of the upper perennial and intermittent stream channels. Therefore, in terms of magnitude and duration, permanent and temporary impacts to these channels total 52 acres and 4 acres, respectively.

The Concentrate Pipeline Variant would increase direct impacts to wetlands in the transportation corridor by seven acres.

CE

Cumulative Effects

The cumulative effects analysis area for wetlands includes the project footprint for each alternative, and the extended geographic area where direct and indirect effects to wetlands can be expected from project construction and operations. Past and present actions that have, or are currently, affecting wetlands in the analysis area consist of mining exploration activities, and a small number of towns, villages and roads that are relatively isolated and dispersed over a large geographic area. These actions have resulted in an incremental loss of wetlands, fragmentation of habitat, changes in wetland types, and loss or degradation of wetland functions, affecting localized areas; but represent a measurable but limited amount of acreage across the area of analysis.

An expanded development scenario for the Pebble project would include an additional 78 years of mine mining and processing, and involve a substantially larger mine site footprint, construction of concentrate and diesel pipelines, and a new deep-water port site at Iniskin Bay. Project construction activities would continue to disturb soil, alter surface water flow, and physically destroy or injure wetland vegetation. Under Action Alternative 1, the expanded footprint would increase the acres of wetlands and waters impacted by an estimated 12,445 acres. The potential impacts under Action Alternatives 2 and 3 would be substantially less, because the transportation corridor and facilities associated with the Amakdedori port site would not be constructed. Mineral exploration is likely to continue in the analysis area, and would result in small areas of wetlands disturbance related to core sampling and exploration facilities. Anticipated community facility and transportation infrastructure development would affect wetlands through direct removal and fill, and indirectly through dust deposition and potential disruption of wetland hydrology. Potential cumulative impacts to wetlands include incremental loss of wetlands, fragmentation of habitat, changes in wetland types, and loss or degradation of wetland functions. Impacts to wetlands are expected to be measurable, but limited in extent across the area of analysis.

3.5 Spill Risk

Scoping comments expressed concerns over spills of various potentially hazardous substances that would be used for the proposed project. The EIS addresses the potential consequences of larger spills or releases of diesel fuel, natural gas, copper-gold ore concentrate, chemical reagents, bulk and pyritic tailings, and untreated contact water.

3.5.1 Spill Impacts Analysis

The EIS Spill Risk section broadly addresses the fate and behavior of spilled materials across a wide range of spill conditions, including varied spill volumes, location, duration, seasons, etc. Seven hypothetical spill scenarios were selected for further detailed analysis of potential impacts. Selected scenarios generally have a low probability of occurrence and relatively higher potential consequences. Impacts analysis in an EIS does not benefit from evaluation of spill scenarios that are so remotely improbable that the risk presented is negligible. Therefore, the Spill Risk section excludes impact analysis of some spill scenarios that have been determined to be highly unlikely.

Potential spills of natural gas and chemical reagents were deemed to be highly unlikely and of low consequence, and are addressed briefly.

Release scenarios for diesel and ore concentrate spills were selected based on historic data and statistical evaluation of their probabilities (AECOM 2019a). Two scenarios for diesel spills and two scenarios for concentrate spills were selected for impacts analysis.

To determine scenarios for tailings and untreated contact water releases to be analyzed in the EIS, an expert panel was convened to conduct a specialized risk assessment called a Failure Modes and Effects Analysis. One release scenario was selected for impact analysis for each material: bulk tailings, pyritic tailings, and untreated contact water.

Anticipated spill response has been included in each scenario, and would be expected to minimize potential impacts.

The impacts analysis area for some of the spill scenarios extends beyond that of the other potential impacts analyzed in the EIS. The hypothetical marine diesel spill analysis area includes lower Cook Inlet; and the hypothetical tailings release scenarios analysis areas extend about 230 river miles downstream of the mine site to the lower Nushagak River where it feeds into Nushagak Bay, part of greater Bristol Bay.

3.5.2 Spills from Iliamna Lake Ferry

Scoping comments included concerns regarding spills from the proposed Iliamna Lake ferry. Available incident data for ferries and similar vessels, including the best available analogue for the ferry, Canada's Williston Transporter, were reviewed to determine historic levels of incidents and probability of occurrence. The probability of a large spill from the proposed lake ferry was judged to be significantly less than the historic spill probability for marine barges, which is already very low.

