ALASKA MINERAL PRODUCTION, TRANSPORTATION, AND PORT CAPACITY STUDY

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PREPARED FOR

AIDEA
Alaska Industrial Development and Export Authority

HOW TO READ THIS REPORT

This report is organized to present a clear, system-level narrative supported by detailed technical analysis. The main body of this report presents system-level findings and comparative conclusions relevant to infrastructure planning and investment decisions. For readability and increased stakeholder engagement the detailed technical analyses, supporting assumptions, and data-intensive material are provided in the appendices and referenced throughout rather than included in the narrative text.

Figures and tables included in the main report are intended to support orientation, comparison, and understanding of scale. Detailed data, design assumptions, and technical analyses are provided in the appendices and referenced throughout the text.

This assessment builds on approximately two years of phased technical work conducted in support of the Ambler[1] Access Project and subsequent request for statewide infrastructure and port evaluation efforts. The analysis incorporates findings from prior feasibility studies, stakeholder coordination, site visits, and supplemental market and infrastructure assessments completed between 2023 and 2025.

- **Readers seeking a high-level understanding** of infrastructure feasibility and recommended development direction can focus on the Executive Summary and the findings-based conclusions presented in 5. Findings-Based Conclusions which synthesize the detailed technical evaluations documented in the transportation analyses, individual port assessments, and supporting appendices.
- **Readers seeking underlying assumptions, capacity analyses, and technical details** should refer to the relevant technical sections and appendices cited throughout the report.

For ease of navigation between appendices and the main report, readers can click on the "Return to Table of Contents" link in the header.

1 Ambler" refers to the multiple mines and mining claims inside the boundaries of the Ambler Mining District, and also the hundreds of thousands of state mining claims and potential mines along the Ambler Road corridor that are outside the Ambler Mining District

EXECUTIVE SUMMARY

This report was prepared for the Alaska Industrial Development and Export Authority (AIDEA) to evaluate transportation and port infrastructure capable of supporting near-term mineral shipments from the Ambler Mining District, the hundreds of thousands of additional mining claims on state land near the Ambler Access road outside the Ambler Mining District and projected long-term mineral export demand across Alaska[2].

The analysis examines how anticipated production volumes, transportation constraints, and port capabilities interact to define feasible export systems under sustained, multi-commodity operating conditions. While Ambler provides a near-term reference case, the evaluation is intentionally framed to reflect cumulative statewide demand, recognizing that infrastructure decisions made today will influence Alaska's ability to support future mineral development.

Findings from this assessment include:

- **Infrastructure must be scalable beyond Ambler.** Ambler production alone does not define long-term infrastructure requirements. When combined with projected statewide base metal and coal production, aggregate export volumes increase substantially, placing sustained demands on transportation corridors and port facilities. Infrastructure solutions designed solely around near-term Ambler needs risk becoming constrained as additional projects advance. Upland areas that can manage significant amounts of ore for export using a combination of storage options, possible storage of incoming ore and other materials for storage or further transit from the port, and potential separation and refining facilities is a key consideration for infrastructure development.

- **Transportation feasibility is governed by reliability and lifecycle performance, not theoretical connectivity.** While multiple combinations of trucking and rail transport are technically viable, systems that rely heavily on long-haul trucking face increasing operating costs, workforce demands, and vulnerability to disruption as volumes scale. Rail-supported systems offer advantages for high-volume movement but require sufficient terminal capacity and well-integrated port interfaces to remain effective over time.

- **Most existing Southcentral Alaska ports are constrained at scale.** Ports developed primarily for containerized freight, fuel, or passenger operations can accommodate limited mineral shipments but face constraints related to land availability, competing uses, and expansion potential. As throughput increases and multiple commodities are introduced, these constraints reduce flexibility and increase long-term cost and reliability risks.

- **Port MacKenzie is uniquely positioned to support projected statewide mineral export demand.** When evaluated against throughput requirements, expansion potential, and lifecycle performance, Port MacKenzie emerges as the only port capable of scaling to accommodate sustained, high-volume, multi-commodity mineral exports. Its deep-water access, extensive undeveloped industrial land, and proximity to rail infrastructure provide the flexibility to support initial Ambler production and future statewide development.

Based on these findings, this report concludes that advancing a scalable port development concept at Port MacKenzie represents the most durable path for supporting Alaska's mineral export needs. This development path aligns near-term infrastructure investments with long-term demand while preserving flexibility as production profiles evolve.

2 Alaska's mining potential is further described in the presentation from the Department of Natural Resources, attached as Appendix J - 2025 Alaska Mining Industry Overview

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ACRONYMS & ABBREVIATIONS

AAC .... Alaska Administrative Code
AASHTO .... American Association of State and Highway Transportation Officials
AAP .... Ambler Access Project
ADCCED .... Alaska Department of Commerce, Community, and Economic Development
ADEC .... Alaska Department of Environmental Conservation
ADNR .... Alaska Department of Natural Resources
ADOT&PF .... Alaska Department of Transportation and Public Facilities
AIDEA .... Alaska Industrial Development and Export Authority
ANILCA .... Alaska National Interest Lands Conservation Act
APDES .... Alaska Pollution Discharge Elimination System
ARRC .... Alaska Railroad Corporation
ASCE .... American Society of Civil Engineers
AWE .... Alaska West Express
BLM .... Bureau of Land Management
CAA .... Clean Air Act
CAPEX .... Capital Expenditures
CFR .... Code of Federal Regulations
DMTS .... DeLong Mountain Transportation System
DTY .... Dalton Transfer Yard
DWT .... Deadweight Tonnage
EIS .... Environmental Impact Statement
FEMA .... Federal Emergency Management Agency
FHWA .... Federal Highway Administration
FMCSA .... Federal Motor Carrier Safety Administration
ft .... feet
FTA .... Federal Transit Administration
ft/sec .... Feet Per Second
GVW .... Gross Vehicle Weight
hr(s) .... Hour(s)
HTL .... High Tide Line
HTY .... Houston Transfer Yard
ISO .... International Organization for Standardization
JBER .... Joint Base Elmendorf-Richardson
kt/y .... Kilotons per Year
km .... Kilometer
ksf .... Kips per Square Foot
lb(s) .... Pound(s)
LiDAR .... Light Detection and Ranging
LOA .... Length Overall
LRTP .... Long-Range Transportation Plan
LT .... Long Tons
LTY .... Livengood Transfer Yard
MHW .... Mean High Water
min. .... Minimum
MLLW .... Mean Lower Low Water
MOA .... Municipality of Anchorage
MP .... Milepost
MSB .... Matanuska-Susitna Borough
NEPA .... National Environmental Policy Act
NHS .... National Highway System
NOA .... Notice of Availability
NOAA .... National Oceanic and Atmospheric Administration
NOS .... National Ocean Service
NPV .... Net Present Value
OPEX .... Operating Expenditures
PAMP .... Port of Alaska Modernization Program
PCD .... Port Commercial District
pcf .... Pounds per Cubic Foot
PCT .... Petroleum and Cement Terminal
PID .... Port Industrial District
PMRE .... Port MacKenzie Rail Extension
POA .... Port of Alaska (Anchorage)
POL .... Petroleum, Oils and Lubricants
psf .... Pounds per Square Foot
RFID .... Radio Frequency Identification
ROD .... Record of Decision
ROW .... Right-of-Way
RS .... Revised Statute
SWAPA .... Southwest Alaska Pilots Association
SWT .... Short Wet Tons
t/y .... Tons per Year
TOTE .... TOTE Maritime Alaska
USACE .... U.S. Army Corps of Engineers
USCG .... U.S. Coast Guard
USGS .... U.S. Geological Survey
WDD .... Waterfront-Dependent District
$MM .... Million Dollars

1. INTRODUCTION

Alaska contains significant undeveloped mineral resources, including copper, zinc, lead, precious metals, and coal, distributed across multiple regions of the state[3]. Many of these resources are located in remote areas with limited existing infrastructure, requiring long-distance transportation to reach processing facilities and export terminals. As additional mining projects advance from exploration to production, cumulative mineral volumes increase, placing growing demands on shared transportation corridors and port infrastructure.

The Ambler Mining District and the hundreds of thousands of state mining claims and potential mines along the Ambler road corridor in Northwest Alaska represents an important near-term driver of mineral export demand. Its isolation and lack of surface access have prompted extensive evaluation of transportation solutions under the Ambler Access Project, including road, rail, and port interfaces necessary to support concentrate export. While Ambler provides a useful reference case for infrastructure planning, long-term investment decisions must account for broader statewide mineral development trends and the combined demands these projects place on transportation and port systems.

This report evaluates transportation and port infrastructure capable of supporting both near-term Ambler shipments and projected statewide mineral export demand. The analysis focuses on identifying infrastructure solutions that remain feasible under sustained, multi-commodity operating conditions, rather than systems optimized for a single project or limited production horizon.

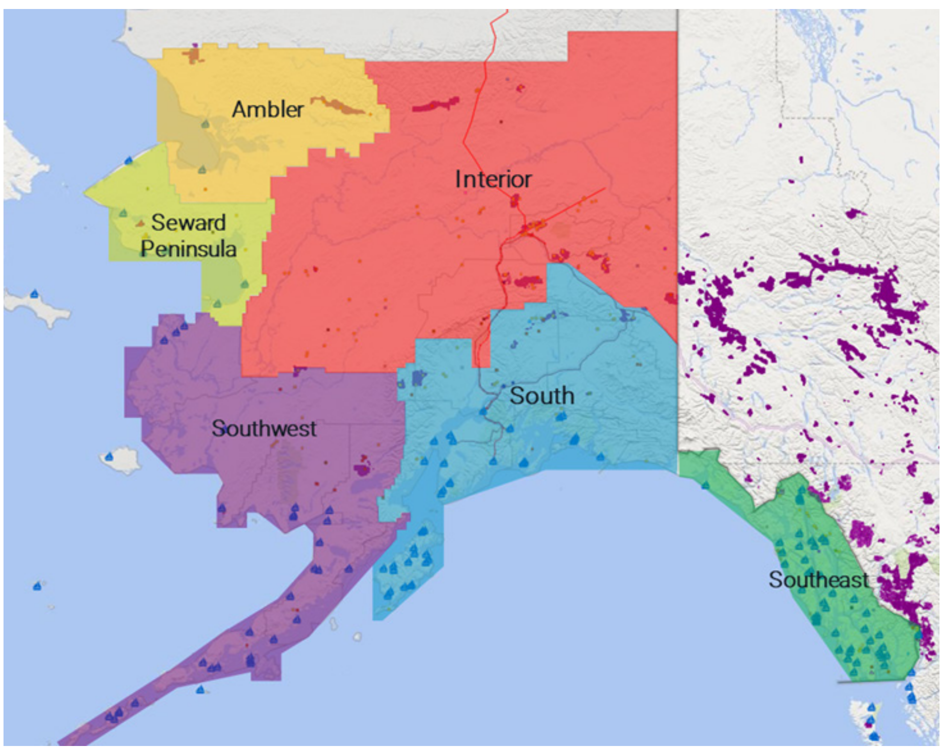

FIGURE 1-1: REGIONAL ASSESSMENT FRAMEWORK

3 Alaska's mining potential is further described in the presentation from the Department of Natural Resources, attached as [Appendix J - 2025 Alaska Mining Industry Overview]

1.1 PURPOSE OF THE ASSESSMENT

The purpose of this assessment is to evaluate how anticipated mineral production volumes, transportation constraints, and port characteristics interact to define feasible export systems for Alaska. The analysis is intended to inform infrastructure planning and investment decisions by identifying solutions that provide year-round operability, sufficient throughput capacity, and flexibility to accommodate future growth.

This report evaluates infrastructure performance at a system level. Emphasis is placed on scalability, operational reliability, and lifecycle performance as production volumes increase and multiple commodities are introduced.

1.2 SCOPE OF EVALUATION

This study is limited to the assessment of transportation corridors originating from the terminus of the Ambler Access Road at the Dalton Highway intersection and proceeding to proposed tidewater ports in Southcentral Alaska. The evaluation includes operations anticipated at intermodal transfer locations and export terminals, and defines the stages of transportation along the corridors and the capital improvements anticipated under the transportation scenarios and port sites evaluated.

The assessment is limited to commitments reflected in current environmental impact studies, including the use of containerized ore concentrate throughout transportation. A key factor in the logistical evaluation is the need for all-season concentrate export to support economic feasibility. Port sites or transportation methods that are seasonally restricted (i.e., summer-only operations) were not evaluated as part of this study.

High-level capital and operating cost considerations are incorporated to inform comparative feasibility among transportation alternatives and port sites. Detailed engineering design, mine development planning, project financing, and regulatory permitting are outside the scope of this report and are expected to be addressed separately as individual projects advance.

1.3 METHODS AND APPROACH

This study started with a thorough assessment of previous studies and documentation prepared to support the Environmental Impact Statement (EIS) for the Ambler Access Project (AAP). Additional documentation was provided by Ambler Metals LLC.

A series of stakeholder meetings were held, including consultations with Ambler Metals, the Alaska Railroad Corporation (ARRC), the Alaska Department of Transportation and Public Facilities (ADOT&PF) – Northern Region, and directors and representatives at the evaluated ports. Site-specific information, including existing infrastructure data and operational capacities, was collected for each port and relevant intermodal facility.

An in-depth evaluation of existing transportation and port infrastructure was performed to assess suitability for the ore concentrate export operations evaluated in this report. Consistent screening criteria was used to compare port and transportation alternatives.

Site visits were conducted at each of the port facilities and at the Fairbanks rail transfer yard to confirm collected data and allow the project team to meet in person with stakeholders to discuss current and planned operations.

Conceptual-level transportation upgrades, port layouts, and operating concepts were developed for each evaluated alternative to support planning-level comparison. Where existing facilities were constrained, these concepts were used to assess scalability and operational limits.

Planning-level cost estimates were prepared for the evaluated transportation and port scenarios, including capital expenditures (CAPEX) for anticipated improvements. This included the basis of cost estimates used with detailed capital expenditure estimates.

Port MacKenzie site plans and concept materials were developed. A high-level assessment of smelter and refinery facility footprint requirements was performed to inform planning-level discussion of potential downstream processing considerations.

1.4 SUPPORTING ANALYSES AND DOCUMENTATION

The findings presented in this report are supported by a combination of technical analyses, market assessments, and feasibility studies studied over multiple phases of work from 2020 - 2025. Mineral production outlooks, transportation system assumptions, and port infrastructure considerations draw on multiple sources developed to address different aspects of the overall evaluation. These materials are used to inform common assumptions, test feasibility under consistent scenarios, and provide traceability for key findings.

In order to maintain clarity and readability, each section of this report shows the evaluation approach, methodology, and output of each effort while detailed data, assumptions, and technical documentation used in the study are provided in the appendices and referenced throughout the study narrative.

In particular, the statewide mineral production context and Port MacKenzie infrastructure concepts are supported by the Ausenco Technical Memorandum (Appendix B – Ausenco Memorandum). This analysis further evaluates aggregate mineral production volumes, port capacity requirements, operating concepts, and planning-level capital costs developed in early stages of the assessment.

The conclusions and comparative evaluations presented herein are based on the integrated assessment of statewide production, transportation systems, port characteristics, and cost considerations developed across all supporting analyses.

2. ALASKA MINING PRODUCTION OUTLOOK

2.1 OVERVIEW OF STATEWIDE MINERAL PRODUCTION

Alaska contains significant undeveloped mineral resources, including copper, zinc, lead, precious metals, and coal, distributed across multiple regions of the state. Many of these resources are located in areas with limited existing infrastructure, requiring long-distance transportation to reach processing facilities and export terminals. As additional mining projects advance from exploration to production, aggregate mineral volumes are expected to increase, placing growing demands on shared transportation corridors and port facilities.

The production outlook presented in this section establishes the range of mineral volumes that transportation and port infrastructure may be required to support under both near-term and longer-term development conditions. While the Ambler Mining District provides an important near-term reference case for comparison of capital cost and infrastructure improvements, statewide production potential is considered to reflect cumulative infrastructure demand resulting from multiple projects operating concurrently.

2.2 STATEWIDE DATA SOURCES AND ANALYTICAL APPROACH

The statewide production outlook analyses highlighted in Section 2.4 Statewide Baseline Production Outlook and 2.5 Statewide Upside and Maximum Production Scenarios are detailed in the Appendix B – Ausenco Memorandum and is informed by a market review of mineral properties across Alaska, incorporating publicly available technical reports, historical production data, and project development information. Properties were screened to identify those relevant for infrastructure planning, with inactive, closed, and placer operations excluded from further consideration. Remaining properties were grouped by region, commodity type, and development stage to support aggregation at a planning level rather than reliance on individual mine plans.

Production estimates combine reported output from operating and advanced-stage projects with planning-level assumptions applied to earlier-stage properties. This approach allows the analysis to reflect both known production commitments and potential future contributions without overstating near-term certainty. To represent uncertainty in project advancement and timing, scenario-based realization factors were applied by development stage to translate resource-level potential into plausible throughput ranges for infrastructure evaluation.

Export and domestic processing pathways were evaluated as alternative development cases to bound infrastructure requirements, with domestic processing assumed to offset export volumes to avoid double-counting. However, the primary port planning consideration is not export tonnage alone, but whether a candidate port has sufficient land and layout flexibility to accommodate large-scale bulk export terminals alongside potential concentrate handling, separation, and refining facilities. This includes allowance for high-capacity bulk terminals recognizing that not all producers will utilize containerized transport.

2.3 AMBLER MINING DISTRICT PRODUCTION ASSUMPTIONS

The Ambler Mining District is expected to be among the first new sources of large-scale base metal production in Alaska. Mineralization within the district supports concentrate production over extended mine lives, with anticipated output requiring regular, year-round transportation and export.

During the initial stages of the study, production rates used to establish baseline throughput conditions are derived from feasibility-level work completed for the Ambler Access Project and from production assumptions documented in the Ambler Road Final Environmental Impact Statement (2020) and Supplemental Environmental Impact Statement (2024). **These estimates were used provide a practical reference case for evaluating transportation and port system performance under sustained operating conditions**. The AAP Technical Assessment studies are detailed in Appendix D.1 – AAP Screening Criteria, Appendix D.2 – AAP Transportation Options, and Appendix D.6 – AAP Logistics and Operations.

It is noted that production rates for the Arctic and Bornite deposits reflected in the Ambler EIS may be conservatively high. Based on discussions with Ambler Metals LLC, concentrate production rates are estimated to be approximately 20 to 30 percent lower than those reflected in the EIS, and production from the Arctic and Bornite sites is not expected to occur concurrently. These considerations reduce peak annual output and are reflected in the baseline throughput assumptions used for infrastructure planning.[4]

While Ambler production alone does not define statewide infrastructure requirements, it establishes an initial load case against which transportation corridors, intermodal facilities, and port operations can be evaluated.

2.4 STATEWIDE BASELINE PRODUCTION OUTLOOK

In addition to Ambler, mineral production is anticipated from interior, southcentral, and western Alaska. These regions include a mix of operating mines, advanced development projects, and known coal resources. Baseline statewide production estimates reflect output from projects with a higher likelihood of reaching commercial operation within the planning horizon, based on development stage, permitting status, and available production data.

When considered collectively, baseline production from multiple regions results in export volumes that exceed those associated with a single mining district. These overlapping flows are relevant for infrastructure planning because transportation corridors and port facilities must be capable of accommodating concurrent shipments from multiple sources rather than sequential, project-specific operations. Baseline production estimates by region and commodity are summarized at a planning level in Table 2-1, with detailed supporting data provided in the Ausenco Technical Memorandum (Appendix B – Ausenco Memorandum).

TABLE 2-1: BASELINE STATEWIDE PRODUCTION FORECAST (RESULTS IN T/Y)

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Interior	0	0	1,000,000	0
Ambler	160,850	116,667	1,329,400	0
South	983,275	0	0	0
Total Base Metal Concentrate	507,915	116,667	1,329,400	0
Total Coal	636,209	0	1,000,000	0
Total All Minerals	**1,144,125**	**116,667**	**2,329,400**	**0**

4 Discussions with Ambler Metals LLC (2024–2025); Ambler Road Final EIS (2020) and Supplemental EIS (2024).

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2.5 STATEWIDE UPSIDE AND MAXIMUM PRODUCTION SCENARIOS

To account for uncertainty in project timing, permitting outcomes, and market conditions, production outlooks were evaluated across multiple scenarios. The upside and maximum scenarios shown in Table 2-2 and Table 2-3 reflect increased participation from earlier-stage projects, higher realization rates, and expanded coal and base metal production beyond baseline assumptions.

Coal production represents a significant contributor to higher-volume scenarios. While no coal resources are identified within the Ambler Mining District, existing and proposed coal operations in interior and southcentral Alaska materially increase aggregate throughput under upside and maximum conditions. Including coal in these scenarios provides a more representative picture of long-term port demand, particularly where coal and base metal concentrates may share storage, handling, and vessel loading infrastructure.

Scenario-based production estimates establish upper bounds on potential throughput and inform the scale, flexibility, and expansion capability required of transportation and port infrastructure.

TABLE 2-2: UPSIDE STATEWIDE PRODUCTION FORECAST (RESULTS IN T/Y)

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Interior	300,000	0	1,000,000	0
Ambler	289,532	157,500	1,329,400	0
South	1,889,913	0	0	0
Total Base Metal Concentrate	1,334,257	157,500	1,329,400	0
Total Coal	1,145,188	0	1,000,000	0
Total All Minerals	**2,479,445**	**157,500**	**2,329,400**	**0**

TABLE 2-3: MAXIMUM STATEWIDE PRODUCTION FORECAST (RESULTS IN T/Y)

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Interior	500,000	0	1,000,000	0
Ambler	482,554	175,000	1,329,400	0
South	3,149,855	0	0	0
Total Base Metal Concentrate	2,223,761	175,000	1,329,400	0
Total Coal	1,908,647	0	1,000,000	0
Total All Minerals	**4,132,409**	**175,000**	**2,329,400**	**0**

3. TRANSPORTATION SYSTEM EVALUATION

The transportation system evaluation establishes the operating assumptions and system constraints used to evaluate port candidates identified in Section 4. Port Candidate Evaluation. Transportation mode selection, intermodal transfer requirements, and corridor performance directly affect port site suitability, upland space requirements, and the scale and complexity of port operations.

This section defines how mineral concentrates are assumed to move from inland production areas to tidewater, identifies the functional interfaces between trucking, rail, and port facilities, and outlines the transportation conditions under which port alternatives are evaluated. The results provide a consistent framework for comparing port sites under common throughput, reliability, and operational assumptions.

3.1 AMBLER-SPECIFIC TRANSPORTATION BASIS

The transportation system evaluation presented in this section is anchored in the Ambler Mining District because Ambler provides the only near-term, feasibility-level reference case for mineral concentrate transport in Alaska that extends from mine site to tidewater. Transportation assumptions for Ambler are defined through completed environmental review and project-level technical studies, including the Ambler Access Project Final Environmental Impact Statement (2020) and Supplemental Environmental Impact Statement (2024).[5]

As a result, early Ambler-specific production estimates were used to establish a consistent and well-documented baseline for evaluating transportation modes, corridor performance, and intermodal transfer requirements. These assumptions define how concentrates are handled, the frequency and reliability of movements required to support continuous operations, and the interfaces between trucking, rail, and port facilities. The transportation analysis in this section therefore reflects project-specific operating conditions rather than generalized or market-based transport demand.

3.2 RELATIONSHIP TO STATEWIDE MARKET ASSESSMENT

The Ambler-based transportation evaluation provides the operational framework used to compare port alternatives, while the Ausenco statewide assessment informs the scale and expansion potential required to accommodate cumulative statewide mineral export demand.

The Ausenco Technical Memorandum (Appendix B – Ausenco Memorandum) evaluates projected statewide mineral volumes at a market level to inform port sizing, land use, and long-term expansion requirements. It does not define project-level transportation routing, corridor performance, or intermodal operating conditions. The AAP Technical Assessments documented in Appendix D.1 – AAP Screening Criteria, Appendix D.2 – AAP Transportation Options, and Appendix D.3 – AAP Transportation Option Concepts examine feasible transportation routes, intermodal transfer locations, and port interfaces necessary to support concentrate export from Ambler under defined production assumptions. Its detailed route screening, engineering constraints, and upgrade concepts are retained as supporting technical documentation and are provided in the appendices referenced throughout this section.

5 Ambler Access Project Final Environmental Impact Statement, Bureau of Land Management, 2020; Ambler Access Project Supplemental Environmental Impact Statement, Bureau of Land Management, 2024.

The transportation system evaluation relies on Ambler-specific transportation definitions to establish realistic system performance parameters, including containerized handling assumptions, intermodal transfer locations, and year-round operational requirements. These parameters are applied consistently when evaluating port candidates, ensuring that port alternatives are assessed under operating conditions aligned with demonstrated project feasibility rather than aggregate volume forecasts.

3.3 AMBLER MINING DISTRICT OVERVIEW AND TRANSPORTATION-RELEVANT CHARACTERISTICS

The Ambler Mining District is located south of the Brooks Range within the Northwest Arctic Borough and is commonly referred to as the Ambler Mineral Belt due to its high concentration of mineral occurrences and active mining claims. More than 1,300 active claims have been identified within the district, reflecting decades of exploration and evaluation. Documented mineralization includes copper, zinc, lead, silver, gold, and associated critical minerals such as cobalt and molybdenum, with multiple deposits demonstrating economic development potential.[6]

Four deposits form the basis for the transportation assumptions applied in this assessment: Arctic, Bornite, Sun, and Smucker. These deposits represent the most advanced and best-characterized resources within the district and collectively define the anticipated scale, duration, and consistency of concentrate production relevant to transportation system planning. Summary resource estimates, concentrate products, production rates, and mine lives for these deposits are presented in Table 3-1, based on data reported in the Ambler Access Project Environmental Impact Statement.

TABLE 3-1: MINESITE OVERALL CONCENTRATE RECOVERIES (AMBLER EIS)

Item	Arctic	Bornite	Sun	Smucker
2018 Resource (metric tonnes)	43 million	182 million	11 million	11.6 million
Concentrate Products	Cu, Zn, Pb, Ag, Au	Cu, Co	Cu, Zn, Pb, Ag, Au	Cu, Zn, Pb, Ag, Au
Mill Throughput (tonnes/day)	10,000	14,250	5,000	5,000
Production Rate (short wet tons/day)	**1,507**	**784**	**548**	**548**
Mine Life (years)	12	35	6	5
Annual/Daily Concentrate Production	1,334,257	157,500	1,329,400	0
(short wet tons)	550,000/1,507	286,000/784	200,000/548	200,000/548

At present, the Ambler Mining District is not connected to Alaska's surface transportation network. Access to the region is limited to aircraft and seasonal overland travel using snowmachine or ice road routes. The absence of permanent transportation infrastructure has been the principal constraint on mine development despite the scale and quality of known mineral resources.

6 DOWL, Ambler Mining District Mineral Resource Summary, 2016.

3.3.1 Development History and Access Context

The Ambler Mining district has long been identified as a high-value site for potential mineral development.[7] Since the 1960's it has been subject to extensive exploration, verification, and feasibility studies throughout its history. At that time, one of the most significant hurdles in developing the resources has been the establishment and maintenance of access routes to the site. Valhalla Metals Inc., and Teck, the current owners of the Sun and Smucker deposits, and Ambler Metals (previously under the name NovaCopper, now a JV between Trilogy Metals and South 32), the current owners of the Arctic and Bornite deposits, have been preparing for the access development since acquiring the deposits. The remote location and lack of transportation infrastructure have prohibited production within the district.

In 1980, congress passed the Alaska National Interest Lands Conservation Act (ANILCA), which established most of the national parklands within Alaska, including the Gates of the Arctic National Park located adjacent to the Ambler Mining District. As part of this legislation, ANILCA specifically recognized the need for access by surface transportation across the federal lands to allow the development of the Ambler Mining District.

3.3.2 Mining Operations and Concentrate Handling Assumptions

Transportation assumptions applied in this assessment are based on the proposed mining and processing approach for the four primary Ambler deposits. Each deposit is assumed to be developed as a standalone mine site with on-site crushing, milling, and flotation facilities. Ore would be processed to produce one or more mineral concentrates depending on deposit characteristics.

Following processing, concentrates are assumed to be thickened, pressure-filtered, and loaded into specialized 20-foot intermodal bulk containers commonly referred to as rotainers. These containers are designed for sealed handling and compatibility with both truck and rail transport, allowing concentrates to move through the transportation system without intermediate re-handling.

FIGURE 3-1: ROTAINER "TYPE B" FOR METAL CONCENTRATES

FIGURE 3-2: "ROTAINERS" IN STACKED STORAGE (5-HIGH CAPABLE)

Export of concentrate from the district is assumed to rely on a dedicated industrial access road capable of accommodating heavy truck traffic between mine sites and the Dalton

7 "The Shungnak Region, Kobuk Valley" By PHILIP S. SMITH and HENRY M. EAKIN. https://pubs.usgs.gov/bul/0480j/report.pdf

Highway corridor. The Ambler Access Road is assumed to be privately owned and restricted to industrial use. Individual mine sites would connect to the main access corridor via capillary roads, including an access road linking the Arctic deposit to the primary corridor.

Previously Studied Transport Alternatives

Narrow-gauge rail, both along the proposed AAP road corridor and connecting to the ARRC rail system adjacent to the Parks Highway, was assessed during the development of the EIS and found to be impractical. Alternative road or rail corridors extending from the mining district to the west (Kotzebue/Cape Blossom and the DeLong Mountain Transportation System [DMTS]), shown in Figure 3-3 were assessed but eliminated from consideration due to not having a rational ending point with an all-season (ice-free) port.

The preferred and advanced alternative for the AAP consists of a new road corridor from the mining district progressing east where it intersects with the Dalton Highway at approximately MP 161, with the alignment of the road selected based on minimizing environmental impact. The proposed 211-mile road corridor would support the development, operations, and export of products for mines contained within the Ambler Mining District.

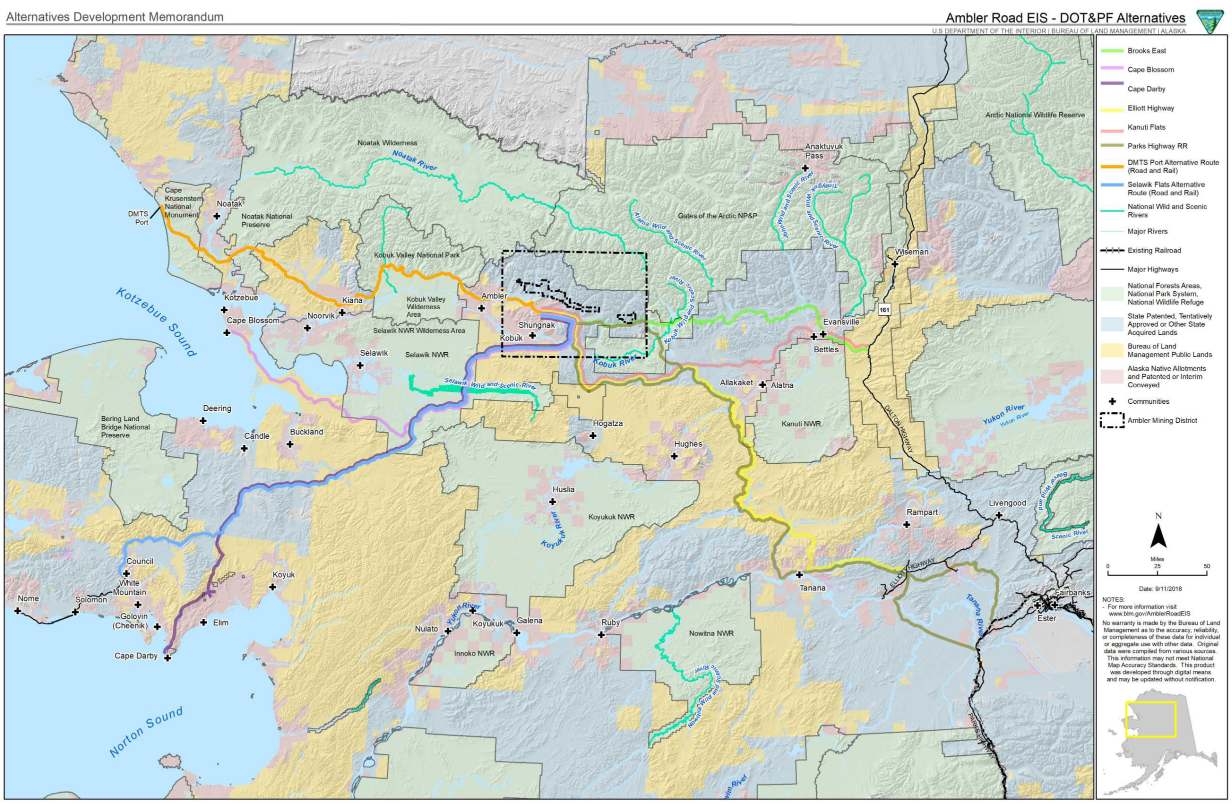

FIGURE 3-3: PREVIOUS AMBLER ROUTE STUDIES (AMBLER EIS)

These mining and handling assumptions define the form, frequency, and reliability requirements for concentrate transport evaluated in subsequent sections. They establish the physical and operational characteristics that underpin the translation of production volumes into transportation demand and inform the evaluation of trucking, rail, and port system performance.

3.4 TRANSLATION OF PRODUCTION VOLUMES TO TRANSPORTATION DEMAND

To evaluate transportation system performance under realistic operating conditions, annual production volumes were translated into transportation demand using defined handling methods, operating schedules, and modal constraints documented in the AAP Technical Assessments (Appendix D.1 – AAP Screening Criteria and Appendix D.6 – AAP Logistics and Operations). **This step links the updated statewide production forecasts presented in Section** 2. Alaska Mining Production Outlook **to the Ambler-specific production forecasts used as the comparison standard.**

Annual concentrate volumes were converted into representative daily movement requirements to reflect continuous operations rather than episodic or campaign-based shipping. This approach allows transportation systems to be evaluated based on sustained throughput and the capacity of corridors and intermodal interfaces to accommodate regular flows under steady-state conditions. Supporting assumptions used to translate production volumes into transportation demand are provided in Appendix D.6 – AAP Logistics and Operations.

For the statewide assessment, these calculations draw on operating assumptions developed under the Ambler Access Project, with modifications applied to reflect broader commodity mixes and transportation modes at a planning level. Supporting assumptions, including the treatment of bulk and containerized concentrate movements used for statewide scenarios, are documented in Appendix D.6 – AAP Logistics and Operations and Appendix B – Ausenco Memorandum.

Transportation demand was evaluated for the primary transportation modes, trucking and rail, using containerized concentrate handling parameters established through the Ambler Access Project. Mode utilization reflects operational feasibility, corridor characteristics, and intermodal transfer requirements as documented in the technical assessment, rather than cost optimization or market-driven routing decisions.

3.5 TRANSPORTATION MODES AND MOVEMENT ASSUMPTIONS

3.5.1 Truck Transportation

Truck transportation is used in all transportation scenarios evaluated as the initial means of moving concentrate from the Ambler Mining District to downstream intermodal transfer locations and, in certain cases, directly to port facilities.

Truck operations were evaluated using highway-legal tractor–trailer configurations consistent with current Alaska freight practice and applicable regulatory requirements. These configurations reflect statutory limits on axle loads and gross vehicle weight, practical operating limits associated with sustained grades, and corridor-specific geometric constraints identified along the Dalton Highway and connecting routes.

Two representative truck configurations were developed for the technical assessment to evaluate transportation performance under differing operating conditions: a single-trailer configuration consistent with unrestricted operation on the public highway system, and a double-trailer configuration evaluated for use on the Ambler Access Road and other controlled segments where geometry, ownership, and operating conditions could support higher-capacity hauling. These configurations were used to evaluate differences in truck volumes, corridor loading, and intermodal transfer requirements.

Driver availability and regulatory compliance were incorporated as operating constraints in the evaluation. Truck operations were assumed to comply with the Federal Motor Carrier Safety Administration 80-Hour, 8-Day rule applicable in Alaska, as established under Title 49 of the Code of Federal Regulations. These requirements influence achievable haul cycles, crew scheduling, and effective vehicle utilization over long-distance corridors.

Annual concentrate volumes were translated into representative daily truck movements to evaluate loading on key transportation corridors, requirements for truck staging and transfer at intermodal facilities, and truck access and queuing conditions at port terminals. Corridor-specific truck volumes, vehicle assumptions, and supporting calculations are documented in Appendix D.6 – AAP Logistics and Operations.

3.5.2 Rail Transportation

Rail transport criteria were established in consultation with the Alaska Railroad Corporation (ARRC). ARRC currently has a maximum annual tonnage capacity of approximately 10 million gross tons and a maximum annual train count of 700 trains.

For a simplified study, the standard 110-ton rail car payload capacity was assumed for all port locations, with each train carrying 45 rail cars holding three containers each, for a total of 135 containers per train.

Under existing conditions, rail served port facilities evaluated in this study are generally constrained to train lengths of approximately 45 rail cars, reflecting terminal layout, yard geometry, and switching limitations rather than mainline rail capacity. These constraints define the practical upper bound for current rail delivery to tidewater under existing infrastructure.

Completion of the Port MacKenzie rail connection and associated rail loop would materially change this condition by enabling longer train consists on the order of up to 110 rail cars, thereby improving operating efficiency and reducing unit transportation costs at higher throughput levels. Rail configuration assumptions and capacity implications associated with the Port MacKenzie concepts are documented in Appendix D.2 – AAP Transportation Options and Appendix G – Port Operation Concepts.

3.6 PORT REQUIREMENTS

3.6.1 Vessels

The exact vessel sizes and tonnage used for concentrate export will depend on individual producers' chartering arrangements and target smelter locations. Typical vessels used for trans-Pacific concentrate shipping have a deadweight tonnage (DWT) on the order of 45,000 metric tonnes. For the purposes of the initial study, vessel sizes ranging from approximately 30,000 to 50,000 DWT were evaluated, corresponding to Handymax and Supramax class vessels.[8]

A single concentrate will rarely exceed approximately 30,000 tonnes of product in a single vessel due to insurable liability considerations. Accordingly, the design vessel developed for this evaluation is a Handymax-class bulk carrier with a nominal capacity of 50,000

8 Coal exports in the Ausenco Technical Memorandum (Appendix B – Ausenco Memorandum) were in 75,000 parcels with larger vessels.

DWT, a length overall (LOA) of approximately 728 feet, a beam width of approximately 106 feet, and a fully laden draft of approximately 41 feet. Vessel particulars were selected to be representative of approximately 99 percent of vessels within the Handysize class.

The design vessel includes five cargo holds, each capable of carrying approximately 10,000 tonnes of concentrate. For evaluation purposes, concentrate volume from Ambler is assumed to be limited to approximately 30,000 tonnes per vessel, with the remaining capacity utilized by other customers in the North American region or by future exporters through the selected port. Vessel loading was assumed to occur in a manner that maintains vessel balance, with the first two holds half-loaded and subsequently completed once loading of the third hold is underway.

Note: *Vessel sizes and loading efficiencies associated with mineral export are constrained by available water depth, berth configuration, and channel maintenance requirements at each port. Ports that rely on routine dredging, including the Port of Alaska, are effectively limited to smaller vessel classes under typical operating conditions due to controlling depths on the order of approximately 35 feet mean lower low water (MLLW).*

Port MacKenzie is located in a naturally deep-water setting with a stated controlling depth of approximately 60 feet MLLW, allowing accommodation of larger bulk vessels and improved loading efficiency as export volumes increase. As projected statewide production grows beyond near-term Ambler volumes, these depth-related constraints become increasingly relevant to sustaining higher throughput and supporting larger parcel sizes, as discussed in Section 2. Alaska Mining Production Outlook.

3.6.2 Container Storage

Each port site was evaluated for the availability of a core container storage area sufficient to accommodate at least one vessel load of concentrate containers. Assuming an export volume of approximately 30,000 tonnes of concentrate per vessel, core storage requirements correspond to approximately 1,000 containers staged at the port.

An additional allowance of approximately 20 percent was included in the evaluation of core storage areas to provide short-term surge capacity and operational flexibility during vessel loading operations. In addition to core storage requirements, each port site was evaluated for the availability of additional space that could support overflow storage or future expansion.

3.6.3 Handling and Loading Equipment

Each port site was assessed for the complement and extent of new equipment required for container unloading/loading operations, in-port drayage, and ship-loading activities. Port sites that do not currently have existing on-berth cranes suitable for delivering containers over the berth onto ships are assumed to require a new mobile harbor crane for ship loading.

3.6.4 Supporting Infrastructure

Each port site was assessed for existing ancillary infrastructure that could support containerized operations. These include but are not limited to general accessibility, sitewide roads, administration buildings, workshops, security, lighting, utilities, and snow handling.

3.7 TRANSPORTATION OPTIONS CONSIDERED

This study evaluates a defined set of road- and rail-based transportation options for moving mineral concentrates from the Ambler Mining District to the identified port sites[9]. All options assume an access road capable of supporting double-trailer truck operations between the mine sites and the Dalton Highway. From the Dalton Highway intersection, transportation configurations vary based on the use of single- or double-trailer trucking, the incorporation of rail transport, and the location of intermodal transfer facilities.

Intermodal transfer, where required, is assumed to occur either at existing Alaska Railroad Corporation (ARRC) facilities in Fairbanks or at a new, purpose-built intermodal yard at Livengood on ARRC property. The scale and nature of capital investments required to support concentrate transportation vary across the options evaluated. Alternatives that rely on double-trailer trucking beyond the Ambler Access Road would require upgrades to the Dalton Highway corridor, while alternatives incorporating rail service originating at Livengood would require construction of the Dunbar–Livengood rail extension. Five general transportation options applicable to each port candidate were identified for evaluation, as shown in Figure 3-4.

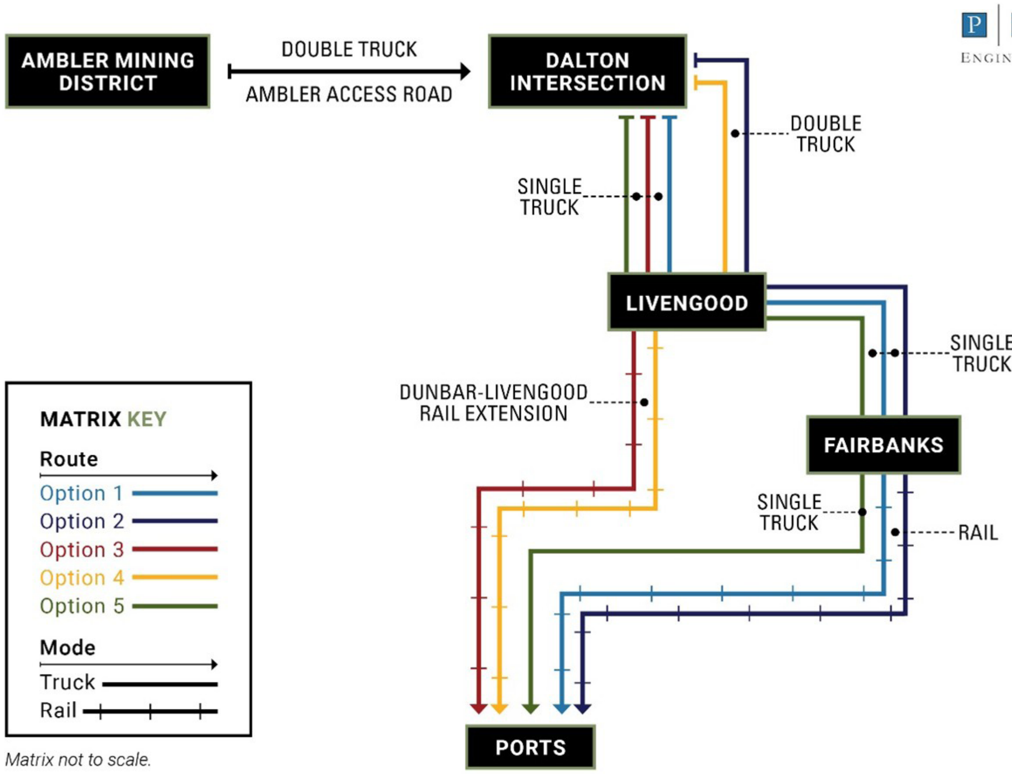

FIGURE 3-4: AAP GENERAL TRANSPORTATION OPTIONS MATRIX

9 This section draws primarily on transportation analyses developed under the Ambler Access Project and is provided to illustrate system behavior and cost sensitivity rather than to represent a comprehensive reevaluation of statewide transportation options. While additional production volumes were not used to redefine transportation scenarios in this section, improvements to transportation efficiency and cost structure may influence the economic feasibility of future mining development as statewide production increases (see Section 2. Alaska Mining Production Outlook).

Summary of considered options:

- **OPTION 1:** Base transportation scenario contained in previous studies and the AAP EIS. A single-trailer truck from the Dalton Transfer Yard to Fairbanks rail yard, then rail transport to ports.
- **OPTION 2:** Double-trailer truck from the Dalton Transfer Yard to Livengood, single-trailer truck to Fairbanks rail yard, then rail transport to ports.
- **OPTION 3:** Single-trailer truck from the Dalton Transfer Yard to Livengood, then rail transport to ports using a newly constructed Dunbar-to-Livengood rail segment that bypasses Fairbanks.
- **OPTION 4:** Double-trailer truck from the Dalton Transfer Yard to Livengood, then rail transport to ports using a newly constructed Dunbar-to-Livengood rail segment that bypasses Fairbanks.
- **OPTION 5:** Single-trailer trucks from the Dalton Transfer Yard directly to the respective ports.
- **Two additional sub-options were evaluated for transport to Port MacKenzie:** (1) rail directly to the Port enabled by fully completing the Port Mackenzie rail extension project, or, (2) rail to Houston, then trucking from Houston to the Port using the existing semi-completed rail embankment upgraded to be a road.

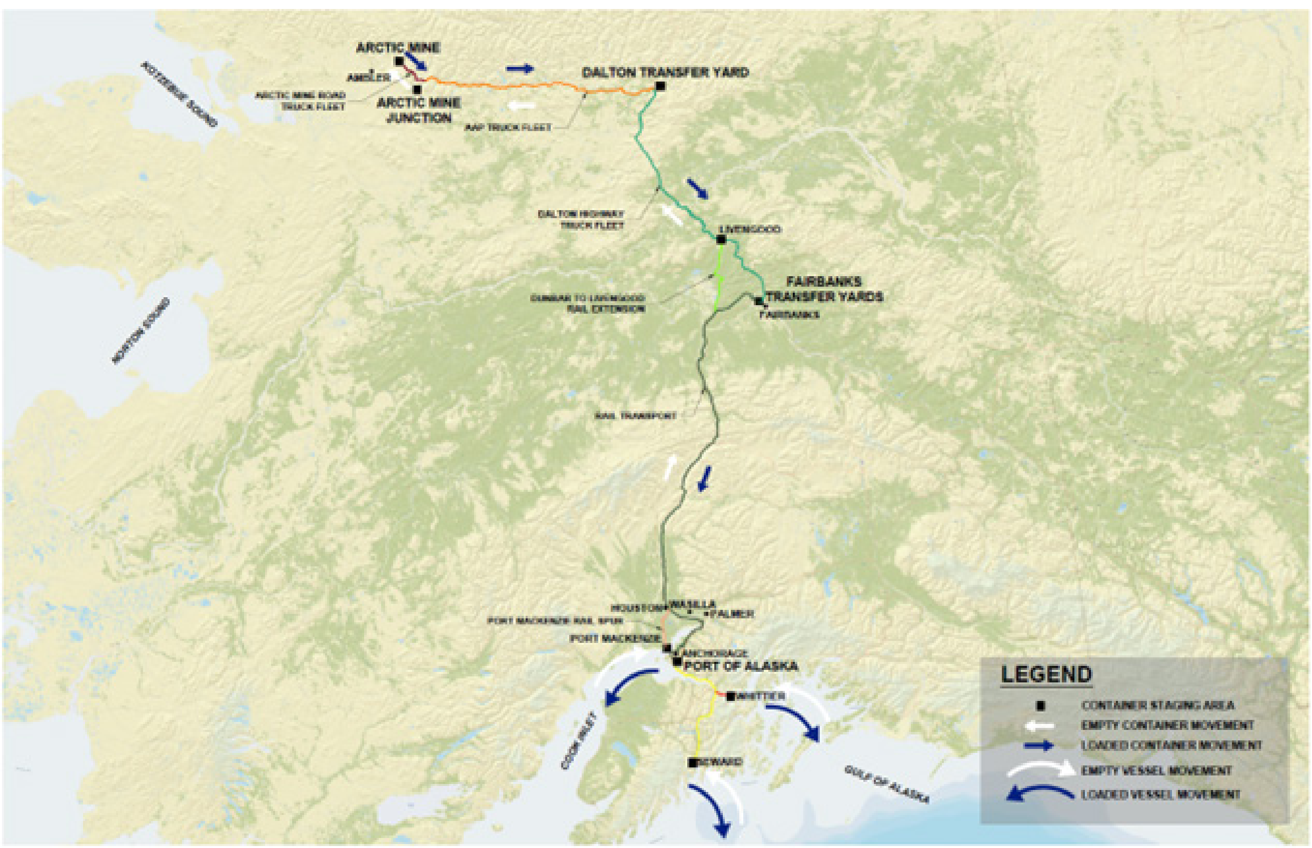

FIGURE 3-5: AAP ROUTE MAP

3.7.1 Existing Infrastructure Evaluation Methodology

The transportation system evaluation incorporates a review of existing road, rail, and intermodal infrastructure to establish baseline operating conditions and identify constraints relevant to concentrate transport. The assessment focused on functional capacity, geometric suitability, operational limitations, and compatibility with the transportation modes evaluated in this study, rather than on detailed condition assessments or asset-level inspections.

Existing infrastructure was evaluated based on publicly available data, agency input, prior technical studies, and site visits where applicable.

- **For roadway corridors,** the evaluation considered alignment characteristics, grades, bridge capacity, lane configuration, and seasonal operating constraints that influence allowable vehicle configurations and operating efficiency.
- **For rail infrastructure,** the assessment considered network connectivity, nominal capacity, operating practices, and interface requirements with intermodal and port facilities, as informed by consultation with the Alaska Railroad Corporation.
- **Intermodal facilities** were evaluated based on available land, access geometry, operational flexibility, and compatibility with containerized concentrate handling. The evaluation emphasized the ability of existing facilities to support sustained, year-round operations under the range of transportation options evaluated, recognizing that certain infrastructure elements may function adequately under lower volumes but become constraining as throughput increases.

3.7.2 Existing Transportation Infrastructure Evaluated

The basic physical capacities and constraints of each road section below comprise the distinct sections of road along the transport route between the Ambler Mining District and the potential ports.

- **Existing Road Infrastructure**
  - Dalton Highway – Hwy 11
  - Elliott Highway – Hwy 2
  - Steese Highway – Hwy 2
  - Johansen Expressway
  - Parks Highway – Hwy 3
  - Glenn Highway – Hwy 1
  - Municipality of Anchorage Roads
  - Seward Highway
  - Existing Bridge Infrastructure
- **Existing Rail Infrastructure**
  - ARRC Rail Yard
  - Alaska West Express Rail Yard

3.7.3 Capital Improvements Evaluation Methodology

Where existing infrastructure was identified as insufficient to support the transportation options evaluated in this study, capital improvements were identified at a conceptual level to enable planning-level assessment of transportation feasibility. The identification of capital improvements was intended to establish the type and scale of infrastructure required to support each transportation configuration, rather than to define detailed designs, construction methods, or implementation sequencing.

Capital improvements were developed based on the functional requirements of the transportation system, including allowable vehicle configurations, target throughput levels, intermodal transfer needs, and year-round operational reliability. Improvements were identified through comparison of transportation option requirements with existing infrastructure capabilities, informed by agency input, prior studies, and corridor-specific constraints documented in Appendix D.2 – AAP Transportation Options.

- **For roadway infrastructure,** capital improvements were identified where existing geometry, pavement structure, bridge capacity, or operational constraints limited the feasibility of single- or double-trailer trucking under sustained operations.
- **For rail infrastructure,** improvements were identified where additional rail connectivity, terminal capacity, or operational flexibility would be required to support intermodal transfer or increased reliance on rail transport. Intermodal facility improvements were identified where new or expanded facilities would be necessary to support container handling, truck–rail transfer, or staging requirements.

Capital improvements were evaluated consistently across transportation options to allow comparison of infrastructure intensity, operational complexity, and scalability as production volumes increase. Improvements were not prioritized or ranked and should not be interpreted as recommended projects. Detailed descriptions of capital improvement concepts and supporting assumptions are provided in Appendix D.3 – AAP Transportation Option Concepts.

3.7.4 Capital Improvements Evaluated

Corridor improvements evaluated in this study support either road-based or rail-based transportation depending on implementation. Where a capital improvement reflects the development or conversion of a transportation corridor rather than an active rail system, it is grouped under roadway infrastructure improvements, even where rail service is one potential outcome.

- **Road Infrastructure Improvements**
  - Dalton Transfer Yard
  - Dalton highway Upgrades
  - Livengood Transfer Yard
  - Port MacKenzie Rail Extension and Converted Road
- **Rail Infrastructure Improvements**
  - Fairbanks Transfer Yard
  - Dunbar-Livengood Rail Extension
  - Livengood Transfer Yard
  - Port MacKenzie Rail Extension

3.7.5 Rail and Intermodal Facility Improvement Concepts

Rail and intermodal facility improvement concepts, including the Dunbar–Livengood rail extension and intermodal yard layouts, are documented in Appendix D.3 – AAP Transportation Option Concepts and Appendix H – Rail and Intermodal Concepts.

4. PORT CANDIDATE EVALUATION

This section evaluates candidate port sites for their ability to support containerized mineral concentrate export under the transportation system assumptions defined in Section 3. Transportation System Evaluation. Ports are assessed as components of an integrated logistics system rather than as standalone facilities, with emphasis placed on operational feasibility, scalability, and compatibility with sustained, year-round export operations.

The port evaluation is conducted at a planning level and is intended to support comparative assessment across multiple port alternatives. The analysis does not define final terminal layouts, construction sequencing, or operating agreements, nor does it recommend a preferred port. Instead, it identifies key operational characteristics, constraints, and expansion considerations relevant to concentrate export under common transportation assumptions.

4.1 EVALUATION BASIS AND ASSUMPTIONS

Port evaluations are based on the transportation configurations described in Section 3. Transportation System Evaluation, including truck and rail access, intermodal transfer locations, containerized concentrate handling, and representative vessel characteristics. Each port is evaluated under consistent assumptions regarding container staging requirements, ship loading operations, and throughput associated with baseline and higher production scenarios.