The proposed ferry would be custom-built specifically for Iliamna Lake conditions, and for hauling project-specific materials. Materials would be transported in secondary containment located away from the shell of the vessel, so that the containers would likely not be impacted in the event of a collision. The 1-inch-thick heavy-steel shell required for ice breaking would result in very low potential for damage to the ferry from grounding or a collision.

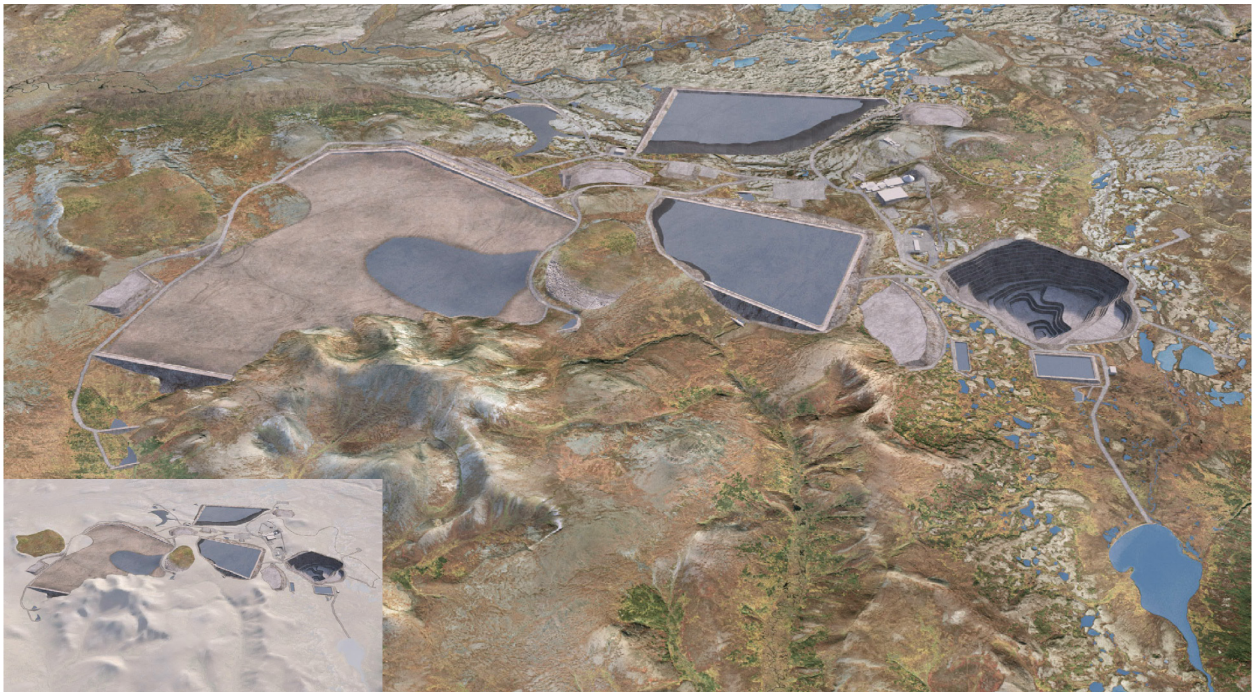
The ferry would be designed with state–of-the-art navigation and propulsion systems, with four azimuthing thrusters, and would have the ability to operate in 100-mile-per-hour winds, with safe station-keeping at winds up to 150 miles per hour. Although subject to potentially extreme weather conditions, the operational environment in the lake is expected to be generally less harsh than the marine environment affecting marine barges. Ferry operations would be suspended as needed during extreme weather.

Based on the historic data, as well as these design and operational features, spills of diesel, concentrate, and reagents from the proposed ferry were determined to be so improbable as to have negligible risk, and were therefore eliminated as scenarios for impacts analysis in the EIS.

3.5.3 Diesel Spills

Diesel is one of the most widely transported hazardous substances. Small spills of diesel (e.g., less than 50 gallons) are very common, while very large spills (e.g., greater than 10,000 gallons) are rare.

Two hypothetical diesel spill scenarios were selected for impacts analysis: 1. a release of 3,000 gallons of diesel due to a tanker truck rollover along one of the proposed access roads; and 2. a 300,000-gallon spill of diesel from a marine tug barge hauling diesel through lower Cook Inlet into Kamishak Bay.



Digital Simulation of Mine Site

1. Road Corridor Diesel Spill – Potential physical impacts from the truck rollover scenario include temporary to short-term contamination of air, soil, surface water, groundwater, and waterbody substrate in the vicinity of the spill. If spilled diesel reaches flowing water, impacts could extend downstream. Diesel readily evaporates and biodegrades in the environment, so these impacts would not be expected to last more than several weeks. Contaminated soils and groundwater could be excavated or remediated as needed.