The assessment assumes containerized handling of mineral concentrates using sealed intermodal containers, with port operations structured to support regular vessel calls and sustained throughput rather than episodic or campaign-based shipping. Vessel sizes evaluated are representative of bulk carriers commonly used for concentrate export and are selected to reflect realistic operating conditions at each port.

The port evaluation relies on a combination of publicly available information, stakeholder input, site visits where available, and technical analyses developed as part of this study. Detailed port evaluation findings and supporting technical assumptions are provided in Appendix D.4 – AAP Port Assessments and Appendix D.5 – AAP Port Assessment Site Plans with representative operational layouts and handling concepts summarized in Appendix G – Port Operation Concepts, and are referenced throughout this section where applicable.

4.2 INDIVIDUAL PORT ASSESSMENTS

Detailed port-specific infrastructure conditions and evaluation findings are documented in the Individual Port Assessments compiled in Appendix D.4 – AAP Port Assessments and Appendix D.5 – AAP Port Assessment Site Plans, with supporting logistics, capital improvement concepts, and cost estimating assumptions provided in the relevant appendices referenced throughout this report.

The Individual Port Assessments are provided to support transparency and traceability of the port candidate evaluation. Taken by themselves, they are not intended to present comparative conclusions or to recommend a preferred port, but rather to document the standardized method for underlying conditions, assumptions, and requirements associated with each port under the transportation scenarios evaluated in this study.

4.2.1 Site Plan and Port Operation Concepts.

For each port assessment, site plans and port operation concepts were developed documenting existing conditions and future development concepts at both a port-wide context scale and a focused study-area scale to support evaluation of overall port constraints and site-specific layout development. These plans form the basis of the logistics and operations assumptions described in Section 4.3 Logistics and Operations Requirements per Transportation Option and the port-related cost estimates summarized in Section 4.4 Cost Estimates.

Port-specific site plans and port operation concepts supporting the Individual Port Assessments are provided at full size in Appendix G – Port Operation Concepts for the following port terminals:

- Port of Alaska (Anchorage)
- Port MacKenzie (Arrival by Truck)
- Seward
- Whittier

Full size drawings supporting intermodal transfer and transportation facilities, including the Alaska Railroad Corporation yard in Fairbanks and the Houston and Livengood intermodal sites, are documented separately in Appendix H – Rail and Intermodal Concepts as part of the rail and transportation capital improvements and are referenced where relevant to port operations.

4.3 LOGISTICS AND OPERATIONS REQUIREMENTS PER TRANSPORTATION OPTION

Logistics and operations concepts were developed for each transportation option to define how containerized mineral concentrate is assumed to move through the transportation and port system under the assumptions described in Section 3. Transportation System Evaluation. These concepts establish consistent operating frameworks for evaluating feasibility, equipment requirements, storage needs, labor demands, and interfaces between trucking, rail, intermodal facilities, and port terminals.

The logistics and operations analysis addresses transportation options as end-to-end systems rather than as isolated segments. For each option, material flow is traced from mine site through intermediate transfer locations, where applicable, to the receiving port and vessel loading operations. Under all options evaluated, container tracking is assumed to be maintained throughout the logistics chain using RFID-based identification to support inventory control and operational coordination.

Operational concepts were developed to reflect steady-state, peak-production conditions sufficient to support regular vessel calls rather than episodic or campaign-based shipping. Cycle times, equipment utilization, storage capacities, and transfer rates were defined at a planning level to test whether each transportation option could reasonably support sustained concentrate export under the production scenarios evaluated. These assumptions form the basis for the capital equipment requirements and operating cost estimates presented elsewhere in this report.

Port-side operational context and port-specific constraints are described in the Individual Port Assessments provided in Appendix D.4 – AAP Port Assessments. The logistics and operations material summarized in Appendix D.6 – AAP Logistics and Operations focuses on transportation-driven operational requirements and differences between transportation options, recognizing that port operations themselves are not anticipated to vary significantly based solely on the upstream transportation alternative..

Detailed descriptions of logistics flows, equipment assumptions, cycle times, and transfer yard operations for each transportation option, including associated figures and tables, are provided in Appendix D.6 – AAP Logistics and Operations. The appendix also documents how these operating concepts were used to inform planning-level capital and operating cost estimates identified in Section 4.4 Cost Estimates.

4.4 COST ESTIMATES

4.4.1 Capital Expenditures (CAPEX) Estimates

CAPEX estimates were developed for individual cost elements using a work breakdown structure (WBS) approach. These elements were subsequently aggregated for each transportation alternative and associated port site combination evaluated in this study. Initial CAPEX estimates are provided in Appendix F.1 – CAPEX Cost Estimates while a full port development CAPEX estimate for Port MacKenzie is included in Appendix F.2 – Port MacKenzie CAPEX Cost Estimate.

The estimates are based on conceptual designs as defined in the basis of design (Appendix E – Basis of Estimate) developed as part of this study and are considered planning-level, with an estimated accuracy range of −50 percent to +100 percent. CAPEX estimates include infrastructure and equipment associated with transportation networks, intermodal facilities, and port operations, as defined in the basis of design. Contingency, escalation, and owner-related costs, including administration, management, insurance, and other indirect costs, are excluded.

Container procurement costs (rotainers) are included within the port CAPEX estimates for each alternative. A summary of port site CAPEX estimates is provided in Table 4-1. CAPEX estimates for each transportation alternative, inclusive of associated port site costs, are summarized in Table 4-2. Transportation Option 5, which consists of direct single-trailer trucking to ports, is not anticipated to require significant transportation network CAPEX beyond improvements required at the receiving port sites.

TABLE 4-1: PORT SITE CAPEX SUMMARY

Port Location	CAPEX Estimate ($MM) 2023 Q4 Dollars
Port of Alaska (Anchorage)	$45.4
Port MacKenzie	$73.6
Whittier	$124.8
Seward	$52.0

TABLE 4-2: TRANSPORTATION OPTIONS CAPEX SUMMARY

Transportation Alternative	Port Site	Transportation Network CAPEX Estimate ($MM)	Port Site CAPEX Estimate ($MM)	Total CAPEX Estimate ($MM)
Option 1 – Single Trailer to Fairbanks, Rail to Ports	Anchorage	$17.0	$45.4	$62.5
	Port MacKenzie (Rail)	$211.3	$73.6	$285.0
	Port MacKenzie (Road)	$115.8	$73.6	$189.4
	Whittier	$17.0	$124.8	$141.8
	Seward	$17.0	$52.0	$69.0
Option 2 – Double Trailer to Livengood, Single Trailer to Fairbanks, Rail to Ports	Anchorage	$1,469.1	$45.4	$1,514.5
	Port MacKenzie (Rail)	$1,663.4	$73.6	$1,737.0
	Port MacKenzie (Road)	$1,567.8	$73.6	$1,641.4
	Whittier	$1,469.1	$124.8	$1,593.9
	Seward	$1,469.1	$52.0	$1,521.1
Option 3 – Single Trailer to Livengood, Rail to Ports	Anchorage	$1,294.1	$45.4	$1,339.6
	Port MacKenzie (Rail)	$1,488.5	$73.6	$1,562.1
	Port MacKenzie (Road)	$1,392.9	$73.6	$1,466.5
	Whittier	$1,294.1	$124.8	$1,418.9
	Seward	$1,294.1	$52.0	$1,346.1
Option 4 – Double Trailer to Livengood, Rail to Ports	Anchorage	$2,727.7	$45.4	$2,773.2
	Port MacKenzie (Rail)	$2,922.1	$73.6	$2,995.7
	Port MacKenzie (Road)	$2,826.5	$73.6	$2,900.1
	Whittier	$2,727.7	$124.8	$2,852.5
	Seward	$2,727.7	$52.0	$2,779.7

4.4.2 Operating Expenditures (OPEX) Estimates

Comparative OPEX estimates were developed for each combination of transportation alternative and port site evaluated. Detailed OPEX estimates and supporting assumptions are provided in Appendix E – Basis of Estimate. A summary of estimated total cargo handling costs is presented in Table 4-3.

All operating costs are expressed in present-day dollars as of late 2023. Given the comparative nature of this evaluation, cost escalation and indexing have not been applied. For any long-term financial analysis or net present value calculations, appropriate escalation and indexing assumptions should be applied separately.

TABLE 4-3: TRANSPORTATION OPTIONS OPEX SUMMARY

Transportation Alternative	Port Site	Total Cargo Handling Cost Peak Production Volumes ($/ton) *2023-2024 Dollars*	Total Cargo Handling Cost Complete Life of Mine ($MM) *2023-2024 Dollars*
Option 1 – Single Trailer to Fairbanks, Rail to Ports	Anchorage	$288.92	$5,492
	Port MacKenzie (Direct Rail)	$276.07	$5,248
	Port MacKenzie (Rail via Houston, Final Leg Road)	$329.80	$6,269
	Whittier	$375.70	$5,588
	Seward	$293.97	$7,159
Option 2 – Double Trailer to Livengood, Single Trailer to Fairbanks, Rail to Ports	Anchorage	$234.90	$4,465
	Port MacKenzie (Direct Rail)	$222.05	$4,221
	Port MacKenzie (Rail via Houston, Final Leg Road)	$275.78	$5,243
	Whittier	$321.68	$4,561
	Seward	$239.95	$6,132
Option 3 – Single Trailer to Livengood, Rail to Ports	Anchorage	$247.98	$4,714
	Port MacKenzie (Direct Rail)	$235.13	$4,470
	Port MacKenzie (Rail via Houston, Final Leg Road)	$288.86	$5,491
	Whittier	$334.76	$4,810
	Seward	$253.03	$6,381
Option 4 – Double Trailer to Livengood, Rail to Ports	Anchorage	$209.39	$3,980
	Port MacKenzie (Direct Rail)	$196.54	$3,736
	Port MacKenzie (Rail via Houston, Final Leg Road)	$250.27	$4,758
	Whittier	$296.17	$4,076
	Seward	$214.44	$5,647
Option 5 – Direct Single Trailer to Ports	Anchorage	$515.18	$9,793
	Port MacKenzie	$502.33	$9,549
	Whittier	$556.53	$11,081
	Seward	$582.89	$10,596

4.4.3 Estimate Summary

The cost estimates indicate substantial variation in both capital and operating expenditures across the transportation and port alternatives evaluated. Certain alternatives require significant capital investment associated with major transportation infrastructure developments, including upgrades to the Dalton Highway corridor, construction of the Dunbar–Livengood Rail Extension, for which concepts are shown in Appendix D.3 – AAP Transportation Option Concepts, as well as the completion of the Port MacKenzie Rail Extension. These alternatives also demonstrate lower estimated operating costs over sustained production periods.

Alternatives relying primarily on direct truck transportation to ports exhibit higher estimated operating costs relative to rail-based alternatives. Similarly, port alternatives differ in both capital requirements and operating cost profiles based on existing infrastructure, access conditions, and handling concepts. These cost estimates provide a planning-level basis for comparing alternatives under consistent assumptions and should be interpreted in conjunction with the standardized format of the Individual Port Assessments provided in Appendix D.4 – AAP Port Assessments and the logistics and operations concepts documented in Appendix D.6 – AAP Logistics and Operations.

NOTE: *Reductions in transportation operating costs can have system-level economic effects that extend beyond individual project economics. International experience summarized by the World Bank indicates that improvements in freight transportation efficiency, including lower unit costs and increased reliability, can materially expand the range of resource projects that become economically viable by reducing delivered costs and investment risk. As production volumes increase, these effects tend to compound, reinforcing the importance of infrastructure configurations that support lower lifecycle operating costs rather than optimizing solely for near-term throughput.*[10]

10 World Bank Group (2020). Transport Corridors and Their Wider Economic Benefits: A Critical Review of the Literature. Policy Research Working Paper No. 8302.

5. FINDINGS-BASED CONCLUSIONS

This section summarizes at a high level the comparative port evaluations into findings-based conclusions regarding each candidate port's ability to support mineral export under sustained operating conditions. The conclusions here were synthesized from the integrated assessment of upland availability, marine access, transportation interfaces, operational flexibility, and scalability as production volumes increase and multiple commodities are introduced. Rather than ranking ports on isolated attributes or near-term feasibility alone, this section focuses on how structural constraints and expansion potential influence long-term system performance and risk. The discussion reflects each ports' relative suitability for supporting sustained, multi-commodity mineral export within a statewide context, recognizing that infrastructure decisions must accommodate growth beyond initial production scenarios.

5.1 PORT OF ALASKA (ANCHORAGE)

The Port of Alaska benefits from existing deep-water facilities, established marine services, and direct rail access within Southcentral Alaska. These attributes allow the port to accommodate limited containerized mineral concentrate handling within its current operational framework. However, available upland space is constrained, and port operations are heavily integrated with essential fuel, freight, and community-serving cargo functions.

As a result, mineral export activities at the Port of Alaska would require careful integration with existing tenants and operating schedules, limiting flexibility and scalability. Expansion opportunities are constrained by land availability and competing uses, increasing reliance on optimized layouts and sequencing assumptions as volumes grow. While feasible under controlled conditions, the port's ability to support sustained, multi-commodity mineral export is limited by these structural constraints.

5.2 PORT OF SEWARD

Seward offers established marine infrastructure, rail connectivity, and proximity to deep-water access, supporting technical feasibility for containerized concentrate export. Existing port facilities can accommodate defined export volumes, particularly where operations align with available dock space and storage areas.

However, the port's developed footprint and existing tenant mix constrain opportunities for large-scale expansion or operational separation. As mineral export volumes increase, available storage capacity, circulation space, and berth flexibility become limiting factors. Sustained high-volume or multi-commodity operations would require significant coordination with existing uses and introduce increasing operational complexity and cost sensitivity.

5.3 PORT OF WHITTIER

Whittier provides direct rail access and sheltered marine conditions that support reliable vessel operations. The port's compact layout and existing infrastructure allow for defined concentrate handling scenarios at moderate volumes, particularly where storage and vessel scheduling assumptions are tightly managed.

The port's constrained upland area and limited expansion potential restrict its ability to accommodate growth beyond initial export scenarios. As volumes increase, operational flexibility diminishes, and reliance on precise timing, stacking density, and shared-use assumptions increases. These characteristics limit Whittier's suitability for long-term, scalable mineral export systems supporting multiple commodities or producers.

5.4 PORT MACKENZIE

Port MacKenzie is characterized by extensive undeveloped industrial land, deep-water marine access, and the ability to accommodate both rail- and truck-served operations. These physical characteristics allow port layouts and operating concepts to be developed without displacement of existing users and with clear separation between functional areas.

The port's available space supports scalable storage configurations, adaptable circulation patterns, and phased expansion aligned with production growth. Logistics and cost analyses indicate that this flexibility reduces long-term operating risk and sensitivity to throughput increases relative to more constrained ports. The largely undeveloped nature of Port MacKenzie is both a defining attribute and a primary constraint, as realizing its potential will require substantial upfront investment and coordinated funding.

Across the evaluated scenarios, Port MacKenzie consistently demonstrates the capacity and adaptability required to support long-term, sustained, high-volume, multi-commodity mineral export. Based on this finding, Port MacKenzie warranted further analysis, which is documented through detailed port operation concepts, site layouts, and scalability considerations presented in Appendix G – Port Operation Concepts, Appendix C – Port MacKenzie Site Figures, and the Ausenco Technical Memorandum (Appendix B – Ausenco Memorandum).

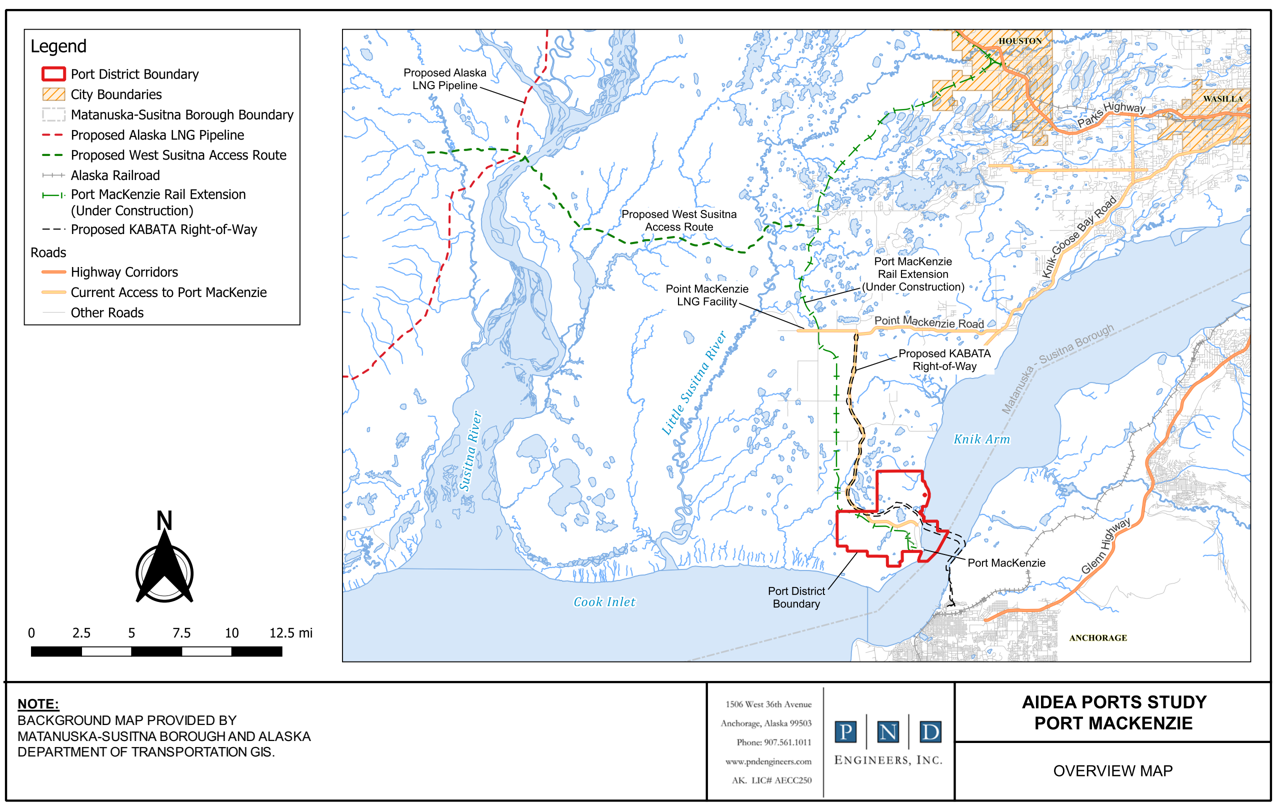

FIGURE 5-1: PORT MACKENZIE OVERVIEW MAP

6. PORT MACKENZIE CONCEPT DEVELOPMENT

The Port MacKenzie concept development responds to direction from AIDEA to examine the implications of aggregate statewide mineral production for port infrastructure in Southcentral Alaska. That direction reflected a need to move beyond project-specific export volumes and evaluate whether a single port facility could accommodate the combined export and import demands associated with multiple mining operations across southern, western, and central Alaska under near- and mid-term production scenarios.

This section primarily summarizes the Port MacKenzie infrastructure concepts developed to evaluate its ability to support large-scale, multi-commodity mineral import and export operations at a planning level. The concepts presented are based on site layouts, operating assumptions, and capacity analyses prepared in the Ausenco Technical Memorandum (Appendix B – Ausenco Memorandum).

The concepts documented in this section illustrate how Port MacKenzie could be configured to support export of bulk and containerized mineral products, inbound delivery of project cargo, equipment, and consumables, and concurrent handling of multiple commodities. The evaluation focuses on physical configuration, operating concepts, capacity drivers, and scalability considerations relevant to long-term infrastructure planning. It does not recommend a development sequence or implementation approach.

The concept development includes a planning-level assessment of the land requirements associated with a representative smelter or refinery facility at Port Mackenzie. This assessment is intended to inform AIDEA's understanding of the spatial compatibility of downstream processing activities with port operations. The analysis is limited to land availability and port interface considerations and does not evaluate technical feasibility, environmental impacts, or commercial viability.

During preparation of this report, a separate policy-oriented assessment examining Port MacKenzie's potential role in supporting domestic mineral production and national supply chain resilience was released by the Ted Stevens Center for Arctic Security Studies (Appendix I – EO Brief). That assessment was developed independently and was not used in the preparation of this study. It is referenced here solely to note high-level alignment between the infrastructure characteristics identified through this technical evaluation and broader strategic considerations discussed in external analyses.

6.1 OVERVIEW OF PORT MACKENZIE CONCEPTS

This illustrates how a Southcentral Alaska port with extensive industrial land, deep-water access, and rail connectivity could be configured to support aggregate statewide mineral production under sustained, multi-commodity conditions. The concepts address export of bulk and containerized mineral products, inbound delivery of project cargo, equipment, and consumables, and concurrent handling of multiple commodity streams.

Representative marine and upland infrastructure site layouts and operational concepts are shown in Figures 6-1 and 6-2. These figures summarize port configuration, separation of functional areas, rail and truck interfaces, and areas reserved for future expansion and are provided full size in Appendix C – Port MacKenzie Site Figures, with supporting evaluation summarized in Appendix D.4 – AAP Port Assessments.

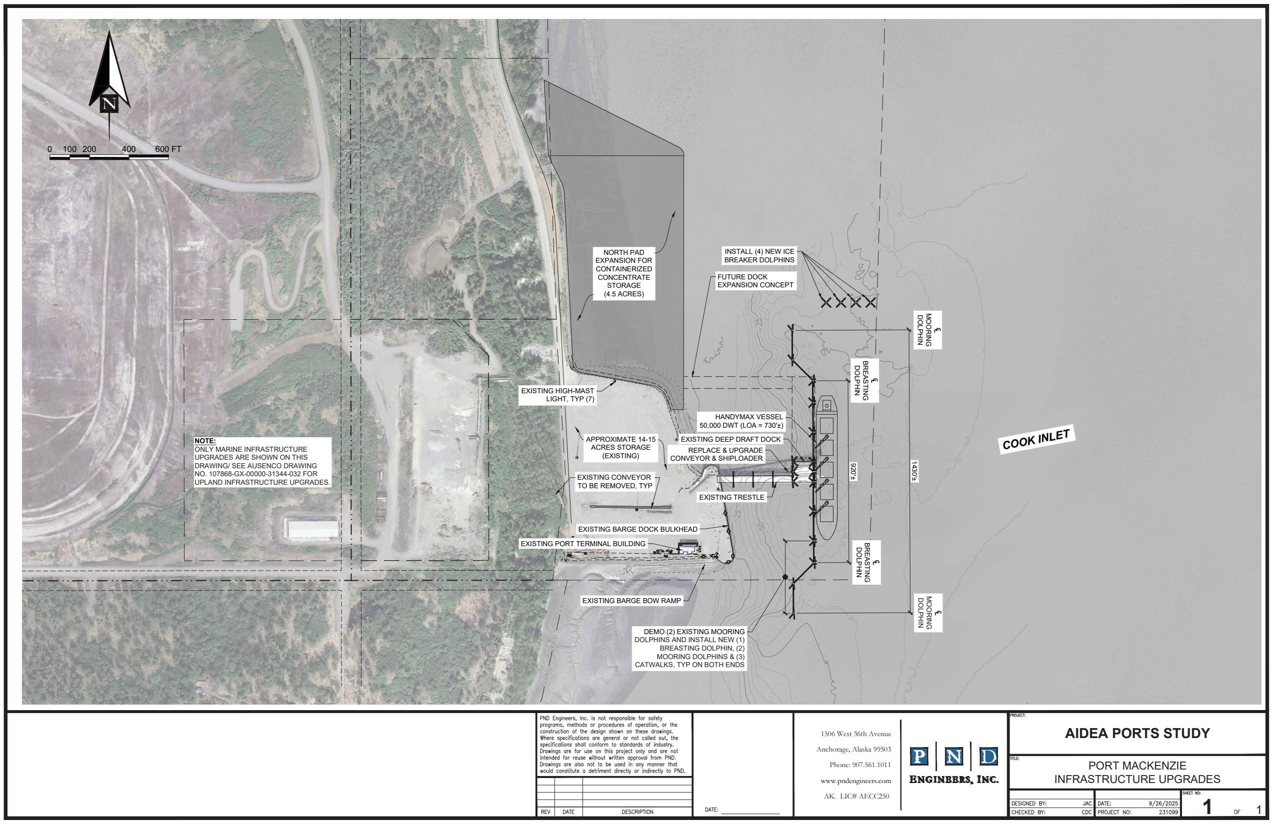

FIGURE 6-1: PORT MACKENZIE MARINE INFRASTRUCTURE UPGRADES

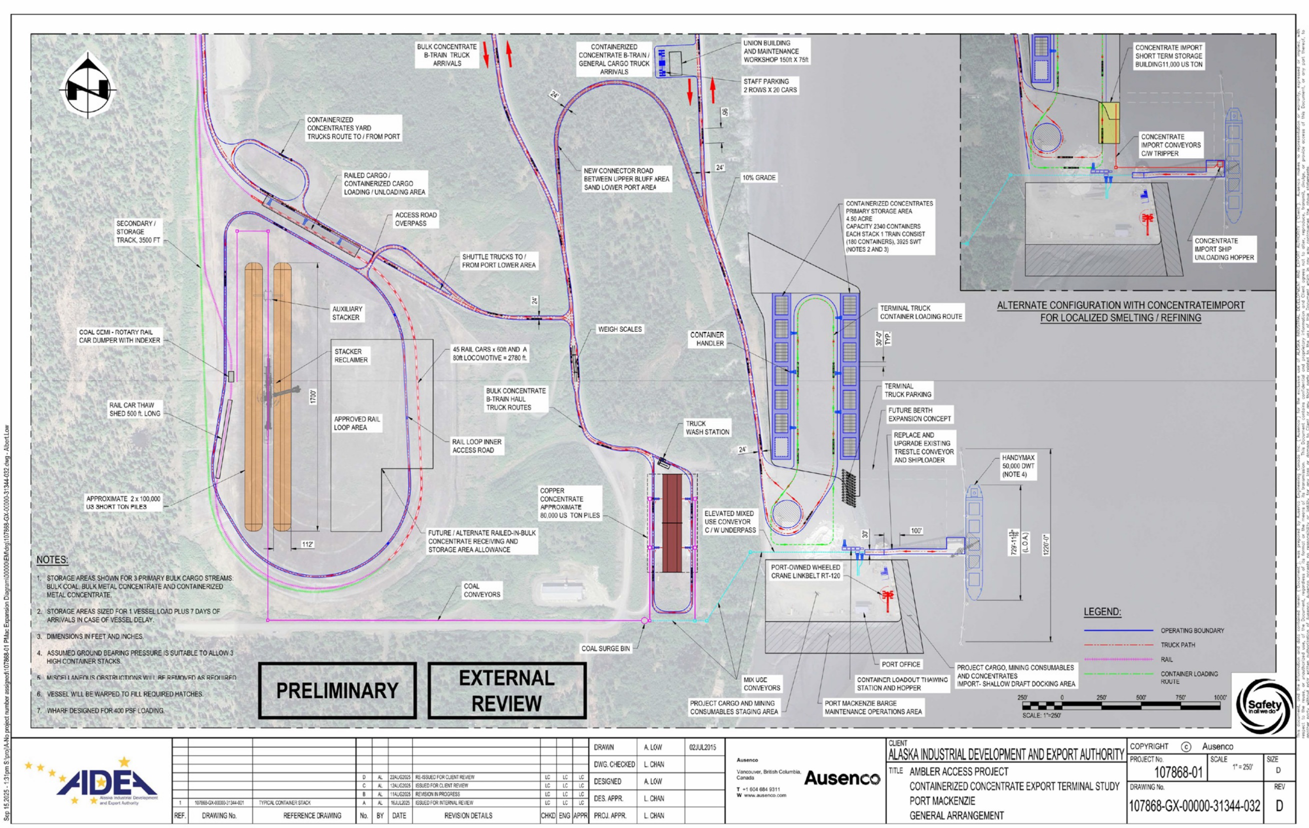

FIGURE 6-2: PORT MACKENZIE UPLAND INFRASTRUCTURE UPGRADES

6.2 KEY PHYSICAL AND OPERATIONAL CHARACTERISTICS

6.2.1 Land Availability and Expansion Capacity

Port MacKenzie includes extensive, generally level uplands controlled by the Matanuska-Susitna Borough and zoned for port and industrial use. Land availability and zoning support development of purpose-built facilities, separation of incompatible activities, and phased expansion without displacement of existing tenants as documented in Appendix D.4 – AAP Port Assessments.

6.2.2 Marine Interface and Berth Capacity

The port is served by a 60' deep-draft, pile-supported dock with a 1,200-foot berth face capable of accommodating Panamax-class vessels without maintenance dredging. Marine operating assumptions, including vessel sizes, berth utilization, and allowances for tidal and ice conditions, are defined in Appendix B – Ausenco Memorandum and summarized in Appendix D.4 – AAP Port Assessments. These are incorporated into the planning-level throughput analysis. Under higher-volume scenarios, the single deep-water berth approaches practical utilization limits, informing scalability considerations and future expansion needs.

6.2.3 Landside Interfaces

Landside access assumptions include road connectivity to the Mat-Su Valley and completion of the Port MacKenzie Rail Extension to the Alaska Railroad mainline near Houston. Rail and truck served operating concepts, including unit coal trains, block container movements, and inbound cargo flows, are documented in Appendix D.6 – AAP Logistics and Operations and Appendix H – Rail and Intermodal Concepts.

6.3 MULTI-COMMODITY HANDLING CONCEPT

The Port MacKenzie concepts were developed to accommodate concurrent handling of coal, bulk metal concentrates, containerized concentrates, and limited import cargo. Commodity-specific handling concepts, system separation, and shared infrastructure assumptions are documented in Appendix G – Port Operation Concepts, with end-to-end logistics and scheduling assumptions provided in Appendix D.6 – AAP Logistics and Operations.

The concepts emphasize physical separation where required, shared use of common systems where practical, and operating assumptions intended to test steady-state feasibility rather than short-term peak optimization.

6.4 SMELTER AND REFINERY SITING – PLANNING ENVELOPE

A planning-level assessment of land requirements associated with representative smelter and refinery facilities was prepared to evaluate spatial compatibility with port operations (Appendix G – Port Operation Concepts). Based on a survey of global facilities, base-metal smelting or refining complexes typically require approximately 160 to 250 contiguous, rail-served acres, while specialty or hydrometallurgical facilities may require approximately 80 to 120 acres, with allowance for expansion.

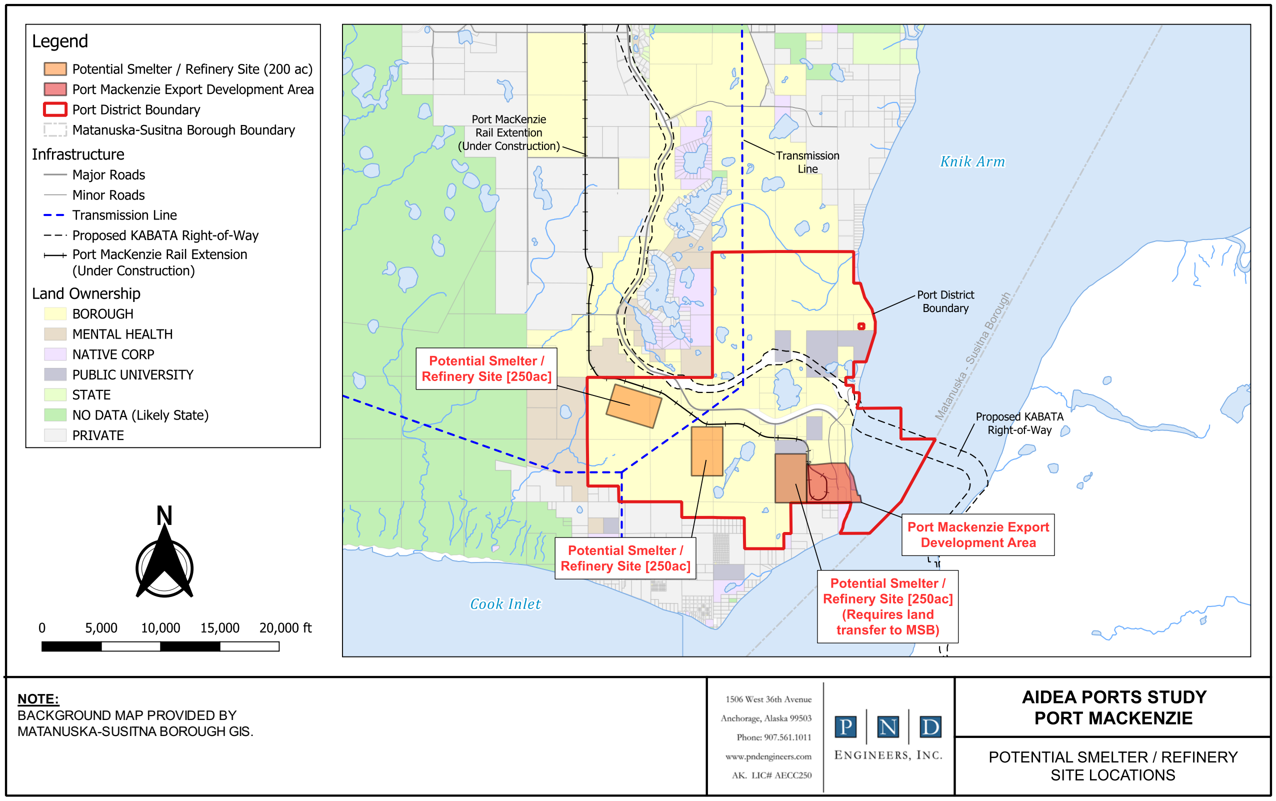

FIGURE 6-3: POTENTIAL SMELTER/REFINERY LOCATIONS

Siting considerations include rail adjacency, separation from active cargo handling areas, access to utilities, and enclosed materials handling suitable for winter operations. Full size site plans and arrangements are included in Appendix C – Port MacKenzie Site Figures. This assessment is limited to land availability and spatial compatibility and does not evaluate technical feasibility, permitting, or commercial viability.

6.5 CAPITAL COST ESTIMATES FOR FULL PORT DEVELOPMENT

Capital expenditure estimates were developed at a planning level using a work breakdown structure (WBS) approach to support evaluation of transportation alternatives and associated port site concepts. A comprehensive capital cost estimate was developed for full build-out of port infrastructure at Port MacKenzie to support sustained, high-volume, multi-commodity operations, with supporting details provided in Appendix F.2 – Port MacKenzie CAPEX Cost Estimate.

6.6 PLANNING IMPLICATIONS

At a planning level, the Port MacKenzie concepts demonstrate that a Southcentral Alaska port with sufficient land area, rail connectivity, and marine access can be configured to accommodate aggregate mineral export and import demand under sustained, multi-commodity scenarios. Planning-level analyses identify berth utilization, landside circulation, and coordination between concurrent commodity streams as the primary capacity drivers and constraints governing scalability, as documented in Appendix D.4 – AAP Port Assessments and Appendix D.6 – AAP Logistics and Operations.

7. RECOMMENDED NEXT STEPS

The findings presented in this report establish a planning-level basis for evaluating Alaska's long-term mineral export infrastructure needs. Progressing beyond feasibility assessment will require targeted follow-on work to refine technical assumptions, reduce key uncertainties, and support coordinated decision-making among stakeholders.

In addition to the Ambler Mining District, multiple mining projects are advancing in the West Susitna region within approximately 100 miles of Port MacKenzie, including projects led by Nova Minerals and U.S. Gold. These projects, along with potential future development, are located within or adjacent to the Yentna Mining District, a highly mineralized area with a long history of mining activity. In light of the findings of this assessment, the proximity and cumulative potential of these operations further support focusing near-term investment and development efforts at Port MacKenzie as the most effective location to advance scalable, shared mineral export infrastructure.

- **Near-term efforts should focus on advancing conceptual engineering for Port MacKenzie.** This work would refine site layouts, validate storage and handling assumptions, and further define marine infrastructure requirements under a range of operating conditions. Additional concept development would support improved cost definition, evaluation of phasing options, and identification of operational and constructability risks while maintaining flexibility for future expansion.
- **Evaluation of rail interfaces should proceed in parallel.** Further analysis is warranted to confirm rail connectivity assumptions, terminal interface requirements, and operational integration between inland transportation systems and port facilities. This effort should consider both initial operating configurations and longer-term rail enhancements to ensure that early infrastructure decisions do not constrain future capacity or efficiency.
- **Coordination with the Matanuska-Susitna Borough is recommended** to align potential infrastructure development with land-use planning and Port District objectives. Early engagement can support identification of compatible development areas, clarification of permitting considerations, and establishment of a framework for phased expansion consistent with long-term port operations.
- **Engagement with mineral producers, carriers, and logistics providers** would provide additional validation of throughput assumptions and operating concepts. Input from potential users can inform facility sizing, equipment selection, and scheduling approaches, and help confirm anticipated demand profiles and development timing.
- **Consideration of funding mechanisms, permitting pathways, and governance structures** appropriate to large-scale infrastructure development may also be warranted. While these topics extend beyond the scope of this report, early assessment of institutional and financial considerations can support a more efficient transition from planning to implementation.

These steps provide a structured path forward that builds on the planning-level findings documented in this report while allowing flexibility to respond to evolving production profiles, market conditions, and infrastructure priorities.

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APPENDICES

APPENDIX A – SITE VISIT DOCUMENTATION

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PND ENGINEERS, INC.

MEMORANDUM

PROJECT NO. 231099 **DATE:** NOVEMBER 22, 2023

PROJECT: Ambler Port Study

TO: Brandon Brefczynski - AIDEA

CC: Click or tap here to enter text.

FROM: PND

SUBJECT: Ambler Port Feasibility Study – Site Visit Summary

Over the period of November 7th through 9th, 2023, the PND and Ausenco Project Team performed site visits to the identified Southcentral Alaska Ports. Facilities visited included the Port of Alaska (POA) in Anchorage, Port MacKenzie in the Mat-Su Borough, Port of Whittier (ARRC-owned), Port of Seward (ARRC-owned), and rail transfer yards located in Fairbanks (owned by ARRC and Lynden). Site visits were attended by Chip Courtright and Derrick Honrud from PND and Lincoln Chan and Ben Marsh from Ausenco.

Photos from the site visits (and referenced in the sections below) are provided in Appendix A. For further site visit information, refer to the separate memo prepared by Ausenco.

1.0 PORT OF ALASKA

The Project Team met during the morning of Tuesday, November 7th with Port Director Steve Ribuffo as the primary contact for the port. The project team discussed operations, questions, and planned development for the Port of Alaska Modernization Project (PAMP) prior to touring the Port. Discussions included the following items:

- The railroad tracks are owned and maintained by the Port to Alaska Railroad Corporation (ARRC) standards.
- Alaska Department of Transportation & Public Facilities (DOT&PF) and ARRC plans for Ocean Dock Road and track realignment.
- Military use of the port; the military is a primary user of rail at the port and is the only other user besides ARRC. They are not contracted for exclusive use. Use is approximately three times per year for a period of 3 to 4 days.
- Potential residential resistance from the Government Hill neighborhood for increased ARRC traffic at the port.

- Uplands areas immediately adjacent to the port terminals are already leased by Tote and Matson. The port is planning an optimization study to see if current operations can be improved considering planned improvements with the PAMP.

- POA owns the existing gantry cranes (38-ft gauge), but they are maintained and operated by Matson. Matson has expressed interest in owning the new cranes (100-ft gauge) proposed under the PAMP.

- Potential upland lease area in the North Extension area which could include extension of tracks into the area.

- POA would need a letter of intent with associated timeline and commitments from AIDEA or Ambler Operators in order to prevent other operations from using planned areas.

During the site visit, the Port Director highlighted the area available at the North Extension (Photo 1) for container storage. The Project Team observed Matson offload operations in progress at Terminal 2 using the existing gantry cranes (Photos 2 and 3).

2.0 PORT MACKENZIE

The Project Team met during the afternoon of Tuesday, November 7th with Port Operations Manager David Griffin at the port offices located at Port MacKenzie prior to touring the port. The project team discussed the following items:

- Existing railbed to the port requires construction of approximately 7 miles of additional embankment and all rail components for completion. All bridges are complete. Right-of-way has been obtained for the unfinished sections of embankment.

- The Borough is currently investigating converting the existing railbed to a public road from Ayrshire Road to Houston.

- The Port District is comprised of over 9,000 acres of Borough-owned load that is zoned for development and potential long-term leasing. The Borough generally rents or leases parcels.

- Two existing, privately-held parcels are adjacent to the port. One is occupied year-round, and one is seasonal. Both are ‘good neighbors’ and pro-port development.

- The port currently receives two large vessels per year:

  - Cement delivery in super-sacks for QAP/Colaska (approximately 30,000 tons) occurring in April/May over a period of approximately 1 week.

  - Road salt delivery for an Alaska DOT&PF contract. Approximately 36,000 tons is delivered in a 600-ft vessel (approximate DWT = 44,000 tonnes). Salt is offloaded using a grapple and conveyor system temporarily installed on the Deep Draft Dock.

- Some discussions have occurred regarding use of the port for the West Susitna project with Nova Minerals.

- The Port is currently planning for removal of the existing conveyor system and loading arm from the Deep Draft dock.

- The Port is currently planning a barge landing area to be located at the north end of the uplands and applied for a PIDP grant to fund the project.

The Project Team toured the waterside port infrastructure including the bulkhead (Barge Dock) and Deep Draft Dock (Photos 5-7). Following observation of the infrastructure, the Project Team toured the near-port section of railbed (Photo 4), the proposed rail yard (Photo 8), and lower storage area (Photo 9).

3.0 WHITTIER

The Project Team traveled to Whittier with Liz Greer (ARRC Program Manager for Marine Facilities) on the morning of November 8th. The Project Team toured the facilities including the location of the previous marginal wharf (Photo 12), the barge slip dock (Photos 11 and 13), and rail yard (Photos 10 and 14). The project team discussed the following items during the site visit:

- Primary operator at Whittier is currently Lynden/Alaska Marine Lines (AML). Operations occur at the barge slip using both direct rail and container handler ro-ro operations.
- The previous marginal wharf was demolished in the early 2000s and was 'dropped in place'. Significant debris should be expected in footprint of the previous dock.
- ARRC currently has a master plan in development for the Whittier Port. The master plan is anticipated to include redevelopment of the marginal wharf.

Existing infrastructure would likely not accommodate the proposed Ambler port operations. Additional port infrastructure, presumably in the footprint of the previous marginal wharf, would likely be required.

4.0 SEWARD

Following the Whittier site visit, the Project Team traveled to Seward with Liz Greer (ARRC Program Manager for Marine Facilities) on November 8th. The project team toured the facilities including the Coal Dock (Photo 15), Passenger Dock, Freight Dock (Photos 16 and 17), and uplands storage areas (Photo 18). The project team discussed the following items during the site visit:

- The Coal Dock has not been in use since 2016. ARRC is planning on removing the loading arm and conveyor located on the dock.
- ARRC is currently in the design phase for expansion of the Freight Dock. Construction of the expansion is expected to be complete by approximately 2028.
- Ongoing loading activities at the Freight Dock were observed to be pass-pass with container handlers.

5.0 FAIRBANKS RAIL YARDS

The Project Team traveled to Fairbanks on November 9th to visit the rail yards owned by ARRC and Lynden/Alaska West Express (AWE).

5.1 ARRC Fairbanks Rail Yard

The Project Team met with Andy Burgess (ARRC Fairbanks Operations Director), who discussed current operations at the yard, proposed operations for the Ambler project (including truck access routes), and provided a driving tour of the yard facilities. The following items were discussed and observations were made during the site visit:

- Layout of preferred loading/storage area identified previously by Brian Lindamood (ARRC Vice President and Chief Engineer). This area appears to have adequate space for container storage and truck turning operations, but needs to be investigated further.
- The best truck access route for the preferred loading/storage area appears to be from the west side of the ARRC Yard: Steese Hwy --> Johansen Expressway --> Peger Rd (exit) --> Phillips Field Rd --> Driveway St (access actually from east side of preferred loading/storage area). There is one track crossing (two tracks) on Driveway St.
- Access from the east side of the ARRC Yard via the College Rd exit off the Johansen Expressway (then on to Illinois St, Phillips Field Rd, and Driveway St) appears to be a much busier route for truck traffic.
- Access to the west side of the preferred loading/storage area via Jack Lindsay Ln is hampered by multiple track crossings and is not recommended.
- The ARRC Fairbanks Operations Director identified a potential alternate loading/storage area on the north side of the Johansen Expressway with direct access from the Peger Rd exit. The potential alternate area is currently being used for snow storage and would require placement of a substantial quantity of fill to raise the grade for adequate container loading/storage operations.

5.2 Lynden/AWE Fairbanks Rail Yard

The project team met with Gage Schutte (AWE Vice President of Freight Operations), who discussed current operations at the yard, proposed operations for the Ambler project (including trucking access routes), and provided a driving tour of the yard facilities. The following items were discussed and observations were made during the site visit:

- AWE currently has a two-track rail loop in their yard.
- Current rail infrastructure would not be adequate to support the anticipated needs of Ambler operations. AWE Vice President of Freight Operations noted that it would likely be possible to expand rail infrastructure as needed to support Ambler operations, if their yard was selected.
- Additional travel time for trains from the ARRC Yard to the AWE Yard is about 90 minutes.

APPENDICES

Appendix A – Photo Log

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PND ENGINEERS, INC.

Appendix A – Photo Log

Ambler Port Feasibility Study

November 2023

Photo 1. POA – Overview of North Extension Area.

Photo 2. POA – Gantry cranes in operation at Terminal 2.

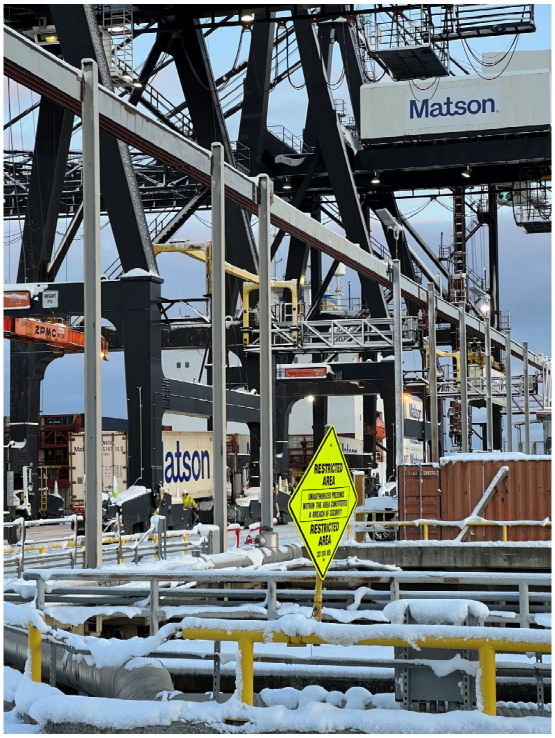

Photo 3. POA – Matson container offload at Terminal 2.

Photo 4. Port MacKenzie – Rail bed at Ayrshire Road.

Photo 5. Port MacKenzie – Overview of Port area.

Photo 6. Port MacKenzie – Deep Draft Dock viewed from bulkhead.

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Photo 7. Port MacKenzie – Loading arm on Deep Draft Dock.

Photo 8. Port MacKenzie – Overview of rail yard loop.

Photo 9. Port MacKenzie – Lower staging area.

Photo 10. Whittier – Track schematic map.

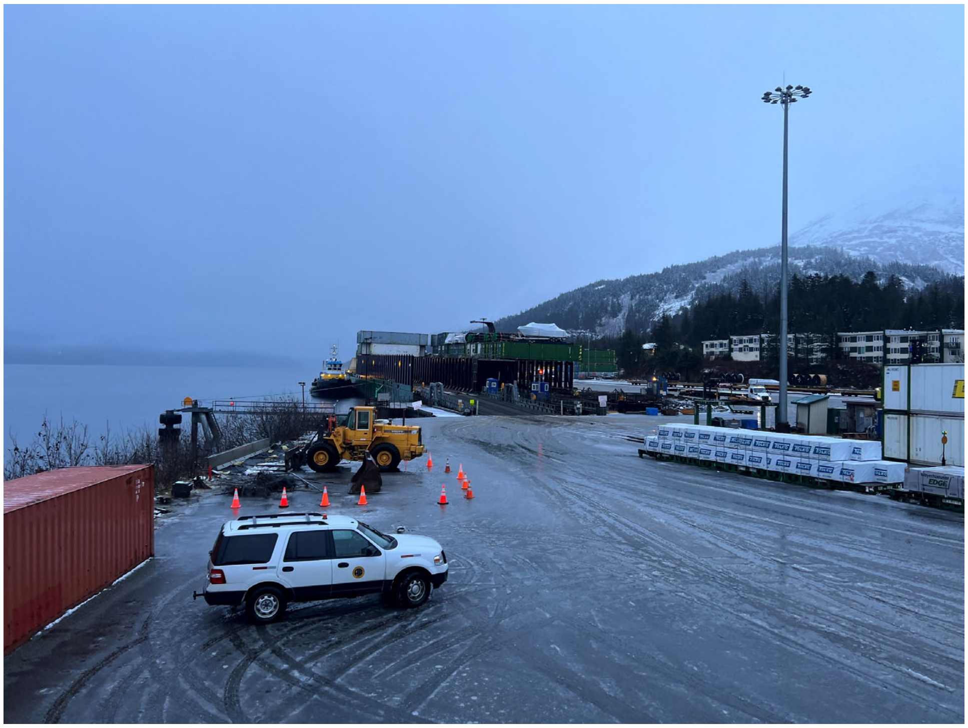

Photo 11. Whittier – Overview from yard office.

Photo 12. Whittier – Previous marginal wharf location.

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Photo 13. Whittier – Barge slip.

Photo 14. Whittier – Storage area between barge slip and main tracks.

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Photo 15. Seward – Coal Dock and loader arm.

Photo 16. Seward – Freight Dock viewed from Passenger Dock.

Photo 17. Seward – Pass-pass loading operations at Freight Dock.

Photo 18. Seward – Upland storage area.

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[107868-GX-00000-19180-001]
Revision Number B

PND Engineers Inc.

AMBLER ACCESS PORT STUDY
Site Visit Report

2023-11-22

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Revision Status

Revision	Date	Description	Author		Approver	
			Name	**Position Title**	**Name**	**Position Title**
A	2023-11-17	Issued for Internal Review	Ben Marsh	Logistics Specialist	Lincoln Chan	Study Manager
B	2023-11-22	Issued for Client Review	Ben Marsh	Logistics Specialist	Lincoln Chan	Study Manager

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Ausenco

PND Engineers, Inc.

1 INTRODUCTION

Alaska Industrial Development and Export Authority (AIDEA) are assessing the feasibility of providing transportation connectivity to the Ambler Mining District (AMD) through the Ambler Access Project (the Project). Ausenco has been engaged via PND Engineers Inc. to provide specialist comment on the materials handling and transportation logistics for the project, with focus on the ports and intermodal facilities. The project itself sees mineral concentrate loaded into specialised enclosed containers that are transported via truck and rail to an eventual port, from there they are tipped into a bulk cargo vessel for marine transport. Ausenco's role is to provide comment on the strengths and weaknesses of each location (SWOT Analysis), layouts of each location as a functional rotating container export terminal and required capital and operating expenditures to make a port viable.

1.1 Purpose of Site Visit

Ausenco visited the following four (4) ports and two (2) intermodal sites to gain a better understanding of the site-specific conditions and requirements that play a role in assessing the overall strengths and weakness with regards to being a suitable port of export for rotating containers. The site trip provided invaluable insight into the operations and constraints of each location, allowing Ausenco to better understand how to overcome their unique challenges.

- Port of Alaska (PoA)
- Port MacKenzie (MacKenzie)
- Seward
- Whittier
- Alaska Railroad Corporation Facility, Fairbanks (Fairbanks)
- Lynden Trucking Yard, Fairbanks (Lynden Yard)

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2 OVERVIEW

2.1 Trip Agenda

The following reflects the high-level agenda of the trip and dates of visit.

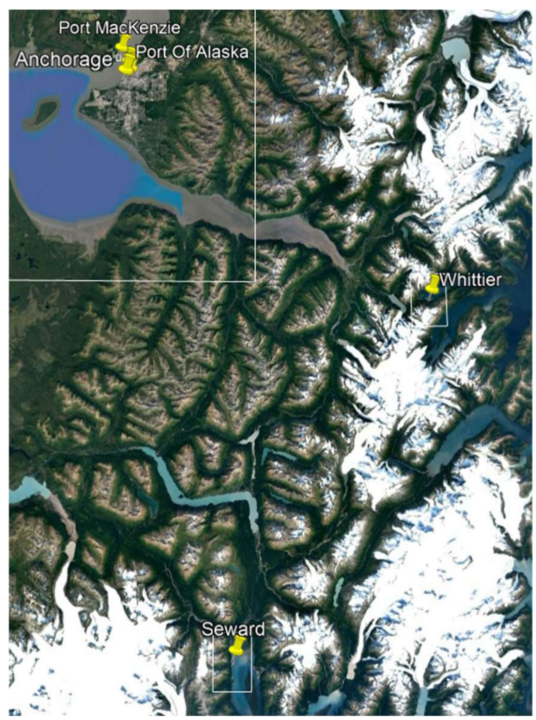
- Day 1 - *2023/11/06*: Ausenco team arrived in Alaska.
- Day 2 - *2023/11/07*: Visit to Port MacKenzie and Port of Anchorage via Road.
- Day 3 - *2023/11/08*: Visit to Seward and Whittier Ports via Road.
- Day 4 - *2023/11/09*: Visit to Alaskan Railroad Corporation Fairbanks yard and Lynden Trucking Facility.
- Day 5 - *2023/11/10*: Ausenco team departed Alaska.

2.2 Facility Locations

The site visit comprised of four (4) ports and two (2) intermodal facilities. It is noted that Lynden's yard was not formally assessed as an intermodal facility as it is out of scope, however it was located near ARRC Fairbanks and was opportune to visit. It provided valuable insight into the trucking portion of the study along with an understanding of their capabilities as a baseline for the trucking industry in Southern Alaska at large. The locations of ports and facilities are shown below in Figure 2-1 and Figure 2-2.

Figure 2-1: All Sites Visited

Figure 2-2: Port Locations



2.3 Parties Involved

The following personnel hosted or provided key insight/support during the site trip; other minor participants were not recorded.