Biological impacts would be temporary, and limited to the vicinity of the spill, and could include temporary acute impacts to wetland vegetation, such as potential mortality; temporary toxicity to some wildlife; temporary and localized toxicity to birds, including potential mortality; and temporary acute toxicity to fish, including potential mortality.

Potential impacts to commercial and recreational fishing would be unlikely, and impacts to subsistence would be localized and temporary. There could be real or perceived risks of contamination to drinking water and subsistence resources. A release of diesel could cause stress to community members in close proximity from real or perceived risks of contamination, and potentially impact human health.

2. Marine Diesel Spill – Physical impacts from the marine diesel spill scenario could include contamination of seawater for potentially miles around the spill location. Diesel spilled into marine water would float on the surface, and naturally evaporate and disperse within 2 to 3 weeks with no recovery efforts. Spill response efforts could reduce the magnitude and duration of the spill. Air pollution would be temporary and localized, depending on the fate of the fuel.

Diesel could spread southward to the shores of Shuyak and Afognak islands (north of Kodiak Island) and /or Cape Douglas, depending on sea conditions, and could be washed on shore. Impacts to surface and groundwater on shore would be unlikely. Impacts to onshore wetlands would be unlikely; impacts to terrestrial wildlife would be minimal. Impacts to marine mammals would be of low likelihood and temporary; individuals or groups could potentially be injured or die, but population-level effects are unlikely.

Impacts to birds (especially seabirds) and fish would vary depending on weather and sea conditions at the time of the spill, and could include acute toxicity and potential mortality. Impacts to birds and fish would be temporary to short term, and could occur across impacted areas of lower Cook Inlet. Potential impacts from a marine diesel spill to Threatened and Endangered Species (TES) could be of high magnitude, depending on the species and the fate of the spilled fuel.

Real or perceived impacts of a spill could briefly impact the socioeconomics of the area. There could be impacts to the limited commercial fisheries in the lower Cook Inlet area, depending on the timing of the spill. Short-term impacts to subsistence would be expected from this scenario, again dependent on timing of the spill and fate of the diesel. A diesel marine spill could cause psychosocial stress resulting from community anxiety. Health impacts could also include potential diesel or diesel fume exposure.

3.5.4 Natural Gas Release

Impacts from a potential release of natural gas from the proposed pipeline would be limited to short-term air quality degradation and limited release of greenhouse gases (GHG). Due to the remote nature of the pipeline, no health and safety impacts would be expected.

3.5.5 Copper-Gold Concentrate Spills

Ore concentrate (concentrate) is composed of finely ground rock and mineral particles that have been processed from raw ore to concentrate the economic metallic minerals. For Action Alternatives 1 and 2, copper-gold concentrate processed at the mine site would be transported by truck and ferry to the port in specialized heavy-steel bulk shipping containers with locking lids. At the port, containers would be transferred from truck trailers onto lightering vessels and transported to waiting bulk carrier vessels, where the concentrate would be loaded deep into the ships' holds for transport to off-site smelters. Action Alternative 3 would include a concentrate pipeline to transport concentrate slurry from the mine site to Diamond Point port.

Two hypothetical scenarios were analyzed for impacts of a gold-copper concentrate release: 1. a spill of 80,000 pounds of concentrate due to a transport truck rollover; and 2. a spill of 54,000 pounds concentrate slurry from the concentrate pipeline considered in Action Alternative 3.

Potential impacts from both scenarios are similar, and are summarized together here for 1. impacts from a spill onto dry land; and 2. impacts from a spill into flowing water. The extent of impacts would vary with the location of the spill, particularly whether the spill reaches flowing water. Magnitude and duration of impacts would vary with the volume of the spill and the effectiveness of recovery efforts.

1. Impacts From a Spill of Concentrate on Land – Concentrate spilled on dry land or in isolated water bodies would be recovered to the extent practicable. Reviews of past spills of concentrate at Red Dog Mine show that concentrate spills on land are generally fully recovered.

The PAG material and metals contained within the concentrate would require years to decades to generate acid or leach metals into the environment. If concentrate is recovered as described in the anticipated spill response, no contamination from metals or acid would impact soil or water resources. Residual amounts of concentrate left behind could generate acid or leach metals over years to decades, but due to dilution, no measurable impacts would be expected.