Table 1: Site Visit Participants

COMPANIES	PEOPLE
Ausenco	• Ben Marsh, Logistics Specialist • Lincoln Chan, Logistics Specialist
PND Engineers Inc.	• Chip Courtright, Principal Engineer • Derrick Honrud, Senior Engineer
Port of Alaska	• Steve Ribuffo, Director (steve.ribuffo@anchorageak.gov)
Port of MacKenzie	• David Griffin, Port Operations Manager (David.Griffin@matsugov.us)
Seward/Whittier	• Elizabeth Greer, Program Manager Docks & Slips (greere@akrr.com)
Lynden	• Gage Schutte, Vice President of Freight Operations (gage@lynden.com)
Alaskan Railroad Company	• Elizabeth Greer, Program Manager Docks & Slips (greere@akrr.com) • Andrew Burgess, Director Fairbanks Operations (burgessa@akrr.com)

3 OBSERVATIONS

The following information of interest to the study was collected.

3.1 Port of Alaska

3.1.1 Advantages

- Feasibility work is being undertaken on track realignment through the Ship Creek area to improve rail access into the port and through Anchorage.
- The rail within the boundary of the PoA is owned by port, however it is designed and maintained to Alaska Railroad Corporation standards as they are the primary user.
- There are currently two rail tracks that are available for use that run on the eastern edge of the port. There are two switches installed, one that is in operation to allow the installed tracks to be used and a second switch to allow for a future third track that would sit to the east of the current rail.
- PoA is not in a naturally deep-water pocket, however, is annually dredged by the United States Army Corps of Engineers for the Port due to its state significance.
- PoA is in conceptual design stage for a new, deeper water wharf nominally located to the south of the current berth. This port is envisaged to be commissioned in 2028. This new berth may shift current tenants Matson's and Tote's yards to the south and avail their current lands for this Project so to be less distant. The execution of this work is understood to be uncertain, therefore this is of note as a future opportunity only.
- Matson is the current operator / tenant for containerized traffic including drayage and longshoring. They appear to be the logical choice for discussing the container handling needs for this Project.

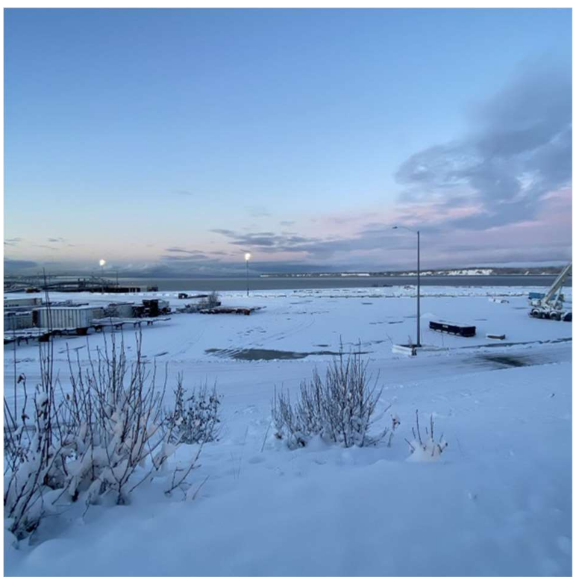
3.1.2 Disadvantages

- The military uses the PoA as a port of embarkation for equipment. It uses the rail and laydown areas to the north of the port is used 3-4 times a year for 3-4 days each time. This commitment is understood to be informal and subject to negotiations if other business needs demand the use of the rail.
- There is concern that residential neighbours of the port on the adjacent hills could have issue with the projected train volumes and associated audible and visual disturbances.
- There is a small hill on the road between the current end of rail and suggested container staging area for this Project. This would need to be levelled to improve drayage traffic flow through the area for train unloading and loading. The hill previously housed an under-passing military oil pipeline, but this has since been relocated with just the hill remaining.
- On the western side of the rail line within the port is a road that extends to the north of the port. This road is municipality-owned and must be always kept clear. The municipality has ownership as it provides potential access to the dormant Knik Arm Bridge project.
- There are three (3) serviceable container gantry cranes on site with a fully developed drayage traffic loop. Ausenco observed active and efficient container ship unloading with an average cycle time of 2 minutes per container. This operation appeared readily competent adapt to mining container operations. Two of the three cranes currently use spreaders rated to 30 long tons to meet those cranes design limit. The final (third) crane is rated to 40 long ton loads under spreader.

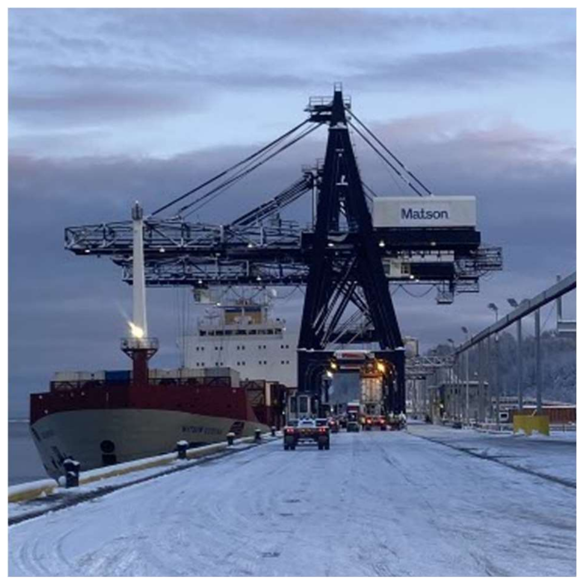
3.1.3 Follow Up Considerations / Open Issues

- PoA is a landowner port and does not directly engage with operations. Project will need to liaise with tenants and operators for operational information. PoA typically permits tenant-installed improvements such as those envisaged for this Project.
- The gantry cranes are smaller calibre than modern typical, on a 38 ft gauge and appear to be limited in payload. However, the new wharf as part of the modernisation project seeks to install cranes up to 100 ft gauge.
- The drayage tractor trailers move in a clockwise direction within the port, unlike general traffic that move anticlockwise. The load ratings of roads on PoA premises follow Alaska Department of Transportation design guidelines.
- Crane manufacturer is noted as Paceco. Technical data on these cranes appear to be limited.
- Concerns over crane capacity for this Project. Crane capacities to be explored to understand true load restrictions and spreader mass. Matson contacts requested through Steve Ribuffo to seek clarification.

Figure 3-1: Port of Alaska Site Photos



1. *Proposed Storage Area (Looking West)*



2. *Cranes and Loading Area on Wharf*

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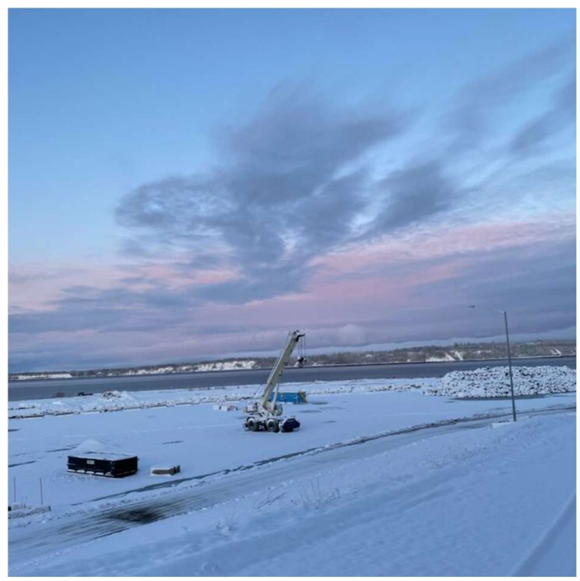
3. *Typical Terminal Tractor Queuing*

4. *30LT Spreader*

5. *Current Operations and Leased Lands (Looking South)*



6. *Proposed Storage (Looking North)*

3.2 Port Mackenzie

3.2.1 Advantages

- The previously cleared land and embankments made for the proposed rail extension from Houston to MacKenzie has substantially completed all civil works, except 7 miles to be built to finish the full pathway between Houston and MacKenzie (civil only, not rail). No rail steel has been installed. The 7 miles of unfinished route are on farms, however the required agreements for this land to be used are understood to be in place.
- The rail loop on MacKenzie premises is in a pre-cleared and graded area, ready to be constructed on. Approvals are also in place for these works.
- The port sits on the only land in the burrow zoned for commercial use.
- Mackenzie's current business has 2 vessels a year bringing in salt, on a recently executed 4-year contract. Berth availability is not a concern.
- No dredging is required other than occasional high spot maintenance, usually cleared by tugs. This is because the wharf sits in a naturally deep pocket.
- The gradient and condition of the main access down road to MacKenzie office where the primary storage area and the wharf are located is reasonable isn't expected to pose an issue for truck traffic hauling containers.
- The proposed primary storage area by the wharf is vacant saved for a small salt-importing tenant. It appeared sufficient for the Project's container volumes.
- The proposed secondary storage area is vacant and is paved for much of the required space.
- The wharf's platform appeared sufficient for space for setting up the Project's proposed material handling crane to handle containers onto ships.

3.2.2 Disadvantages

- As it stands currently, the rail extension into MacKenzie has been set aside and preference for a conversion to a haul road has been actively lobbied by MacKenzie, due to lack of funding available for the rail to be completed. No substantial discussions or decisions have been made. The only access to MacKenzie is the existing South Knik-Goose Bay Road.
- There is concern however that by adding a new haul road, landowners in the area would build their own driveways up to the road and use it for their own purposes, rather than being a designated private haul road.
- Other stakeholders in the area include several residents with access to port grounds require it to reach their property. This would provide conflict with proposed trucking routes within the port and would require a high degree of caution to separate public traffic from port operations.
- There is a significant hill in between the secondary storage area and the cleared rail loop, which impacts the path for container handling movements.
- The wharf face is small and would require vessel warping to fill the required hatches. MacKenzie advises that each warping movement is estimated to take 2 hours from start to finish.
- The trestle is rated to 120,000-pound axle and vehicle loads and is relatively narrow. Consideration required for possibility of mobile harbor crane being installed permanently placed on wharf platform at the tip, and not being able to leave the wharf.
- The trestle has a temporary conveyor installed along its full length by another tenant, which is presumed to be immovable. This takes up part of the trestle's available lane width for this Project.

- The trestle driveway (remaining) is 30 ft wide and then widens to 100 feet by 100 feet on the main platform at the tip. Single lane traffic only on trestle due to width constraints.
- Headframe of current conveyor and ship loader impede mobile harbor crane movements and will need to be removed.
- It is a 45-minute drive from Wasilla to MacKenzie or 2 hours from Anchorage, both being the likely source of staff and supplies.
- There are currently no permanent operational staff or employees other than the Port Director, who is new to port operations.

3.2.3 Follow Up Considerations / Open Issues

- Load bearing pressures for the lower and upper lands representing the primary and secondary storage areas respectively should be assessed to confirm container stacking limitations.
- There is a possibility of extending the rail spur at Houston into the approved rail extension corridor for the minimum required length to allow a full train to enter and exit. Containers could be removed from the train and stored temporarily rail side until they are shuttled to Port. Empties could be placed back onto the train and returned to Fairbanks. In essence, developing Houston as an intermodal point between rail from/to Fairbanks and trucking to/from MacKenzie.
- Electrical equipment and control room at wharf entrance to be relocated to avoid collision risk.

Figure 3-2: Port MacKenzie Site Photos

1. *Partially Completed Rail Embankment Example*

2. *Load Limit Sign on Trestle*

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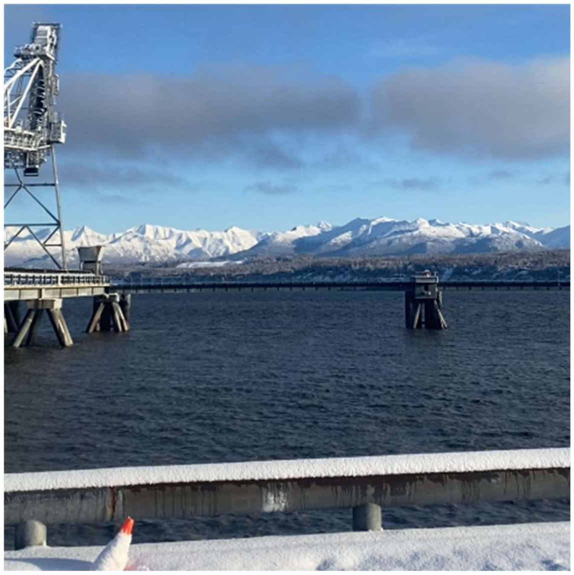


3. Southern Dolphin and Ship Loader

4. Elevated Conveyor feeding Ship Loader

5. Road into the Primary Storage Area/Wharf

6. Northern Catwalk and Dolphins

» CLICK TO RETURN TO TABLE OF CONTENTS

7. *Cleared Rail Loop Area and Embankment*

8. *Paved Secondary Storage Area (Upper Lands)*

3.3 Seward

3.3.1 Advantages

- High availability of land to use for storage.
- Existing freight dock is being expanded to support 1,000 ft vessels, suitable for this Project.
- In an established town with good local presence for availability of new workers.
- Existing operators onsite with experience in loading/unloading.

3.3.2 Disadvantages

- Rail issues during winter due to high snow load through the passage between Whittier and Seward. There is a need to account for downtime or avalanche warning to confirm safety of trains passing through.
- There is an existing barge / tug maintenance tenant on site in the uplands. This Project's space claim will need to work around them but expect no major concerns.

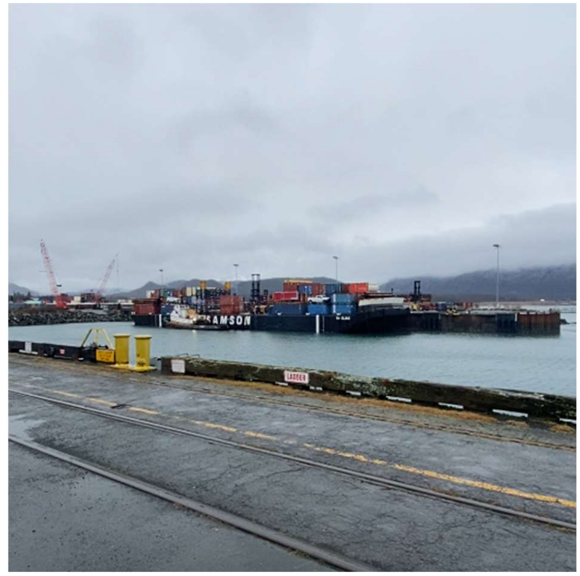
3.3.3 Follow Up Considerations / Open Issues

- Need to confirm operating months or any legitimate down time during winter at port or with the railway.
- Interactions between the freight dock and the adjacent cruise ship passenger dock needs to be better understood, especially during tourism peak season where cruise ship berthing may be frequent and may impede this Project's freight operations.
- Current rail service extends directly onto freight dock and was observed to be in active usage. This space may be available to this Project to store containers directly on dock versus storing them uplands, thereby improving cycle times.

» CLICK TO RETURN TO TABLE OF CONTENTS

Figure 3-3: Seward Site Photos

1. Rail Track to Port & Coal Stacker/Reclaimer



2. Freight Dock from Passenger Dock (Looking East)

3. Barge Being Loaded on Freight Dock

4. End of Freight Dock (Looking North)

5. Route to Proposed Storage Area

6. All Rail into Port

3.4 Whittier

3.4.1 Advantages

- Container staging area was paved.
- Skilled operator (Alaska Marine Lines) present at the port already and is likely able to expand to take on this Projects drayage and loading operations.
- Long running port with proven track record.
- Staging area chosen prior to visit is appropriate, however rail alignment should be adjusted on the drawing to better suit area. Was noted that operations should generally not block the barge loading area.

3.4.2 Disadvantages

- Heavily congested rail yard from Alaskan Marine Lines operations to load and unload barges.
- Space constraint, clutter, irregular site space and a high rate of container stacker and yard truck traffic may make the drayage operations required by this Project quite hazardous.
- Marginal wharf has failed into the water and needs a full redesign and rebuild. There is currently no ability to berth / load the design vessel.
- Track is suggested to need upgrades.
- The one-way tunnel into and out of Whittier is a bottleneck for the volume of trains required to enter and exit the port for this Project. This may be exasperated by existing port cargo and cruise ship tourism traffic.
- The barge loading ramp sits to the edge of a proposed thorough fare of container handlers moving containers to the vessel loading area.
- Isolation of Whittier as a community may make hiring a labour force difficult or costly.

3.4.3 Follow Up Considerations / Open Issues

- Was suggested trains could be sent as required, given the business case of the project, Ambler trains would be given priority to enter the port and can run when required.
- Further consideration needs to be applied to the bottle necking associated with all train traffic having to go through the tunnel.
- Shuttling distance of containers from proposed staging area to the marginal wharf may directly use container handlers and dispense with yard tractor trailers. The current barge operation employs the same method.

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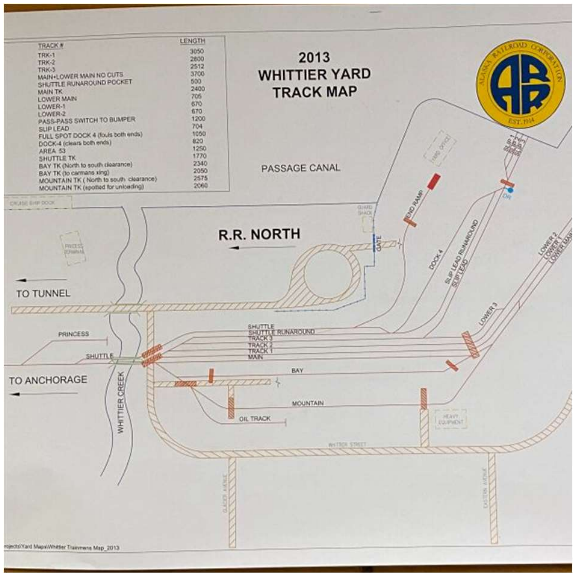
Figure 3-4: Whittier Site Photos



1. *Track Map in Site Office*

2. *Barge Dock near Potential Storage*

3. *Site Office and Snow Dump (on Marginal Wharf)*

4. *Rail (to Barge) in Front of Proposed Storage Area*

5. Container Handler and Multiple Rail Lines

6. ARRC Locomotives

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3.5 ARRC Fairbanks Rail Yard

3.5.1 Advantages

- The space nominated by ARRC for this Project appears likely able to provide the envisaged storage, train loading / unloading, and truck loading/unloading operations and truck inbound and egress circuit.
- Despite the numerous rail spurs through this yard at large, this proposed area would see to trucks crossing rails only at one location (at Driveway Street).
- Rail B currently committed to other tenants on site has just undergone refurbishment.
- Peger Road the only viable route out of the site, as the other option leads through congested roads in Fairbanks used primarily by the public and not freight.

3.5.2 Disadvantages

- Trucking entrance and egress from the nominated storage area already sees high traffic which would be exacerbated by the proposed Ambler volumes. The intersection at Driveway Street and Phillips Field Road would require upgraded traffic management and minor reconfiguration for better truck manoeuvring in and out.
- This entrance crosses the ARRC yard rail at Driveway Street, which may be occupied from time to time, impeding trucking flow. There is little room on public roads (Phillps Field) or in yard for trucks to stage while waiting for the crossing to be cleared.
- The land is bounded on all sides by multiple rail lines and commercial properties and unable to expand.
- Rail A nominated for use by this Project is understood to require refurbishment.
- High snow loads and persistent low temperatures from October to April requires constant snow removal and considerations for significant snow stockpiling.

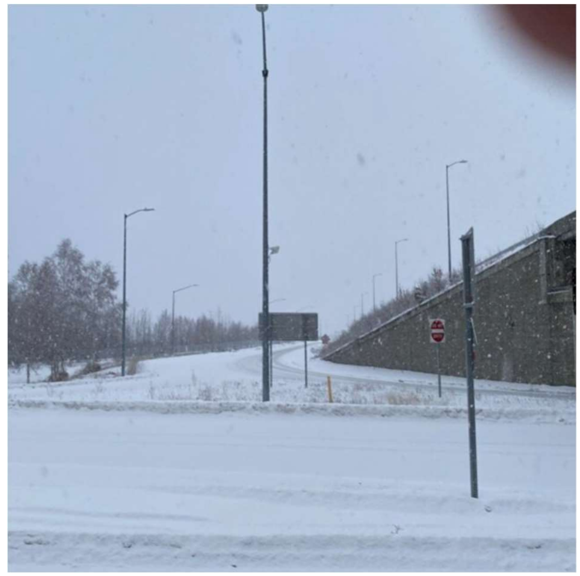
3.5.3 Follow Up Considerations and Open Issues

- The proposed new track to join tracks A and B to the east end of the property would be beneficial to allow for smoother train movements into and out of the area.
- An alternate site to the west end of the yard was presented by Andrew (ARRC Fairbanks Yard Director), near the Peger Road interchange. While this yard is out of scope and not formally nominated by ARRC, it presents various benefits in terms of traffic flow, truck staging, container storage space and train interfacing. This appears to be a viable area for this Project and may be studied.

» CLICK TO RETURN TO TABLE OF CONTENTS

Figure 3-5: Fairbanks Rail Yard Site Photos

1. *Peger Road Access, Looking South*



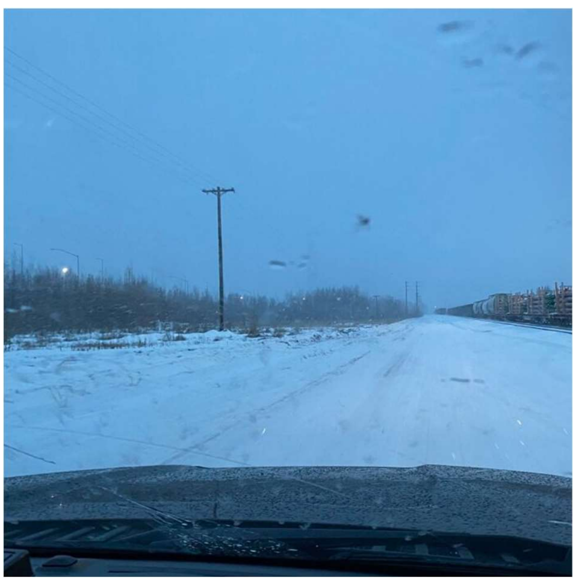
2. *Peger Road Off Ramp (from Dalton Highway)*

3. *Track A and B (Western End of Yard)*

4. *Sand Storage to be Removed & Truck In/Out Access*

5. *Proposed Entrance from Driveway Street*

6. *Rail on Driveway St, Before Phillips Field Road (taken from Google Maps due to obstruction of view due to snow)*



7. *Secondary Site (Proposed by Andrew)*

8. *Secondary Site Entrance from Peger Street*

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3.6 Alaska West Express (Lynden) Trucking Yard

Lynden (doing business as Alaska West Express) in Fairbanks is not formally in scope for assessment as an intermodal yard. However, given it was in the locale, Ausenco extended our visit to this location for familiarity and in case the scope is expanded to cover this location.

3.6.1 Observations

- For ARRC rail to reach the Lynden yard, an extra 90 minutes each way is required for trains to reach the site as opposed to the Fairbanks yard, as it is not a direct alignment.
- Lynden currently has a rail yard with a loop track that is heavily utilized with train arrivals 5 days a week. Additional capacity for this Project's cargo is unconfirmed. Lynden appeared willing to consider investing in an expansion if the opportunity is credible.
- It was noted that Lynden's current operations have ~30 full time drivers and ~30 contracted drivers. This supports current operations, including the largest draw being northern slope's activity.
- There are significant driver / maintainers / consumables (tyres mainly) constraints on the industry currently. Issues with sourcing parts and recruitment of capable drivers is a concern. Wage increases had been unprecedented to retain drivers (+30% over 1 year).
- Lynden advised that train loading operations should be smoothed out to achieve continuous loading (vice rushing to load then stopping) to avoid labour surging and stopping. If their rail were to be used, need to be run in half trains to improve their efficiency.
- The philosophy of truck ownership is they are driven for 5 years then retired to short trip lengths until no longer suitable for use. The idea is to stops trucks being cannibalised by local companies to be used against them.
- The feedback of 90+ drivers being required to facilitate the expected Ambler traffic would be difficult to fulfill. Lynden is not optimistic about Alaska's driving labour pool to staff both the Dalton-FBX loop and the prospective FBX-Mackenzie loops.
- Lynden has a large multi-use yard with various tenants. Likely no concern to store the Project's containers if required.
- Recently acquired additional land next to current operations that a new rail loop could be built on if required for the project.

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Figure 3-6: Lynden Trucking Yard Site Photos

1. *Typical Truck*

2. *Newly Acquired Lot (looking South-East)*

3. *Maintenance Shed*

4. *Current Storage Yard, Typical (partial view)*

4 CONCLUSION

The trip provided wholistic knowledge of the project that was unable to be acquired from a pure desktop review alone. Engaging with key stakeholders and presenting the proposed layouts allowed for constructive feedback and critical analysis to take place.

The data collected serves as a valuable resource for conducting a robust SWOT analysis on each site, enabling a more informed decision-making process. Ausenco extends its sincere gratitude to AIDEA and PND Engineers Inc. for affording the opportunity to undertake this information gathering exercise in Anchorage and Fairbanks.

This collaborative effort has undoubtedly enhanced the project's foundations and set the stage for informed and strategic planning moving forward.

» CLICK TO RETURN TO TABLE OF CONTENTS

Appendix 1 – SITE LAYOUT MARKUPS

Andy Burgess (ARRC) 11/9/23 8:50am

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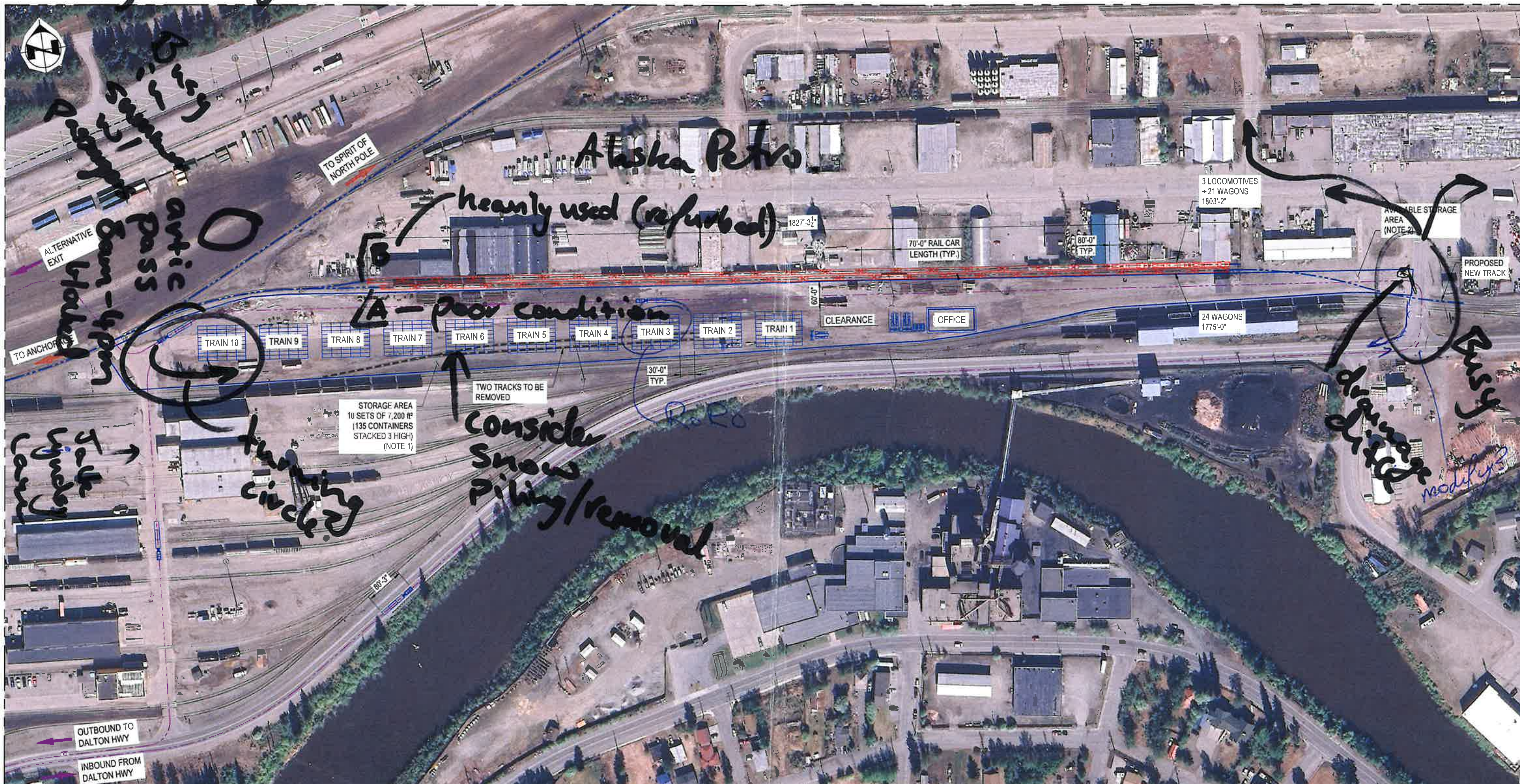

Consider alternate location to west [in and out pegor]

NOTES:

1 - DIMENSIONS IN FEET.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
3 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.