Concentrate spilled on land that is able to dry out has the potential to become airborne fugitive dust in the form of particulate matter and particulate hazardous pollutants. Assuming the spill response as included in the scenario, any fugitive dust produced would likely not have measurable impacts on air quality.

Vegetation that is buried by spilled concentrate could experience temporary, localized impacts. Wildlife could experience limited localized impacts from burial of food sources, burial of small mammals by concentrate, or disruption from cleanup activities. For a spill during the summer, there is a low potential for bird species that nest on the ground to be impacted if a spill covers up their nest or young. If cleanup activities occur during the summer breeding season in close proximity to nests, some species may abandon their nests, which may result in breeding failure or loss of clutches.

If released into an enclosed waterbody like a pond or a lake, the concentrate would sink to the bottom and contribute to sedimentation. The fine particles would bury the natural substrate, and could smother benthic organisms or eliminate benthic habitat. Recovery efforts could remove spilled concentrate from pond or lake bottoms where practicable, although the impact to benthic habitat would likely occur prior to recovery efforts. Additionally, dredging to remove spilled concentrate could cause further disruption of the aquatic habitat.

2. Impacts From a Spill of Concentrate into Flowing Water – If concentrate is released into flowing water, the fine-grained spilled concentrate would be difficult to recover, and would be transported downstream, increasing the geographic extent of impacts. The primary impact would be temporarily elevated TSS in downstream waters. Elevated TSS could extend down drainages that intersect the road corridor or the concentrate pipeline corridor, and extend to the shores of Iliamna Lake or Kamishak Bay before being diluted by the larger water bodies.

Potential impacts to fish from increased TSS and sedimentation include temporary decreased success of incubating salmon eggs; reduced food sources for rearing juvenile salmon; modified habitat; and in extreme cases, mortality to eggs and rearing fish in the immediate area of the spill. This could impact a small fraction of the total salmonid eggs in a stream, and would not result in any measurable impacts on future salmon populations or the wildlife that depend on salmon. Likewise, the probability of impacts on commercial salmon harvest values would likely be extremely low. Impacts to TES or marine mammals from concentrate spills would not be expected.

A concentrate spill into flowing water could temporarily displace recreational angling efforts in the vicinity of the spill if the event or cleanup occurred during the open water fishing season. A concentrate release would likely cause concerns over contamination for local subsistence users that could cause users to avoid the area and alter their harvest patterns. A release of concentrate could cause stress to community members in close proximity from real or perceived risks of contamination, therefore potentially impacting human health.

The metals contained within the concentrate would require decades to leach into water. Any metals leached from concentrate spilled into a waterway would be produced very slowly over years to decades, and would be heavily diluted by stream water, so that no measurable impacts would occur. Generation of acid from PAG materials in the concentrate would not occur when concentrate is submerged under water.

Concentrate spills could have localized, temporary effects on recreational resources. Spill recovery efforts could generate temporary, localized noise.

The potential for release of fugitive dust during concentrate transport is also addressed in Spill Risk. The proposed project would implement extensive mitigation to reduce the potential for fugitive dust generation, including fully sealed and locking lids on transport trucks, and an automated system that opens the lids to the containers only once they are deep inside the holds of the waiting marine vessels.

3.5.6 Reagent Spills

Reagents are chemicals that promote or restrict certain chemical reactions in the process of separating metals from crushed ore. Spill Risk reviews the list of chemical reagents to be used, and their fate and behavior when released into the environment. Chemical reagents would be transported in 1-ton bags or specialized containers/tanks. The reagents would be contained within secondary containment at all times during transport and use. Any spill of chemical reagents would therefore likely be contained, and not released to the environment, so that full analysis of environmental impacts was determined to be unnecessary in the EIS.

3.5.7 Tailings Releases

Tailings spilled in historic releases have damaged downstream environments and sometimes resulted in human casualties. Long-term environmental contamination has occurred when spilled tailings are not recovered, and are able to leach metals and generate acid over time periods of decades.

PLP proposes to separate the pyritic tailings (high level of PAG, requiring subaqueous storage in a tailings "pond") from the bulk tailings (primarily non-PAG) in two separate TSFs. The pyritic tailings would be placed in the open pit at the close of operations, eliminating the need for a perpetual tailings pond, and limiting the spill risk to operational years only. The bulk TSF would remain in perpetuity, with bulk tailings in "dry" closure, reducing the spill risk.

The bulk tailings release scenario selected for analysis involves an earthquake (greater than the OBE) which causes shearing of the two tailings delivery pipelines, and a total release of 1.56 million cubic feet (ft^3) of bulk tailings slurry into the NFK over 6 hours. The pyritic tailings release scenario selected for analysis involves operational error(s) and lift construction difficulties that result in a partial breach of the tailings embankment, and a total release of 185 million ft^3 of solid and fluid tailings into the SFK over about 3 weeks. Potential impacts from both tailings release scenarios are comparable, with the pyritic release of higher magnitude, and are summarized together here.

PI Physical Impacts of Tailings Release Scenarios

Tailings solids would be expected to be deposited on about 46 acres during the bulk tailings release; and 220 acres during the pyritic tailings release. Spilled tailings would be recovered to the extent practicable. Small amounts of tailings that may remain on land or in waterways would likely be naturally flushed downstream by precipitation, overland flow, and stream water over months to years. Some small amounts of tailings solids may settle in side channels, and some may be incorporated into the stream's natural sediment bedload.

Metals contained within the tailings solids would require years to decades for metals leaching (ML) or generation of ARD in the environment. If spilled tailings are recovered as described in the spill response, no measurable ML or ARD would be expected. Small amounts of tailings that are not recovered could leach metals or generate acid very slowly over years to decades, but the metals and acid would be heavily diluted by rain, overland flood, and stream water; and would be unlikely to have any measurable effects.

Soils near the release site and in areas of overbank flooding could experience limited erosion and contamination with metals. Soils could be stabilized and excavated, as needed, and the habitats restored.

Most of the fine tailings particles would be transported downstream, causing elevated TSS in exceedance of water quality criteria (WQC) for approximately 230 miles downstream as far as the Nushagak River Estuary, where the river feeds into Nushagak Bay, part of greater Bristol Bay. Elevated TSS would likely last up to a week from the bulk tailings release, and several weeks from the pyritic tailings release.

Additional TSS would be generated due to ongoing erosion and sedimentation from potential stream destabilization during the release floods, particularly from the higher-volume pyritic tailings release. Additional ongoing elevated TSS could persist for months to years, depending on the speed and effectiveness of stream reclamation efforts that would control streambed erosion.

Tailings fluids (contact water used to mix the bulk tailings slurry, and pyritic supernatant fluid) would contain concentrations of some metals that exceed WQC. Tailings fluids from both releases would have elevated concentrations of the following metals relative to the applicable WQCs: antimony, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, molybdenum, selenium, silver, and zinc, with the addition of cobalt for the pyritic tailings release.

Most of the dissolved metals would be transported downstream with the initial release floods. A small amount of metals may contaminate soils near the release location; impacted soils could be excavated as needed.

The metals would be diluted in downstream waters to various degrees, depending on stream flow (seasonal). Metals with the highest concentrations would continue to exceed WQC for tens of miles downstream.

For the bulk tailings release, based on mean annual discharge (MAD) levels of stream flow:

- Copper concentrations would exceed the most stringent WQC to the Koktuli River below the NFK and SFK confluence, about 23 miles downstream from the mine site.
- Molybdenum, zinc, lead, and manganese concentrations would exceed the most stringent WQC until the Mulchatna River below the Koktuli River confluence, about 62 miles downstream.
- Cadmium concentrations would exceed the most stringent WQC until the Mulchatna River below the Stuyahok River confluence, about 78 miles downstream from the mine site.

For the higher-volume pyritic tailings release, based on MAD levels of stream flow:

- Copper would remain at levels exceeding the most stringent WQC until the Mulchatna River below the Koktuli River confluence, about 80 miles downstream of the mine site.
- Zinc, lead, and manganese would remain at levels exceeding the most stringent WQC until the Nushagak River below the Mulchatna River confluence, about 122 miles downstream of the mine site.
- Cadmium and molybdenum would remain at levels exceeding the most stringent WQC as far downstream as the Nushagak River Estuary where it enters Nushagak Bay, part of the greater Bristol Bay, about 230 miles downstream from the mine site.

Elevated metals concentrations in downstream waters are expected to last no more than 1 week for the bulk tailings release, and several weeks for the pyritic tailings release. No measurable impacts to groundwater quality would be expected from these scenarios.

Noise could be generated from spill recovery operations, including increased vehicle and/or helicopter traffic, and use of heavy machinery and other cleanup equipment. Any potential fugitive dust produced from settled tailings would likely not have measurable impacts on air quality.