SCALE: 1"=100'

LEGEND:

- OPERATING BOUNDARY
- TRUCK PATH
- RAIL

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REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
			B	SR	01-11-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
			A	SR	27-10-2023	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	27OCT2023
DWG. CHECKED	BM	27OCT2023
DESIGNED	SR	27OCT2023
DES. APPR.	LC	27OCT2023
PROJ. APPR.	LC	27OCT2023

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CLIENT: ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY

TITLE: AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
ARRK FAIRBANKS
PLOT PLAN

PROJECT No. 107868-01 | SCALE 1/112" = 1'-0" | SIZE D

DRAWING No. 107868-GX-00000-31344-010 | REV B

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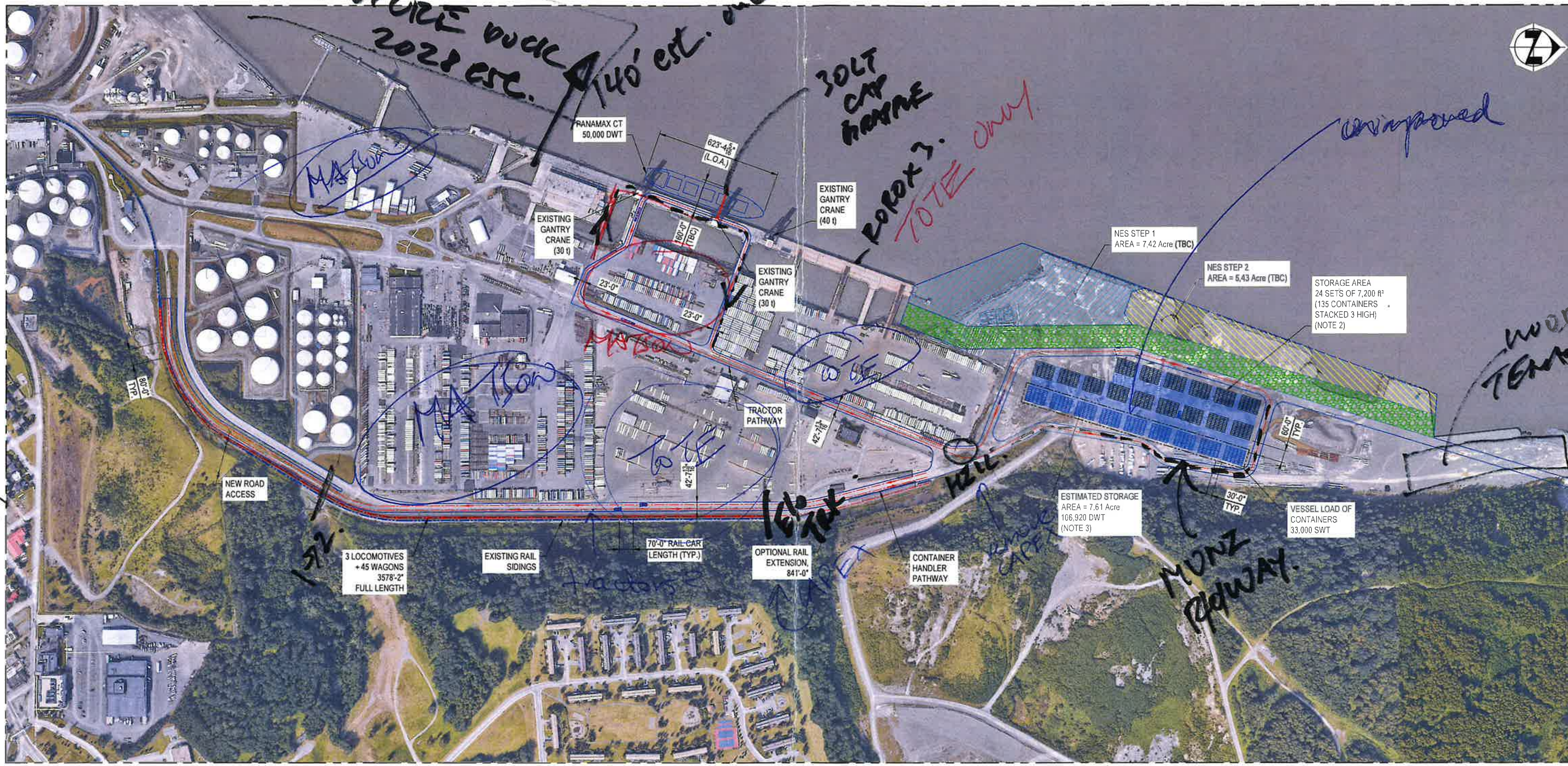

NOTES:

1 - DIMENSIONS IN FEET.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
3 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.

SCALE: 1"=250' (250' 0 250' 500' 750' 1000')

LEGEND:

- OPERATING BOUNDARY
- RAIL
- TRUCK PATH
- HANDLER PATH
- NES STEP 1
- NES STEP 2
- SHORELINE PROTECTION

REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
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DES. APPR.	LC	23OCT2023
PROJ. APPR.	LC	23OCT2023

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TITLE: AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
PORT OF ALASKA IN ANCHORAGE
PLOT PLAN

PROJECT No. 107868-01 | SCALE 1" = 250' | SIZE D

DRAWING No. 107868-GX-00000-31344-020 | REV B

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7 NOV w/ S. RIZUTTO

David Griffin (Port Mack) 11/7/23

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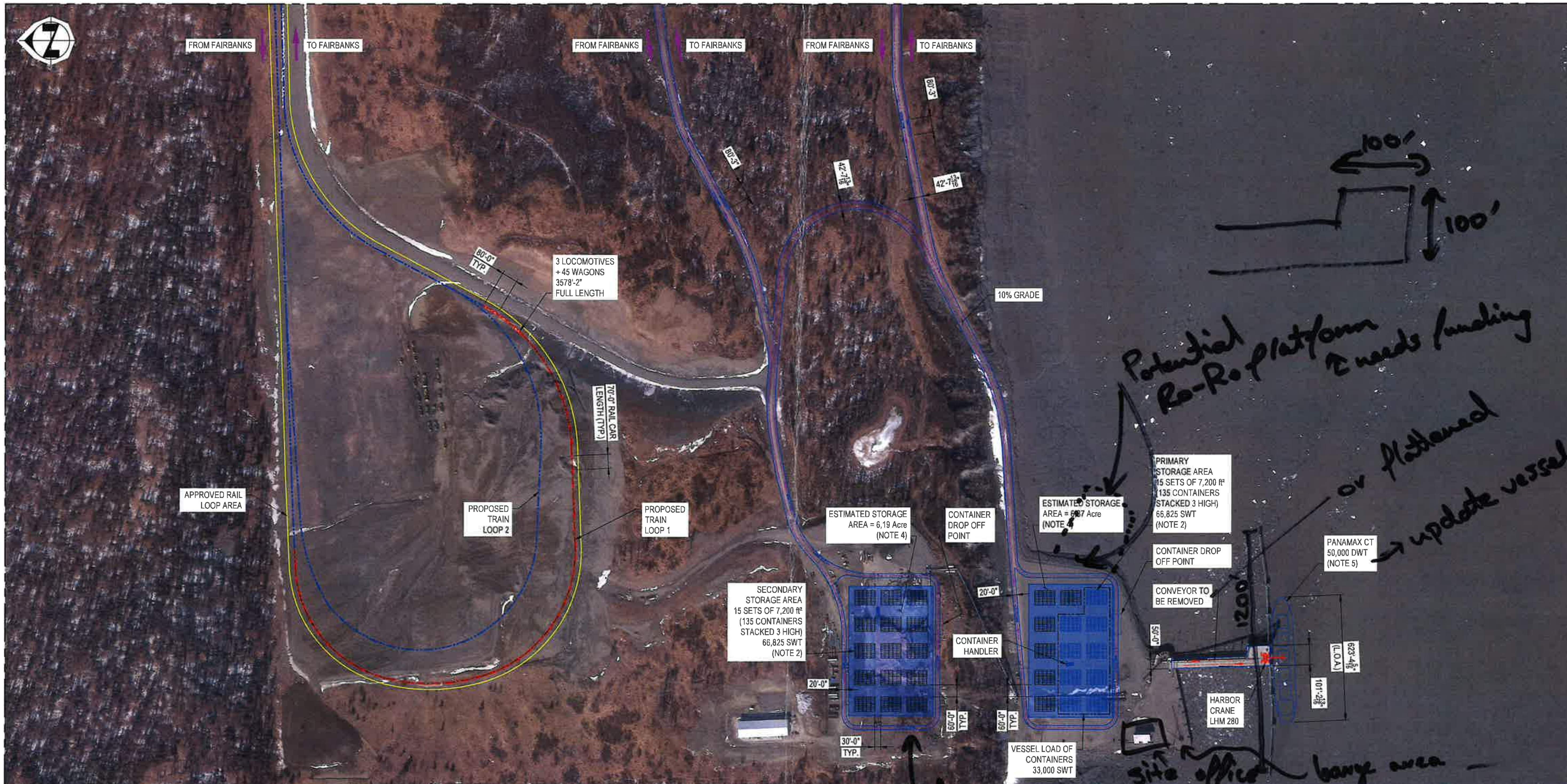

NOTES:

1 - DIMENSIONS IN FEET.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
3 - WHARF WILL BE CONSTRUCTED TO SUIT 1000 ft VESSELS WITH A BEARING CAPACITY SUITABLE FOR AT LEAST 350 lb.ft²
4 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.
5 - VESSEL WILL BE WARPED TO FILL REQUIRED HATCHES.

250' 0 250' 500' 750' 1000'
SCALE: 1"=250'

LEGEND:
OPERATING BOUNDARY
TRUCK PATH
RAIL

Safety in all we do

Nov 01,2023 - 3:09pm C:\Users\Samuel.Ragozin\AUSENCO\BEN MARSH\107868-GX-00000-31344-030.dwg - Samuel.Ragozin

AIDEA Alaska Industrial Development and Export Authority

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CLIENT ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY

TITLE AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
PORT MACKENZIE
PLOT PLAN

PROJECT No. 107868-01 | SCALE 1" = 250' | SIZE D
DRAWING No. 107868-GX-00000-31344-030 | REV B

APPENDIX B – AUSENCO MEMORANDUM

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Technical Memorandum

Attention:	Chip Courtwright, Vice President, PND Engineers Inc.
CC:	Derrick Honrud, Senior Engineer, PND Engineers Inc.
From:	Lincoln Chan, Study Lead, Transportation & Logistics, Ausenco Engineering Canada Logan Philips, Analyst, Business Development, Ausenco Engineering Canada
Subject:	Multi-Commodity Port Infrastructure Assessment and Capital Cost Estimate
Date:	October 17, 2025
Page:	1 of 38
Document Ref:	107868-01-RL-00000-18171-001 Rev. 1

1 Disclaimer

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2 Introduction

Between 2023 and 2024, Ausenco, together with PND, was retained by AIDEA to conduct a study of four existing ports facilities in south-central Alaska and assess their feasibility for handling mining concentrates originating out of the Ambler Mining District. The four ports studied included Ports of Alaska (Anchorage), MacKenzie, Seward and Whittier. The study also analysed various inland transportation options of concentrates reporting to these four ports, including overland trucking and rail by Alaska Rail Road Corporation (ARRC), as well as and various combinations of these modes at transloading locations in Fairbanks, Livengood and Houston. The transportation system was assessed with a view of up to 836,000 tons of total concentrates from Arctic, Bornite, Sun and Smucker operations. For full details of this (original) study, refer to PND's Port Technical Feasibility Study – Ambler Access Project (Draft) dated August 2024.

In 2025, Ausenco and PND received direction from AIDEA to conduct a wider market study of the entirety of Alaska in order to understand the total aggregate volumes of all mining cargo by all producers in southern, western and central Alaska that have a reasonable likelihood of materializing and producing in near and mid future. The total, optimistic production quantities would provide guidance for the sizing, design and expansion of a port facility in south-central Alaska to handle these quantities for export. Related, the port facility is also expected to handle the importing needs of these mining operations, such as project cargo, spare parts and consumables arriving by sea, which will leverage the return transport going back up to the mines. The identified port(s) is envisaged to become the definitive central hub of mining import and export traffic for all of Alaska's mining activities.

In parallel with the above, AIDEA would like to understand, at a high level, the space claim required for a typical and 'generic' smelter or refinery complex, as part of their initiative to understand the feasibility of bringing these later-stage processing activities into Alaska. Localized smelting and refining are envisaged to inject significant economic activity into the region, can significantly reduce transportation costs by eliminating ocean freight, and can reinforce the economic and mineral resiliency of not only Alaska but also the wider US.

A key focus of this study, therefore, is to assess which ports have the capacity or expandability to handle the total volume of these bidirectional cargo and, possibly, future smelting facilities.

This report summarizes the Ausenco's work in the following lines of effort:

- Mining cargo market study and volume assessment;
- Port selection and traffic volume estimation;
- Port infrastructure development;
- Port area capital cost estimate.

The above analysis altogether suggested that Port MacKenzie may likely be the only port with land availability, and expansion feasibility, to handle the envisaged mining traffic and cargo throughput.

3 Mining Cargo Volumes Assessment

Ausenco conducted a market study of the potential mining cargo that may reasonably be expected to flow through the Port of Alaska. This assessment was conducted using publicly available information at the time of the request. In addition, metal concentrate tonnage that could be shipped within the state has been assessed to determine potential market volume for a smelter operation.

3.1 Basis of Estimation

The assessment of concentrate tonnage has been performed based on the following assumptions:

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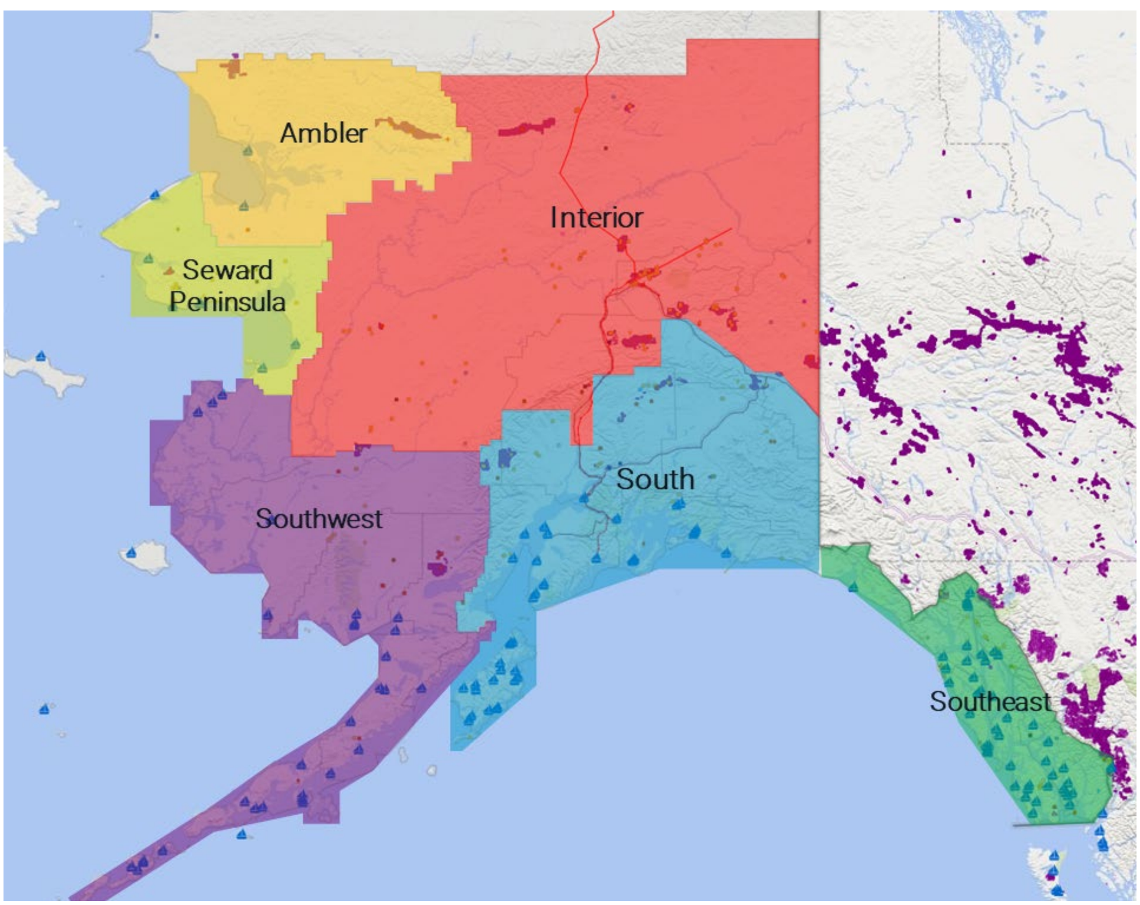
- Property information was collected on May 22, 2025, from S&P Capital IQ database of public data. For this analysis, a database of mineral and metal properties was compiled including both development projects and operations. Red Dog production revised to include production forecasts from announced planned expansion.
- Operations and development projects primarily producing a precious metal or platinum group metal (PGM) product without appreciable base metal resource typically do not ship concentrate products to smelters except in limited circumstances. For this reason, precious metal and PGM projects have been excluded unless their technical reports indicate concentrate production.
- Base metal development projects, including copper, zinc, lead, and nickel, are assumed to produce concentrates at typical concentrate grades. The exception to this assumption is projects with published technical reports indicating the production of atypical concentrate or a metal product such as copper cathode or zinc matte.
- Active base metal operations are assumed to produce concentrate at their typical historic metal grades unless a projected deviation is expected.
- Placer operations and development projects which extract mineralized materials from riverbeds are typically low tonnage, precious metal projects that do not materially impact the accuracy of the forward projection and as such are excluded.
- Properties are divided into six geographical regions as depicted in Figure 3-1. Distant Seward, Southwest, and Southeast regions are excluded from export tonnage estimates as mines in these regions are likely to use local ports.

Figure 3-1: Division of Regions for Assessment



Properties are categorised into six groups for this assessment as outlined below. A comprehensive list of all assets analysed in this exercise is included in Appendix A.

- **Early-Stage Development:** Projects in this category are not expected to proceed into operations within five years. This category includes development projects that have either published an early-stage development study such as a resource estimate, preliminary economic assessment, or a pre-feasibility study, or have yet to publish a resource estimate. Further included in this study are development projects that have completed late-stage studies such as feasibility studies and basic engineering but have not published for the past 10 years or have demonstrated poor economics indicating the need for further development or resource expansion.
  - **Exploration:** Early exploration base metal projects that do not have published resource estimates are assumed to produce a default quantity of 50 kt/y of concentrate for the upside volume estimate.
- **Late-Stage Development:** Projects in this category are expected to have a reasonable probability of progressing into construction within five years. These include projects that have published a feasibility study, basic engineering study, or similar within the past 10 years with economic projections that support a positive FID.
- **Active Operations:** Operations in this category are expected to continue production for a period of at least five years. This category further includes active construction projects that are anticipated to commence production within two years. Brownfield expansions and exploration are categorized independently based on development stage.
- **Care and Maintenance:** Operations which have previously operated and may resume with the discovery of additional mineralized material or shifting market conditions.
- **Closed:** Operations which have been permanently closed and will not resume operations.
- **Inactive:** Operations and projects which have been forfeited, abandoned, or sold to property holders who will not advance development.

The estimation of concentrate tonnage is compiled from a grouping of data points within the database as each estimation method carries a different accuracy risk, the most accurate method is utilized whenever available. The methods of estimation are (in decreasing order of accuracy):

1. Direct disclosure of operating capacity taken from historical production reports.
2. Production forecasts for late-stage development projects provided by the owner in engineered technical reports.
3. Calculated tonnage based on mine life heuristic, published resource estimate, and estimated production grade.
4. (Upside case only) assumed concentrate production of 50 kt/y for base metal exploration projects without published resource estimates.

For the estimation of concentrate production, the following concentrate grades are assumed unless otherwise reported.

Table 3-1: Summary of Assumed Concentrate Grades

Commodity	Concentrate Grade Assumed (%wt.)
Lead	50%

Commodity	Concentrate Grade Assumed (%wt.)
Nickel	40%
Zinc	40%
Copper	25%

For the determination of future production from non-operating properties, a factor is applied to the calculated concentrate production rate to arrive at the factored production rate, the factors applied for each category are summarized for both the base case estimate and the upside production case in Table 3-2. These factors represent corrections to adjust the total concentrate production based on the likelihood of a typical property within each category achieving commercial production.

Table 3-2: Summary of Concentrate Correction Factors

Stage	Base Case Factor (%)	Upside Case Factor (%)
Early-Stage Development	33%	60%
Late-Stage Development	67%	90%
Active Operations	100%	100%
Care and Maintenance	50%	50%
Closed and Inactive	0%	0%

No allowance has been made to correct tonnage based on region specific probabilities or likelihood of transport through Anchorage apart from the exclusion of Seward, Southwest, and Southeast regions.

The volume assessment is speculative in nature and relies on publicly reported information aggregated by a third-party data service. Therefore, it includes resources that are considered too speculative geologically to be categorized as reserves, and there is no certainty that volume projection will be realized.

3.2 Review of Data

Based on the data collected from Capital IQ, 264 properties were included in the database for assessment. Each property was then categorized based on the criteria outlined in Section 3.1. Of the properties contained in the database, 180 are inactive, representing 68%, while a further 8 properties are previously operating projects that have permanently closed and a further 6 properties are placer operations excluded from consideration, leaving 70 properties for consideration. The breakdown of the stage and location of the non-placer properties is provided in This breakdown indicates a typical distribution of properties between development stages with the majority of development projects in early phases. Of the 53 early-stage development projects, 48 are in early exploration and may not have published resource estimates. As a result, the projection of production capacity from these properties is speculative.

Dividing by region and commodity the 70 properties that are considered for this assessment gives Table 3-4, indicating that base metals are the predominant project type across all regions.

Table 3-3.

This breakdown indicates a typical distribution of properties between development stages with the majority of development projects in early phases. Of the 53 early-stage development projects, 48 are in early exploration and may not have published resource estimates. As a result, the projection of production capacity from these properties is speculative.

Dividing by region and commodity the 70 properties that are considered for this assessment gives Table 3-4, indicating that base metals are the predominant project type across all regions.

Table 3-3: Distribution of Subject Properties by Region and Stage

Region	Early-Stage Development	Late-Stage Development	Active Operations	Care and Maintenance	Closed	Inactive
Interior	21	1	3	1	1	60
Ambler	2	1	1	0	0	4
Southwest*	7	1	0	0	0	15
Southeast**	9	1	2	0	2	30
South	11	2	2	0	0	36
Seward*	3	1	0	1	0	15

* Excluded from mining cargo estimate for port capacity.

** Excluded from mining cargo estimate for port capacity and concentrate estimate for smelter capacity.

Table 3-4: Distribution of Subject Properties by Region and Stage

Region	Coal	Base Metal	Precious Metals + PNG	Other
Interior	1	12	13	0
Ambler	0	4	0	0
Southwest	0	6	2	0
Southeast	0	8	2	2
South	2	9	4	0
Seward	0	0	3	2

3.3 Results

3.3.1 Exports-Only Scenario

The transport tonnage forecast from Interior, Ambler, and South regions for ocean export has been estimated at three levels of assumption:

- **Baseline:** which reduces calculated production forecasts based on probable factors outlined in Table 3-2 to arrive at a reasonable projection of tonnage. These results are summarized in Table 3-5.

- **Upside:** which uses more favourable factors, outlined in Table 3-2, to adjust the calculated production forecasts while also assuming all base metal properties without a published estimate will produce a nominal quantity of concentrate. These results are summarized in Table 3-6.
- **Maximum:** This includes all assumptions in the upside case, without factors applied to represent the likelihood of the properties achieving commercial production. These results are summarized in Table 3-7.

Table 3-5: Baseline Production Forecast (results in t/y)

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Interior	0	0	1,000,000	0
Ambler	160,850	116,667	1,329,400	0
South	983,275	0	0	0
Total	**1,144,125**	**116,667**	**2,329,400**	**0**
Total Coal	636,209	0	1,000,000	0
Total Base Metal Concentrate	507,915	116,667	1,329,400	0

Table 3-6: Upside Production Forecast (results in t/y)

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Interior	300,000	0	1,000,000	0
Ambler	289,532	157,500	1,329,400	0
South	1,889,913	0	0	0
Total	**2,479,445**	**157,500**	**2,329,400**	**0**
Total Coal	1,145,188	0	1,000,000	0
Total Base Metal Concentrate	1,334,257	157,500	1,329,400	0

Table 3-7: Maximum Production Forecast (results in t/y)

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Interior	500,000	0	1,000,000	0
Ambler	482,554	175,000	1,329,400	0
South	3,149,855	0	0	0
Total	4,132,409	175,000	2,329,400	0

	Early Stage +	Late Stage Studies	Active Operations	Care and Maintenance
Total Coal	1,908,647	0	1,000,000	0
Total Base Metal Concentrate	2,223,761	175,000	1,329,400	0

3.3.2 Domestic-smelting Scenario

For the identification of the volumes available from all mining districts, all reporting to a new local smelting complex potentially to be built within the Port MacKenzie borough, the three scenarios were repeated without exclusion of the more distant regions (Southwest, Seward). Tonnages from these districts are considered and, again, are reported by specific commodity. These results are shown in Table 3-8, Table 3-9 and Table 3-10. The very distant Southeast district's volumes continue to be excluded, due to its exceptional distance.