BI Biological Impacts of Tailings Release Scenarios

Wetland vegetation may be temporarily covered in limited areas where solid tailings particles are deposited, estimated to be no more than 46 acres beneath the bulk tailings release site, and about 220 acres beneath the pyritic tailings release site.

Small mammals and species that cannot easily avoid flood conditions could be washed downstream, or forced to seek higher ground during the initial tailings release floods. Erosion from flooding may alter bird and wildlife habitat in the immediate downstream areas for months to years, pending reclamation efforts. There could be moderate impacts to wildlife and birds from the elevated metals. Potential impacts to fish could impact birds and wildlife that rely on fish as a food source, particularly avian prey populations. No population-level impacts to wildlife species are expected.

For both tailings release scenarios, fish and other aquatic organisms would be simultaneously impacted by the elevated TSS and metals concentrations in the water, leading to potential physical injury, loss of habitat and food, and potentially lethal metals toxicity.

In the short term, and immediately downstream of the spill, potentially lethal acute metal toxicity may occur in fish and other sensitive aquatic species. Over days to weeks in downstream locations, sub-lethal effects, such as impairment of olfaction, behavior, and chemo/mechanosensory responses, may also occur in these receptors, specifically due to copper.

Based on the site-specific toxicity results and the predicted exposure regime (only for several days), impacts on fish due to metals toxicity would be limited for the bulk tailings release, and likely overshadowed by impacts via physical injury, and loss of habitat and food. For the pyritic release, acute impacts (lethality) on fish due to metals toxicity would not occur within the predicted time frame and extent of WQCs exceedances. Sub-lethal impacts on fish is unknown, especially because these sub-lethal impacts, if any, would occur at the longer time frame beyond a week after the initial physical impacts (TSS) subside. However, chronic exposures to elevated metals above baseline are not predicted beyond several weeks.

Acute impacts from TSS and metals would last approximately 1 week after the bulk tailings release scenario, with further intermittent increases in TSS as remaining tailings are transported downstream, and damage from stream erosion is stabilized. Impacts from elevated metals could last for 5 to 6 weeks after the pyritic release scenario, while TSS impacts could last for months to years, depending on the effectiveness of stream restoration efforts.

No population-level impacts would be expected for fish from either tailings release scenario.

SI Social Impacts of Tailings Release Scenarios

Clean-up efforts following either spill release could potentially increase local employment opportunities for less than 1 year. Real or perceived impacts of the spill could cause a longer-term decline on employment, income, and sales if commercial and recreational fishing and/or tourism were to suffer. Potential adverse impacts from the spill event could disproportionately impact minority and low-income communities.

Commercial fishing could be impacted, depending on impacts to fish in the affected drainages. Recreational anglers fishing these waters could experience a temporary reduction in harvest rates or catch per unit effort rates if the sub-lethal effects reduced target species ability or desire to feed/strike at anglers' lures.

Tailings spills could cause psychosocial stress resulting from community anxiety over a tailings release, particularly in areas of valued subsistence and fishing activities. There could be exposures to potentially hazardous materials, including metals, particularly in the pyritic tailings release, and communications and precautions about both acute and chronic exposures would help allay public concerns. Subsistence users may choose to avoid the area and alter their harvest patterns, due to potential perceptions of subsistence food contamination that extend throughout the area.

3.5.8 Untreated Contact Water Release

Contact water is defined as surface water or groundwater that has contacted mining infrastructure. Contact water stored in the main WMP would be elevated in several metals that would exceed WQC.

The selected scenario analyzed for impacts involves liner damage from ice hitting the geomembrane liner during spring break-up, resulting in a slow release of 5.3 million ft^3 of untreated contact water from the main WMP into the NFK over a period of 1 month. This release volume is less than 4 percent of the average volume of contact water stored in the main WMP.

Due to the slow release of the untreated contact water, no flood wave would be produced; therefore, there would be no health and safety impacts due to flooding.

Untreated contact water released into the downstream drainages would contain elevated levels of aluminum, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, molybdenum, nickel, selenium (a metalloid), silver, and zinc in exceedance of the most stringent WQC. The released untreated contact water would be diluted by stream water as it flows downstream, so that some metals concentrations could remain elevated above WQC for up to 45 miles downstream of the mine site, just before the confluence with the Swan River. WQC exceedance would last for the entire month of the release.

PI Potential Physical Impacts of Untreated Contact Water Release Scenario

Soil directly beneath the point of release could experience limited erosion and contamination by metals. Soils could be stabilized and excavated, as needed, and the habitats restored.

Surface water downstream from the release would be elevated in several metals above WQC, particularly molybdenum, cadmium, lead, zinc, and manganese. Depending on stream flow conditions, metals concentrations in exceedance of WQC could persist in stream water in the Tributary NFK 1.120, NFK, and the main stem Koktuli just upstream from the confluence of the Swan River as follows (downstream distances are estimated to be):

- Molybdenum for about 15 to 45 miles downstream.
- Cadmium for a shorter downstream distance than molybdenum; cadmium would require 60 percent of the dilution required by molybdenum.
- Lead, zinc, and manganese would require less than one-quarter of the dilution compared to molybdenum; so concentration of these metals would exceed their WQC for a shorter downstream extent compared to molybdenum.
- Copper would require about 10 percent of the dilution required by molybdenum, and would be diluted to below its WQC within several miles of the release site.

These metals would remain at elevated levels above WQC for a month or more during and after the release. Groundwater quality is not likely to be impacted by this scenario.

BI Potential Biological Impacts of Untreated Contact Water Release Scenario

Wetland vegetation in a limited area near the release site could experience temporary reduction of growth or mortality. There could be moderate-magnitude impacts to wildlife and bird species from increased levels of metals in the impacted drainages as far downstream as the confluence of the main stem Koktuli with the Swan River. Potential impacts to fish could impact birds and wildlife that rely on fish as a food source, particularly avian prey populations. The duration could be from months to years depending on impacts to fish populations. No population-level impacts to wildlife species are expected.

Potential impacts to fish from the release of untreated contact water would be similar to those described above for elevated metals impacts from the pyritic release scenario. Acute toxicity due to metals would not occur; however, prolonged exposure to metals concentrations in slight exceedance of WQC may result in sub-lethal effects. Wildlife and birds that depend on fish and aquatic invertebrates as prey could experience moderate-intensity impacts, depending on the level of metals toxicity in fish and aquatic invertebrates. The scenario may have low-intensity indirect effects on the marine mammals of Bristol Bay, based on the sub-lethal metals toxicity impacts of their fish prey from the impacted watersheds.

SI Potential Social Impacts of Untreated Contact Water Release Scenario

Real or perceived impacts of the spill could cause a longer-term decline on employment, income, and sales if commercial and recreational fishing and/or tourism were to suffer. Potential adverse impacts from the release of untreated contact water could disproportionately impact minority and low-income communities. Commercial fishing could be impacted, depending on impacts to fish in the affected drainages. Recreational anglers fishing these waters could experience a temporary reduction in harvest rates or catch per unit effort rates if the sub-lethal effects reduced target species' ability or desire to feed/strike at anglers' lures. Subsistence users may choose to avoid the area and alter their harvest patterns. Spills of untreated contact water could cause psychosocial stress, particularly in areas of valued subsistence and fishing activities.

3.5.9 Expected Effects of Alternatives

NA No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken; there would be no construction, operations, or closure activities. Therefore, no future spills related to construction and operation of the mine would be expected. However, PLP would retain the ability to apply for and continue mineral exploration activities under the State's authorization process, as well as any activity that would not require federal authorization. In addition, there are many valid mining claims in the area, and these lands would remain open to mineral entry and exploration by other entities. The potential for spills from these activities would remain the same as current conditions.

AAV Action Alternatives and Variants

The probabilities and consequences of hypothetical spills are similar across the action alternatives. Differences among the alternatives and variants include the following:

- Action Alternative 2 would include construction of the bulk TSF main embankment by the downstream method, rather than the centerline method proposed for Action Alternative 1. The downstream method may provide minimal additional stability over the Action Alternative 1 design.
- Action Alternative 3 would include a concentrate pipeline to transport concentrate as slurry from the mine site to Diamond Point port, rather than transport by truck and ferry, as proposed for Action Alternatives 1 and 2.
- Differences in road transport length and terrain impacting road grade across the various road corridors could slightly affect the probability of a truck-related spill.
- Variation in rocky shoals and sea conditions between the two port locations could alter the probability of a marine tug-barge allision (the running of one ship on another ship that is stationary; distinguished from collision).