Table 3-8: Baseline Production Forecast (results in t/y)

Region	Coal (t/y)	Zinc (t/y)	Copper (t/y)	Nickel (t/y)
Interior	1,000,000	0	0	0
Ambler	0	1,452,868	154,049	0
Southwest	0	0	482,953	0
South	636,209	0	70,969	261,254
Seward	0	0	0	0
Total	**1,636,209**	**1,452,868**	**707,971**	**261,254**

Table 3-9: Upside Production Forecast (results in t/y)

Region	Coal (t/y)	Zinc (t/y)	Copper (t/y)	Nickel (t/y)
Interior	1,000,000	0	150,000	0
Ambler	0	1,551,645	224,787	0
Southwest	0	0	761,614	0
South	1,145,188	0	127,746	470,262
Seward	0	0	0	0
Total	**2,145,188**	**1,551,645**	**1,264,147**	**470,262**

Table 3-10: Maximum Production Forecast (results in t/y)

Region	Coal (t/y)	Zinc (t/y)	Copper (t/y)	Nickel (t/y)
Interior	1,000,000	0	250,000	0
Ambler	0	1,699,808	287,146	0
Southwest	0	0	989,857	0
South	1,908,647	0	212,909	783,770
Seward	0	0	0	0
Total	**2,908,647**	**1,699,808**	**1,739,912**	**783,770**

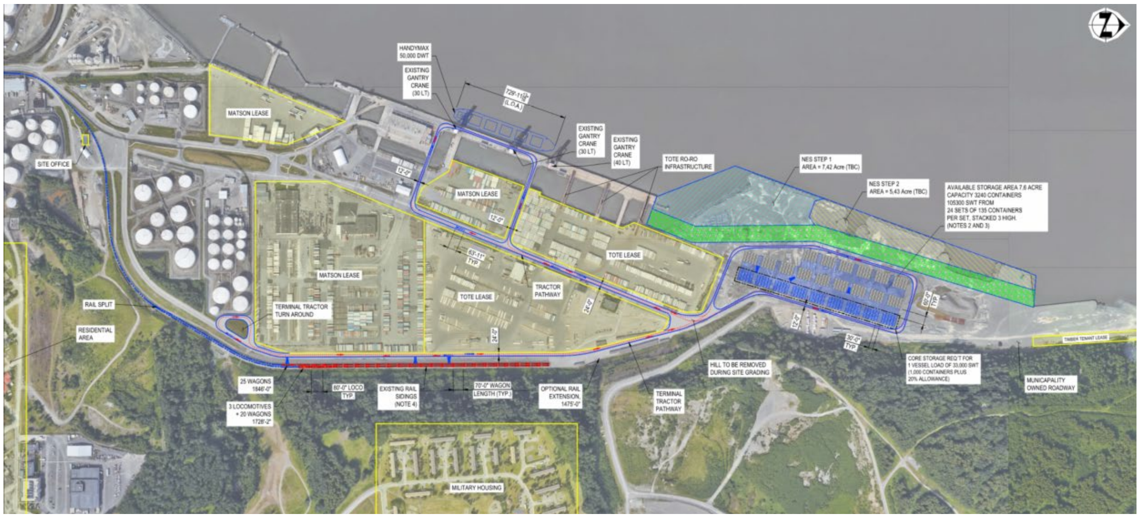
4 Port Selection – Port MacKenzie vs Port of Alaska (Anchorage)

Of the four original port candidates, Ports of Seward and Whittier have been eliminated from further consideration in this study. From the original study it was apparent that Seward was preferring to focus on tourism and cruise ship traffic, whilst Whittier definitively lacks space and is exceptionally isolated. For all transportation options and permutations, Seward and Whittier were repeatedly the most expensive options on a $/ton basis owing in part to their distances.

Based on the cargo volumes and varieties projected in Section 3 above, the Port of Alaska uplands lack the space for most of the cargo envisaged. Referring to Figure 4-1, except for containerized concentrates which may take the space of the North End expansion as originally recommended, the entirety of coal's train receiving, storage and bulk shiploading infrastructure is unlikely to be accommodated on PoA's existing grounds, which are fully tenanted. There is generally no space for high-throughput bulk shiploading infrastructure required by coal. Space allowance for project cargo would be largely incidental and opportune only. For bulk concentrates, the environmental footprint and the perception of environmental pollution with such close proximity to residential housing may result in major socio-economic roadblocks to actualizing this at PoA.

For the reasons above, Port MacKenzie, with its advantageous separation from Anchorage's urban areas, relatively expansive free space in the uplands, and its general under utilization, makes it the only reasonable, recommended choice for onward study in terms of infrastructure improvements and capital funding assignment.

Figure 4-1: Port of Alaska's Existing Utilization Diagram (yellow), with Accommodation for Containerized Concentrates in North End Expansion (green and blue)



5 Study Criteria

5.1 Battery Limits of Analysis

The battery limits of this analysis were the port facility only, from 'entrance gate' to discharge of cargo onto the ship. Marine structure and bathymetry considerations were by PND.

Considerations, costs, availability, utilization factor for all upstream transportation, before arriving into port, were excluded. Despite, this analysis considered the configuration of trucks and train consists that would most likely be feasible on the journey to port in terms of payload, length and axle counts, as applicable. These parameters then guided the conceptual design of the port in terms of the receiving of these vehicles.

5.2 Key Assumptions and Limitations

The following key assumptions were applied in this analysis:

- Rail extension to Port MacKenzie, currently completed as far as just earth embankments, would be completed by other initiatives, including a substantially completed single track rail loop.
- Coal is assumed to be that of the upside case at 2,400,000 ton/a, arriving by rail in bulk gondola cars, as is industry standard.
- It is assumed that 75% of all projected upside metal concentrates volumes, 2,117,000 ton/a, would arrive into the port by bulk trucking. This acknowledges that bulk trucking is the incumbent in Alaska and is well supported by industry.
- It is assumed that 25% of all projected upside metal concentrates volumes, 706,000 ton/a, would be containerized and arrive into port by train. This stems from our original study's finding that rail transport is far more economical than trucking but acknowledges that containerized bulk does not have precedence in Alaska yet and may have limited uptake in the near-mid future.

- Regionally produced concentrates imported into Port MacKenzie for smelting in the immediate uplands are assumed to be the mid-range volumes from the marketing assessment to a design aggregate total of 500,000 ton/a.
- Shipping from these districts is considered regional, and depending on each consigning producer's volumes, the vessels of choice may range from 5,000 metric tonne self-unloading transshipment barges to 50,000 metric tonne parcel vessels. This study conservatively assumes a 10,000-tonne parcel on a generic large barge, or small vessel.
- Export concentrate ship parcels in all cases are 30,000 metric tonnes parcels per sailing, as per original study. Export coal parcels are 75,000 metric tonnes based on typical benchmark from other coal facilities.
- Project cargo quantities and types are undefined and can vary greatly depending on project phases, maintenance cycles, and size of mining operations. The study proceeds only with a general space allowance for this sector.

5.3 Concentrate Import vs Export Exclusivity

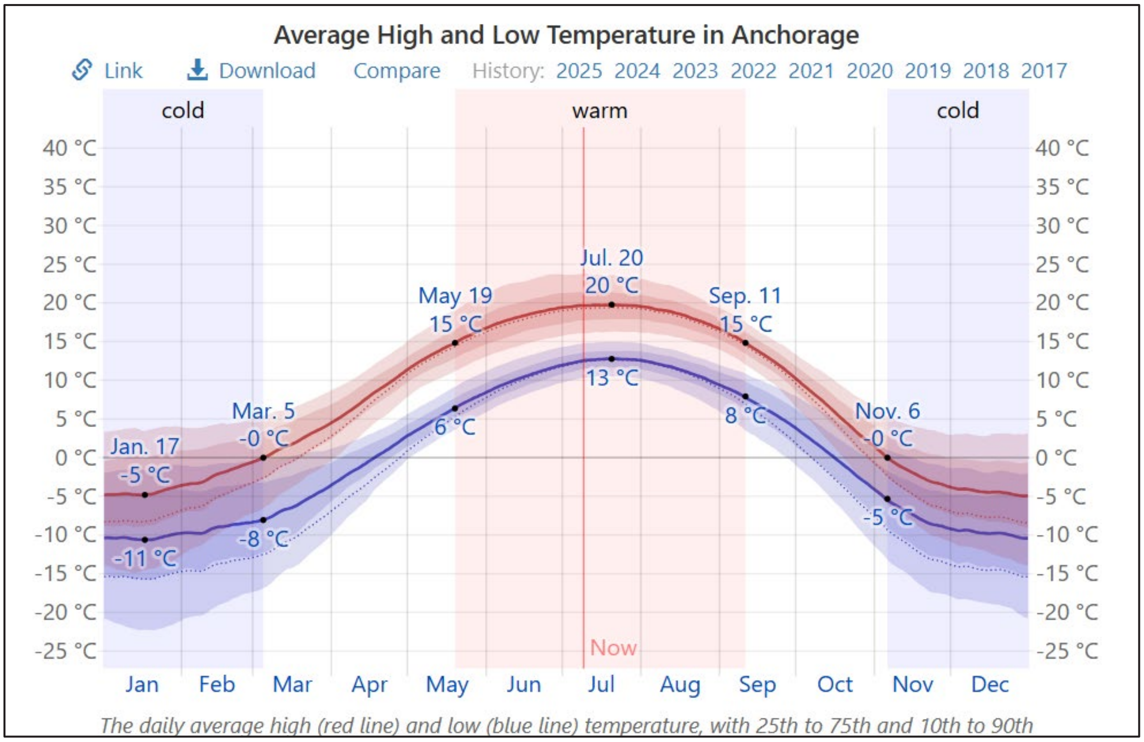
It is assumed that a local smelting or refining complex in the MacKenzie borough will divert most, if not all concentrate export volumes for local smelting. A majority of the concentrate volumes will therefore no longer report to the port, thereby availing large swaths of port and berth availability for regional concentrate import (for smelting), as well as for the export of final refined metal products.

Therefore, the export vs import quantifies of metal concentrates are assumed to be mutually exclusive and are not accounted for additively.

5.4 Availability and Winter Closure

Port MacKenzie is located across the Knik Arm Inlet from the Port of Alaska and likely benefits from similar annual temperature distributions. Referring to Figure 5-1, on average, the port is below freezing (0ºC) from the start of November to the end of March every year (5 months), with November and March being shoulder months, and the remainder with deeper cold weather but seldom below -15ºC. These onshore temperatures provide guidance on how likely bulk cargo with significant moisture content would be frozen, and how they can be handled.

Figure 5-1: Average Temperatures at Port MacKenzie



Despite relatively mild onshore temperatures, the Knik Arm Inlet is prone to receiving significant ice floes. In the original study it was identified that Port MacKenzie as compared to Port of Alaska may be more exposed to ice conditions, potentially reducing its availability for shiploading. Notwithstanding ice defense infrastructure that may be recommended by PND as part of this study, from a port usability perspective Ausenco has conservatively assumed a one-month out of service period for berthing and shiploading activities. While onshore activities are unlikely to be affected, a smaller two-week out of service period for onshore cargo receiving and storage activities has been assumed, to allow for general annual maintenance. Therefore, the whole of Port Mackenzie is assumed to continue receiving, storing but not shiploading for two more weeks past the berth shutting down. The availability assumptions of Port MacKenzie are therefore summarized as:

- Onshore cargo receiving and storage – 15 days shutdown; 350 days operational.
- Berthing and shiploading – 30 days shutdown; 335 days operational.
- Total port shut down – 15 days.

It is expected that producers will need to store 15 days' worth of cargo at mine sites, at other holding facilities, or plan to have similar shutdown windows.

6 Cargo Arrivals – Volumes, Transport and Storage

6.1 Coal

All coal, up to 2,400,000 ton/a, would arrive by rail in nominally 60 ft open top bulk gondola cars, as is industry standard, see Figure 6-1. Based on advice from ARRC from the original study as to optimal train length and motive power, each coal train consist would be 45 cars long of 110-ton coal each, to a total of 2,780 ft including one locomotive. At these annual volumes there would be 485 train arrivals per year. Fewer, longer trains may be possible if agreeable with ARRC but not assumed at this time.

Figure 6-1: Typical Bulk Coal Gondola Rail Car

Once arrived at port, the train is routed through a continuous thaw shed (500 ft long) to thaw any frozen cargo during the winter months, before proceeding onward to a semi-rotary rail car dumper for emptying the coal, see Figure 6-3. The dumper complex provides integral car advancement using its parallel rack and pinion car indexer. This semi-rotary style of dumpers, unlikely continuous fully rotating car dumpers, require each car to be manually decoupled prior to tipping, but is more cost effective for this study's coal tonnages and scale of operation. The need for a fully underground dumper pit with bottom hoppers and feeders is not required in favour of an at-grade hopper and conveyor, alleviating the need for costly excavation.

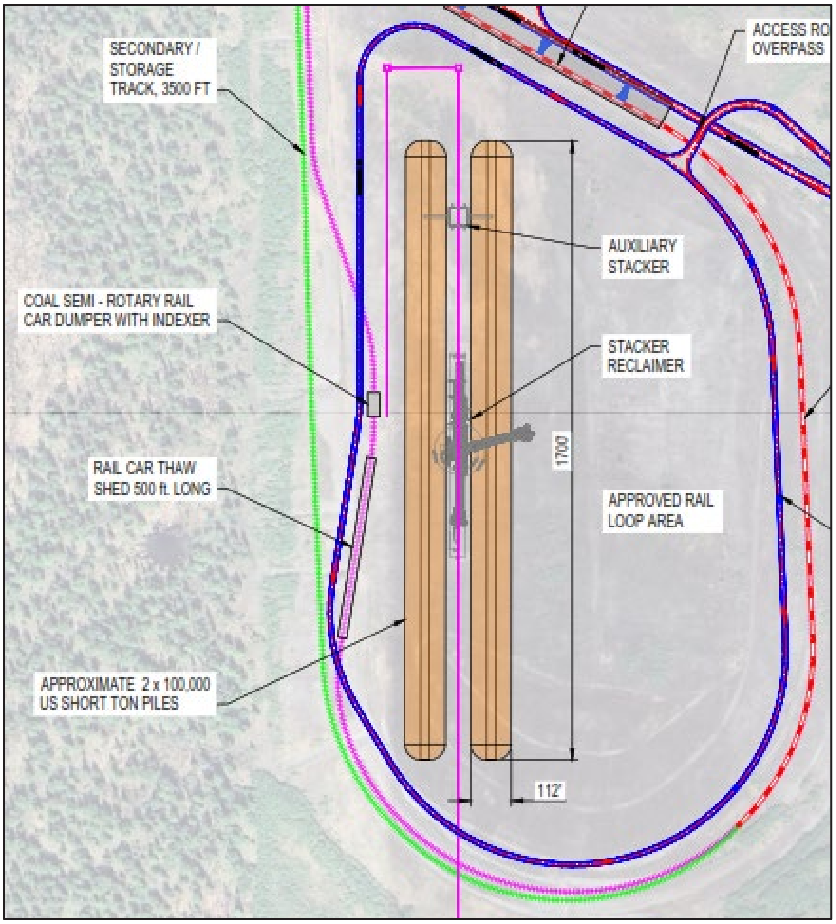
Whilst the rated capacity of a typical dumper of this type is up to 25 cars per hour, a year-round derate down to 15 cars per hour is assumed to account for reduced labour efficiency during the winter months. The derate allows frozen coal cars more residence time through the thaw shed and receive the required heat soak treatment.

Considering arrival and departure staging times, and a general eight-hour (overnight) delay, each train is in port for an average of 13 hours. The annual port loop track utilization by coal trains alone is up to 75%.

Coal received from rail cars is loaded into the storage yard by a series of transfer conveyors and a yard stacker reclaimer running on rails, see Figure 6-4. In case that the primary stacker reclaimer is involved in active shiploading, an auxiliary twin-boom stacker provides back up train unloading and inloading capability, see Figure 6-5.

For a storage capacity of one vessel's load of 75,000 tonnes, plus one week's worth of arrivals in case of a one-week vessel delay, the total port capacity required is 130,000 tons. A 200,000 ton storage yard has been sized based on two 1700 ft long, 100,000 ton piles, for additional capacity.

Figure 6-2: Coal Receiving and Storage



Ancillary functions of the coal receiving and storage area includes a ring access road inside of the rail loop to provide maintenance access to train cars and the dumper system, and rail scales prior to and after car dumping for inventory control.

During shiploading, coal is reclaimed by the primary reclaimer and placed onto yard conveyors, transported down the bluff towards the trestle for shiploading. For shiploading operations, see Section 7.

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Figure 6-3: Typical Semi-rotary Dumper System with Adjacent Hopper and Manual Railcar Disconnect

Figure 6-4: Indicative Coal Stacker Reclaimer

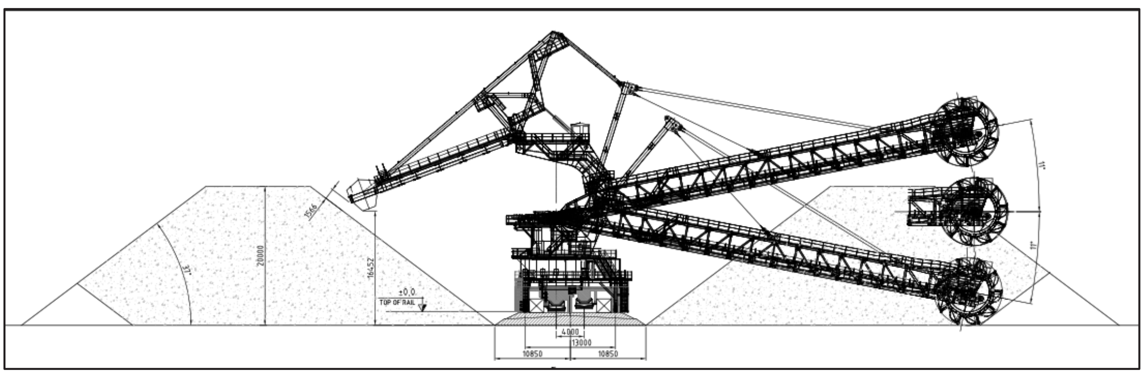

Figure 6-5: Auxiliary Twin-Boom Coal Stacker

6.2 Bulk Metal Concentrates

Approximately 75% of the metal concentrates, up to 2,117,000 ton/a, are assumed to arrive in bulk format by truck. This study has assumed the same truck configuration as that of the Mahn Choh operation undertaken by Black Gold Transport (BGT). The trucks would be tandem trailered (B-train) with 16 axles total, carrying 102,000 lbs (51 ton) of cargo in two side-dump trailers, see Figure 6-6. This configuration is legal for all southern Alaska main public roads and is also the design vehicle for the West Susitna Access Road being contemplated by AIDEA. The selection of this vehicle as the study basis provides good continuity with upstream logistics and their constraints as of today. On roads nominally north of Fairbanks and on smaller mine access roads, the trailers can simply be decoupled and hauled as single trailers by separate tractors.

Additionally, preliminary consultation with BGT revealed that the payload of the vehicle can likely be upsized as long as axle loads, particularly over bridges, can be mitigated to be within limits through additional axles. BGT has proposed a larger tandem tractor trailer combination with 20 axles and a gross payload of 122,000 lbs (61 tons), see Figure 6-7. Similarly, the tandem trailers can be neatly broken up for haulage on smaller roads in the north. Larger payload per trucks would allow further reductions in overland transport costs for the producers.

The cycle times and traffic estimate of this study has assumed the 16-axle truck to be conservative, however the port's layout such as turning radii has been done to accommodate the larger 20 axle truck of up to 114 ft length, should it become suitable in the future.

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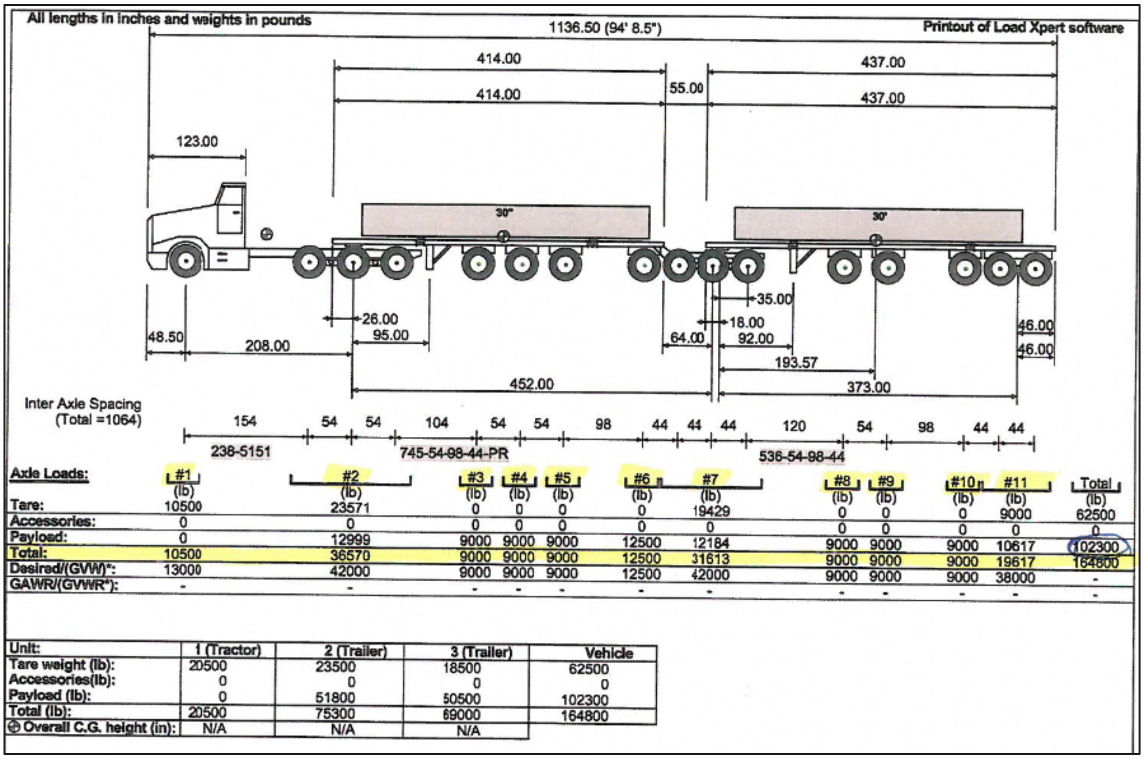
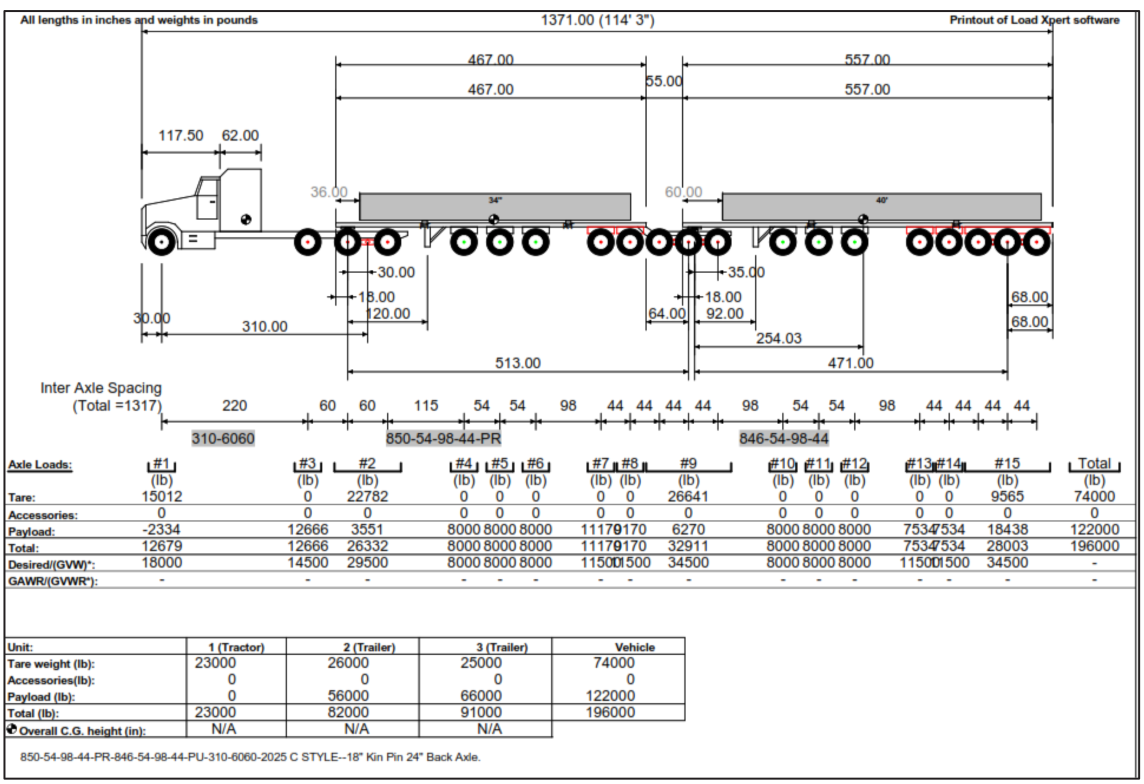
Figure 6-6: Bulk Trucking Design Vehicle – 16 Axle Tandem Tractor Trailer



Axle Loads:	#1 (lb)	#2 (lb)	#3 (lb)	#4 (lb)	#5 (lb)	#6 (lb)	#7 (lb)	#8 (lb)	#9 (lb)	#10 (lb)	#11 (lb)	Total (lb)
Tare:	10500	23571	0	0	0	0	19429	0	0	0	9000	62500
Accessories:	0	0	0	0	0	0	0	0	0	0	0	0
Payload:	0	12999	9000	9000	9000	12500	12184	9000	9000	9000	10617	102300
Total:	10500	36570	9000	9000	9000	12500	31613	9000	9000	9000	19617	164800
Desired/(GVW)*:	13000	42000	9000	9000	9000	12500	42000	9000	9000	9000	38000	-
GAWR/(GVWR*):	-	-	-	-	-	-	-	-	-	-	-	-

Unit:	1 (Tractor)	2 (Trailer)	3 (Trailer)	Vehicle
Tare weight (lb):	20500	23500	18500	62500
Accessories(lb):	0	0	0	0
Payload (lb):	0	51800	50500	102300
Total (lb):	20500	75300	69000	164800
⊕ Overall C.G. height (in):	N/A	N/A	N/A	

Figure 6-7: Future Bulk Truck Vehicle – 20 Axle Tandem Tractor Trailer



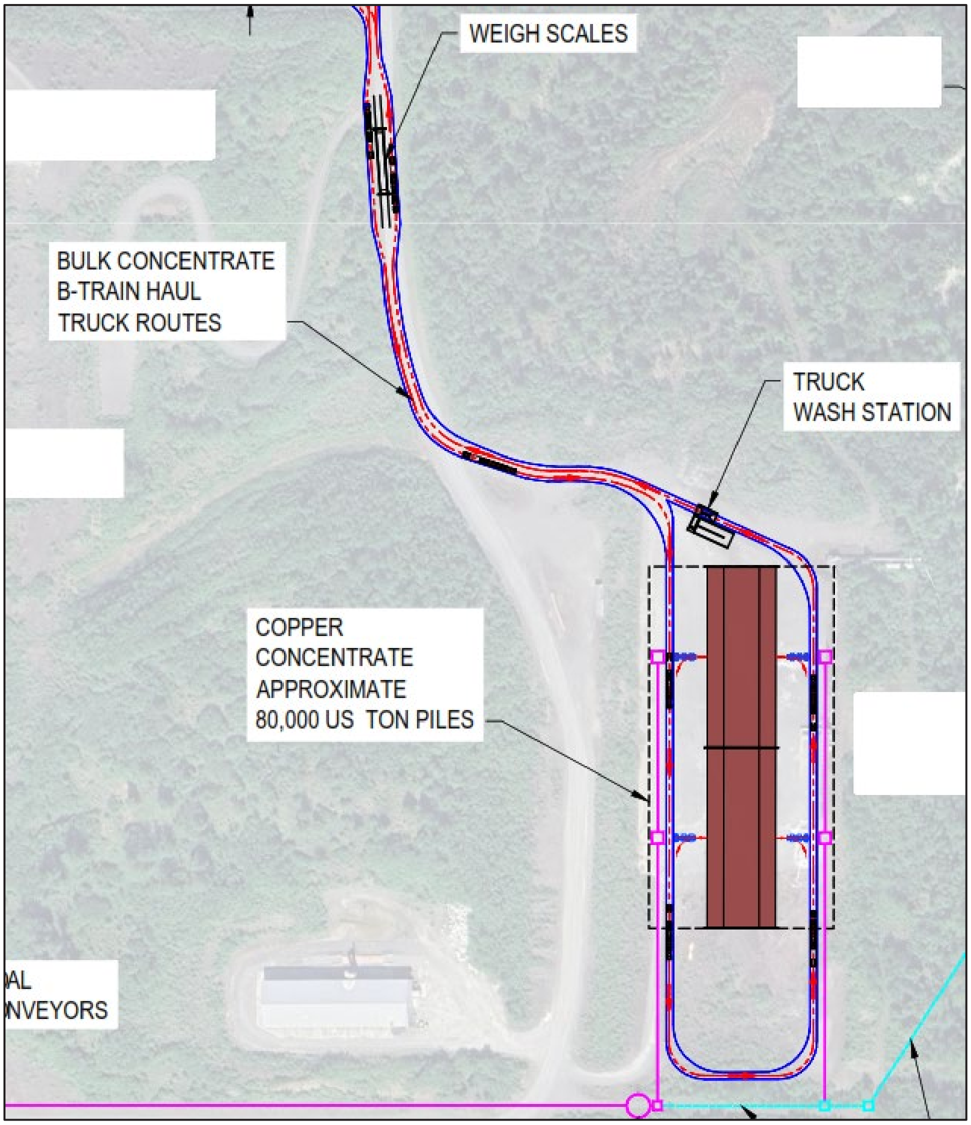
Axle Loads:	#1 (lb)	#3 (lb)	#2 (lb)	#4 (lb)	#5 (lb)	#6 (lb)	#7 (lb)	#8 (lb)	#9 (lb)	#10 (lb)	#11 (lb)	#12 (lb)	#13 (lb)	#14 (lb)	#15 (lb)	Total (lb)
Tare:	15012	0	22782	0	0	0	0	0	26641	0	0	0	0	0	9565	74000
Accessories:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Payload:	-2334	12666	3551	8000	8000	8000	11170	9170	6270	8000	8000	8000	7534	7534	18438	122000
Total:	12679	12666	26332	8000	8000	8000	11170	9170	32911	8000	8000	8000	7534	7534	28003	196000
Desired/(GVW)*:	18000	14500	29500	8000	8000	8000	11500	11500	34500	8000	8000	8000	11500	11500	34500	-
GAWR/(GVWR*):	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit:	1 (Tractor)	2 (Trailer)	3 (Trailer)	Vehicle
Tare weight (lb):	23000	26000	25000	74000
Accessories(lb):	0	0	0	0
Payload (lb):	0	56000	66000	122000
Total (lb):	23000	82000	91000	196000
⊕ Overall C.G. height (in):	N/A	N/A	N/A	

850-54-98-44-PR-846-54-98-44-PU-310-6060-2025 C STYLE--18" Kin Pin 24" Back Axle.