3.6 Climate Change

Climate change has the potential to result in environmental impacts relevant to the proposed project and its alternatives in three primary ways. These include:

- Effects of the project on climate change as indicated by (GHG emissions. Project-caused GHG emissions are discussed and analyzed in Section 4.20, Air Quality.
- Effects of climate change on the project area, which examines the impacts of climate change on a proposed action that could affect sensitive populations or environmental resources. Climate change as a cumulative effect is considered under this category. Climate change trends are integrated into resource discussions in Chapter 3, Affected Environment, while climate change as a cumulative effect is discussed in the cumulative effects subsection of Chapter 4, Environmental Consequences.
- Effects of climate change on proposed project infrastructure, addressing the effects on the proposed project infrastructure from climate change, and accounting for potential climate change effects on a proposed action over the course of its anticipated useful life, especially in areas that may be vulnerable to specific effects of climate change. Climate change effects on proposed project infrastructure are addressed in Chapter 4, Environmental Consequences.

The DEIS Chapter 3 discussion on trends includes:

- Section 3.1, Introduction to Affected Environment, provides a framework for discussion of climate change in the EIS, and the location in the EIS of climate change information.
- Section 3.9, Subsistence, discusses climate change in the context of traditional resource use change.
- Section 3.16, Surface Water Hydrology, discusses how water balance modeling incorporates cyclical and predicted climate data to account for changes in climate.
- Section 3.17, Groundwater Hydrology, discusses how climate variability incorporated into water balance modeling informs the groundwater model.
- Section 3.18, Water and Sediment Quality, discusses climate trends and oscillations for temperature specifically.
- Section 3.20, Air Quality, provides detailed information about air quality and climate change in the context of estimated predicted future temperature and precipitation values.
- Section 3.22, Wetlands and Other Waters/ Special Aquatic Sites, includes discussion of the potential impacts on wetlands and other waters in a changing climate. Section 3.26, Vegetation, provides similar discussion on trends, such as changes in phenology that may affect vegetation.
- Section 3.23, Wildlife Values, includes detailed analysis of potential impacts of climate change on terrestrial wildlife, birds, and marine mammals, including TES. Section 3.25, Threatened and Endangered Species, also includes discussion of climate change trends for Steller's eider.
- Section 3.24, Fish Values, discusses climate change in the context of hydrological changes and potential large-scale shifts in populations.

The DEIS Chapter 4 discussion on contributions of the project to GHG emissions, or impacts of climate change on the proposed project, is primarily discussed in the physical science sections. Discussion includes:

- Section 4.16, Surface Water Hydrology, provides analysis of water balance models specific to the project components and operations that incorporate climate variability.
- Section 4.17, Groundwater Hydrology, analyzes climate and recharge variability in model predictions of project component effects such as open pit drawdown.
- Section 4.20, Air Quality, includes a detailed analysis of project-related GHG emissions.

4.0 IMPACT AVOIDANCE, MINIMIZATION, AND MITIGATION

The DEIS serves in part to inform the public and review agencies of design features, BMPs, and mitigative measures that are included in the project to reduce or avoid impacts. The USACE views these elements as part of the project, and considers PLP's proposed mitigation measures described in Chapter 5, Mitigation, as inherent to the proposed alternative, as well as other action alternatives' applicable components. To the extent possible, these measures, including any potential impacts associated with these measures, were considered when assessing the impacts of the project on the resources. Where there is insufficient detail to determine if an impact can be avoided or minimized, the measure cannot be incorporated into the impact analysis, but serves to inform the public of PLP's plans.

Additional mitigative measures identified or recommended to date during the NEPA process have been compiled, and would be considered by the USACE and cooperating agencies as part of their permit decisions to further minimize project impacts. This list will be updated after public review of the DEIS for a comprehensive list of all measures identified during the NEPA process. All measures will be assessed with the goal of disclosing the likelihood that the measures would be adopted by the applicant, or implemented as a condition in a state, federal, or local permit by the responsible agencies as part of their permit decisions following completion of the NEPA process. Specific mitigation conditions would be determined following completion of the environmental review and would be included in the ROD for any permit that may be issued.

Compensatory mitigation for unavoidable impacts to aquatic resources may be required to ensure that activities requiring a permit comply with 404(b)(1) guidelines. Compensatory mitigation is the restoration (reestablishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources to offset unavoidable adverse impacts. PLP has developed a draft conceptual Compensatory Mitigation Plan (CMP) outlining their proposed approach for compensatory mitigation. The CMP would be amended in the future to include proposed mitigation plans. In addition, PLP proposes to use monitoring measures through construction, operations, and closure of the project to assess predicted project impacts and the effectiveness of mitigation measures.