At the design volumes, 119 bulk concentrate trucks would arrive at port daily, or 6 trucks every hour on a 20-hour basis, allowing 4 hours for catch up and incidental maintenance. Bulk concentrate trucks arriving at port would be weighed in on a truck scale, and report to the bulk concentrate storage shed, see Figure 6-8. Concentrate is then side dumped and stockpiled by front end loaders up to 23 feet (7 m) high in the shed. Empty trucks U-turn at the far side of the shed and depart site.

Figure 6-8: Bulk Concentrate Truck Arrivals and Bulk Concentrate Storage



Trucks arriving six times hourly is a high intensity operation and prone to congestion. Instead of a single-track flow with a U-turn at the far end, future designs may consider two parallel streams of trucks to simultaneously arrive and unload into the shed, effectively halving the traffic intensity to three trucks per hour, per stream. This would require conveyors to the south of the building to be buried.

For a storage capacity of one vessel's load of 30,000 tonnes, plus one week's worth of arrivals in case of a one-week vessel delay, the total storage capacity required of the shed is 76,000 tons.

An 80,000-ton storage shed has been sized based on concentrate being managed to 23 ft high by FELs.

Ancillary functions of the bulk concentrate receiving and storage area includes incoming and outgoing truck scales, a self-contained wheel wash station with a settling pit and water filtration to mitigate concentrate track out, a dry-vacuum station for the same to be used during winter, and a U-turn area for trucks once through the shed.

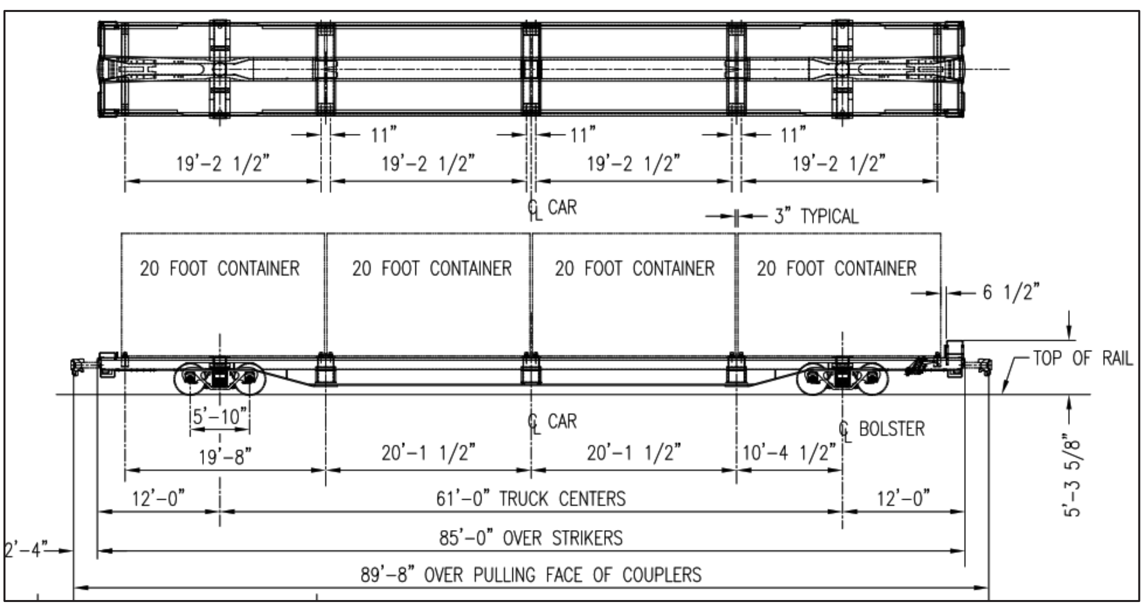
During shiploading, bulk concentrates would be loaded into one of several (four) hoppers atop outload conveyors inside the building. The concentrate shares the same outloading conveyor as coal and is transported down the bluff towards the trestle for shiploading. For shiploading operations, see Section 7.

As of the time of this report, Port MacKenzie management indicated that this area may be allocated to a future fuel farm for imported fuels. The placement of this shed in this study was to leverage the already semi-prepared area (gravel and existing roads) to reduce CAPEX. It may be relocated to other locations at later stages of design if required.

6.3 Containerized Metal Concentrates

25% of the metal concentrates, up to 706,000 ton/a, are assumed to arrive in containerized format (using “rotainers”) by rail due to the significant cost reduction compared with overland trucking, as identified in the original study. Based on advice from ARRC from the original study as to optimal train length and motive power, each train consist would be 45 cars long of 90 ft each, each carrying 4 containers, to a total length of 4,130 ft including one locomotive, see Figure 6-9. Each container carries 21.8 tons of concentrates to the limit of the rail car’s capacity, to a total of 87.2 ton concentrate per car, or 3,900 tons per train. At these annual volumes there would be 180 train arrivals per year. Fewer, longer, heavier trains may be possible if agreeable with ARRC but not assumed at this time.

Figure 6-9: Typical 90 ft Flat Rail Car for Containerized Concentrate Haul



As volumes are aggregated from multiple producers but no definition as yet for which producers will subscribe to containerized logistics, this study did not analyse whether a 45-car train is suitably sized as unit trains for a single producer or be a manifest-type service aggregating smaller volumes from multiple producers. This work can be commissioned once producer-specific volumes and origins are known.

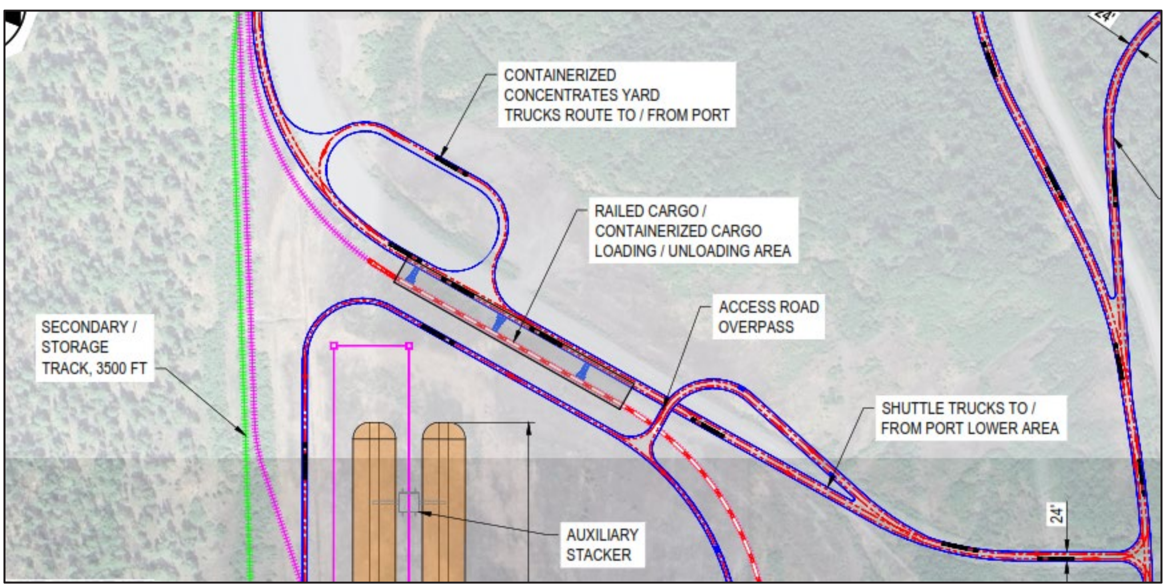
Once arrived at port, the train is routed alongside a reinforced concrete loading pad for container offloading. Port shuttle trucks similar to those in Figure 6-11 drive up and receive containers offloaded by container reach stackers and concurrently deliver empty containers back onto the train for the return journey. Due to the weight, gradient of site roads and reduced speeds, each shuttle truck trip may take up to 28 minutes. Up to 9 shuttle trucks and trailers are required to operate continuously between the rail area and the lower port area.

Considering arrival and departure staging times, and a general 8-hour (overnight) delay, each 45-car train is in port for an average of 12.4 hours. The annual port loop track utilization by containerized trains alone is 27%.

Referring to Section 6.1 which estimated coal train track utilization at 75%, the addition 27% herein places the single loop track at over 100% (102%) utilization. While this estimate is based on optimistic production scenarios and not all volumes may actually materialize at the same time, or at all, 102% utilization provides no ability to accommodate any further delays upstream, or with offloading activities within the port. It is therefore recommended that one spare track fitting at least one complete train of 4,200 ft be constructed to bolster the availability of the rail loop. The spare track is indicated in green in Figure 6-10.

Concentrate containers are stored in the lower uplands of the port, using the north end extension that was previously permitted in the port's previous expansion master plan, but was never built. Containers are stored segregated by train load on the presumption that one train is the cargo for one producer. The segregation of cargo is fluid and can be adjusted as required.

Figure 6-10: Rail receiving area for containerized concentrates.



For a storage capacity of one vessel's load of 30,000 tonnes, plus one week's worth of arrivals in case of a 1-week vessel delay, the total storage capacity required is 48,000 tons. A storage area for 50,000 ton in 2,300 containers has been sized based on containers being stacked 3-high. The 3-high stacking is deemed to be conservative in terms of ground pressure and risk of settlement. Once geotechnical conditions are proven in later work, stacking up to 5-high is possible to reduce the storage footprint.

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Figure 6-11: Typical Terminal Shuttle Truck and Trailer

During shiploading, containerized concentrates would be placed onto shuttle trucks for movement to a receiving hopper atop the trestle conveyor for onward conveying to the shiploader. For shiploading operations and special winter considerations, see Section 7.

6.4 Metal Concentrates – Import

Import of metal concentrates via Port MacKenzie presumes that a smelting / refining complex has been built in the uplands of the Borough, which will attract all types of concentrates for localized processing into final metals. Some of these volumes from isolated districts will need to arrive into Port MacKenize by vessel, such as those from the Southwest and Seward districts. This is presumed to be 500,000 ton/a based on an approximate mid-range scenario from our market assessment in Section 3.

It is also presumed that some, if not all quantities originally arriving by train or truck destined for export, will instead be diverted straight to the smelting complex. While it is not clear how much this will be, some will likely still need to be exported through Port MacKenzie. In any case it will be a net reduction of export traffic and berth usage from those estimated in above Sections 6.2 and 6.3 , providing more availability for importation and other activities.

As imports will be transiting in regional waters only, the vessels are unlikely to be exceptionally large. They can be smaller barges or shallow-draft type transshipment vessels. A wide assortment and variations of these vessels exist. Parcel sizes depend on the vessel type, such as 5,000 tonne self unloading barges of the Teck Red Dog style (Figure 6-12) or other larger barges or motorized bulk vessels. Lacking proper definition at this time, A 10,000 tonne parcel size has been assumed for this analysis, and so 55 ships will visit per year.

Assuming a conservative approach of unloading with grab buckets from either a barge's crane or a shore mounted crane, the average unloading rate will be in the order of 750 tonnes per hour. A receiving hopper will feed the cargo onto a reverse-flow trestle conveyor and onward into a short-term storage building, see Figure 6-13.

The concept of import by vessel is to offload from the vessel as quickly as possible into temporary storage in the immediately uplands of the port, to avail the berth. The short-term storage building at port thus is sized for one 10,000 tonnes (11,000 US ton) shipment, see typical style in Figure 6-14 . Contracted trucking will drive through, load up, and move the concentrate steadily to the smelting complex prior to the next vessel arrival.

At this stage of study, no consideration has been given for the batching and separation of cargo from multiple producers in the storage building, but this can typically be done easily with prefabricated concrete barriers (Lok-Bloks). The building can be modular with capacity to easily expand lengthwise should throughput volumes grow.

Figure 6-12. Typical Self Unloading Barge (Teck Red Dog Operations Shown)

Figure 6-13. Typical Ship Unloading Hopper, Interfacing with Ship's gear and Grab Bucket

Figure 6-14: Typical Short Term Concentrate Storage Building

6.5 Project Cargo and Mining Consumables

Port MacKenzie is also envisaged to be the point of arrival for mining project cargo and consumables. The cargo is highly variable; it may be outsized, whole vehicles, on pallets, in containers, or in tanks and totes. As of this report there is no definition for the volumes of this cargo. This study has allocated the southern end of the immediate uplands at Port MacKenzie for a general staging area, see Figure 6-15. This cargo is envisaged to arrive by barge, as with the Teck Red Dog model (see Figure 6-16), and be offloaded via the marginal shallow draft barge dock. This allows this entire stream of traffic to be set apart from bulk cargo and the deepwater berth. Port MacKenzie is in process of procuring a 120-ton wheeled crane for general use and will be fit for this purpose.

Note that the current deepwater berth's utilization is already at the upper limit with the projected bulk cargo volumes and would be unable to accommodate project cargo through it with any manner of extension. Should there be a future expansion by way of an *entirely new second berth,* this type of cargo can then arrive by larger deep-draft vessels and berth there. Cargo can be handled by a mobile harbor crane on the new dock. Future excessive volumes of project cargo can be accommodated easily with the vast real estate further uplands, including, notably, the inside of the rail loop.

Figure 6-15: Project Cargo and Mining Consumables Area

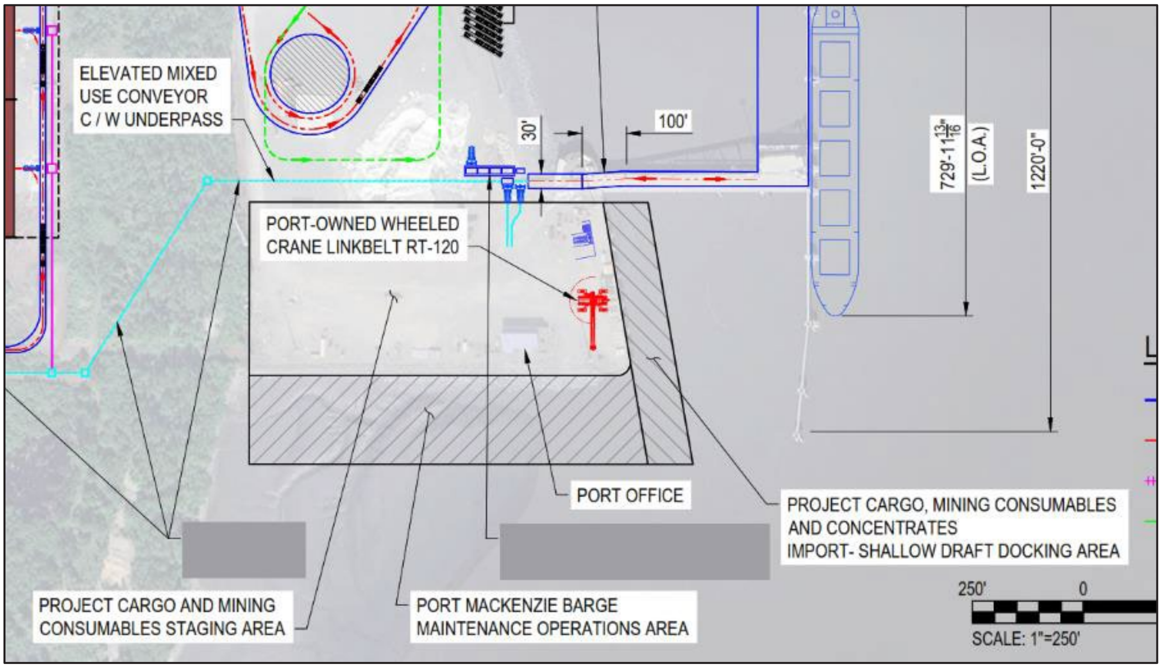
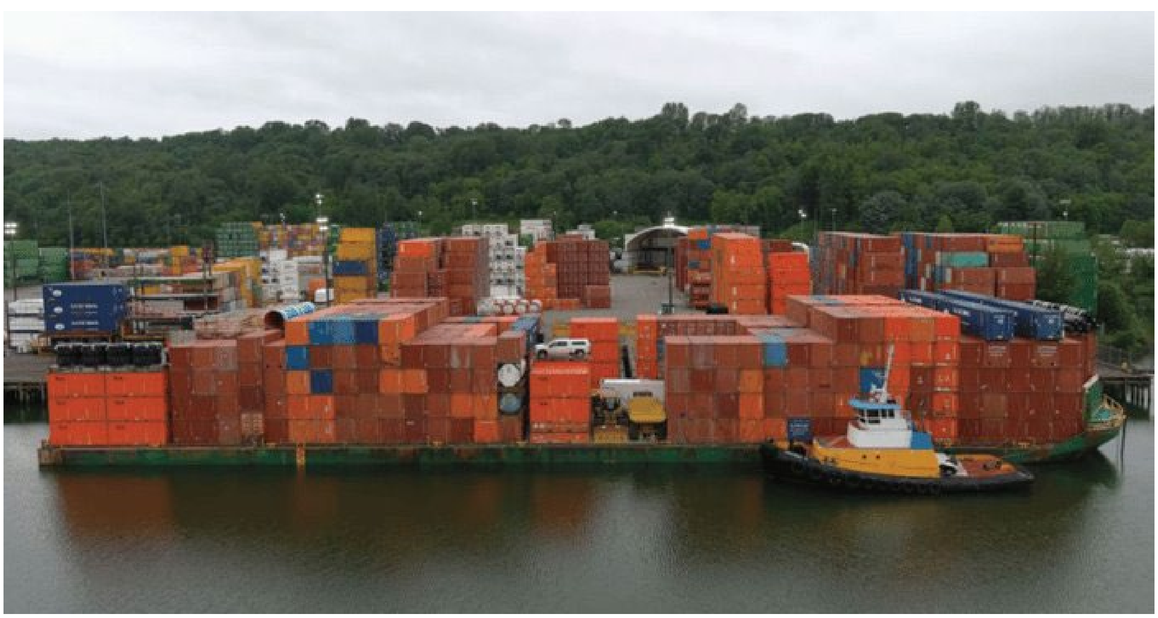


Figure 6-16: Typical Barge Arrivals with Project Cargo



6.6 Cargo Arrivals Summary

Table 6-1 provides a tabularized summary of key metrics for all cargo and traffic arriving at Port MacKenzie discussed in the above sections.

Table 6-1: Port MacKenzie Cargo Arrivals Summary and Key Metrics

	Coal Export	Bulk Concentrates Export	Containerized Concentrates Export	Bulk Concentrates Import	Project Cargo
Design Tonnage (ton/a)	2,400,000	2,117,000	706,000	500,000	Unknown
Arrivals Transportation Mode	45-car coal train, 110 ton per car	16 Axle Tandem Tractor Trailer, 51 ton cargo	45-car concentrate train, 4 x 21.8-ton cargo containers per car	10,000 tonne parcel barges / small transshipment vessel	Barges
Arrivals Frequency	485 trains per year	119 trucks per day	180 trains per year	55 ships per year	Unknown
Total Time In Port (Per)	13 hours	10 minutes	12.4 hours	25 hours	Unknown
Rail Loop Utilization (%)	75% (Note 1)	Not used	27% (Note 1)	Not used	Note 2

Note 1: Combined utilization exceeds 100%. A second loop track is recommended.

Note 2: Opportunity for select mining cargo to utilize empty mining containers on trains in a backhaul fashion going back up to the mines.

7 Export Cargo Outload – Volumes and Methodology

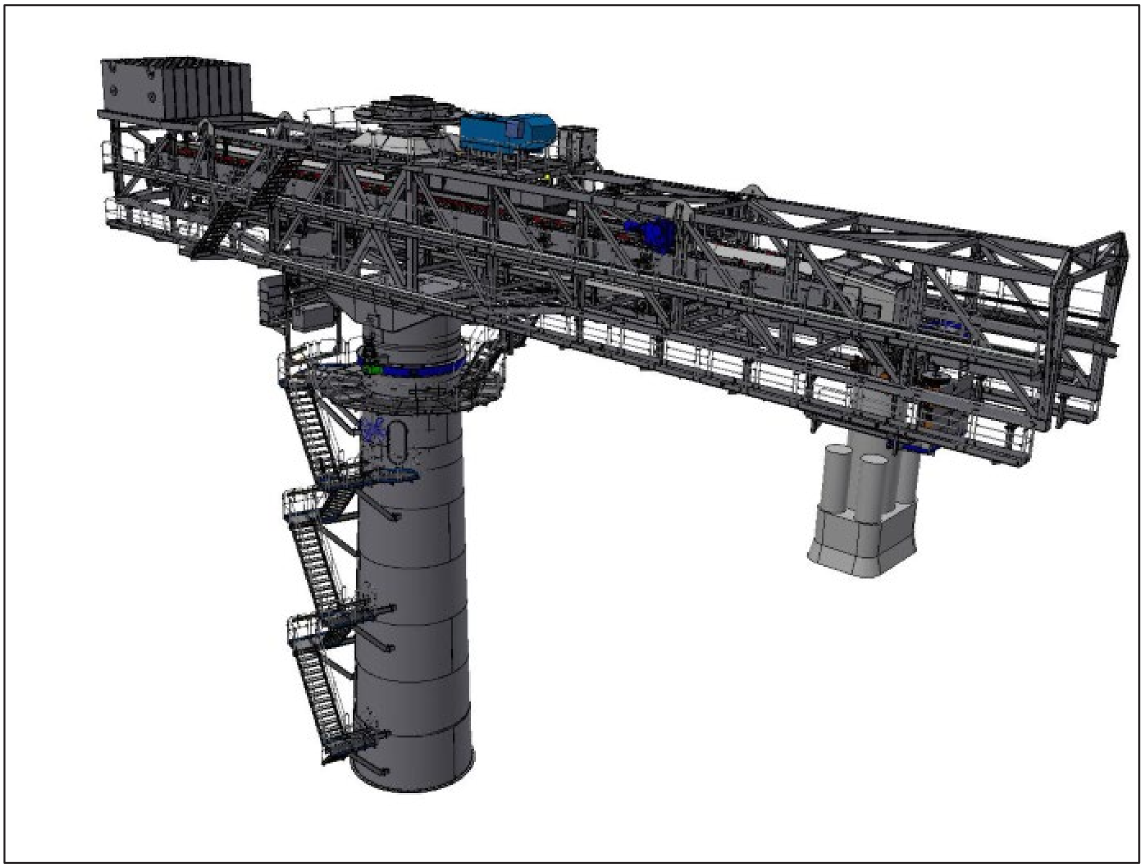
7.1 Coal

Outload of coal is presumed to be in 75,000 t parcels, benchmarked upon another prominent coal export terminal in Northern British Columbia. Coal will be reclaimed from the coal storage yard by the primary stacker reclaimer and moved towards the berth via a conveyor that descends the bluff onto a trestle conveyor and ultimately the shiploader.

The existing shiploader and trestle conveyor are inadequate for the combined coal and bulk concentrate loading duty as explained in sections below. A complete demolition and replacement of the current trestle conveyor and shiploader is required, replaced with a new system capable of a sustained capacity of 3,000 mtph. The shiploader to be installed will be a fix-mounted pedestal type with a slewing and telescopic boom, befitting the narrow footprint of the dock. Should the dock be expanded north or south, a long travelling type shiploader should be considered as it will be more versatile, provide better hatch coverage, and reduce the times for loading. A typical fixed pedestal type shiploader recommended is shown in Figure 7-1.

For the design 2,400,000 ton/a throughput and 75,000 tonne parcels, 35 vessels will visit Port MacKenzie per year. Considering berthing, deberthing, hatch change, shift change and other operational delays, each ship would be at berth for approximately 41 hours. Annually, the berth utilization rate of all coal ships is estimated to be at 18% of the total available time of the berth (full year less one month of winter shut down). The last ship of the year prior to shut down would empty the complete coal storage inventory in the yard, thereby availing space for two more weeks of coal arrivals.

Figure 7-1: Typical Fixed Pedestal Shiploader

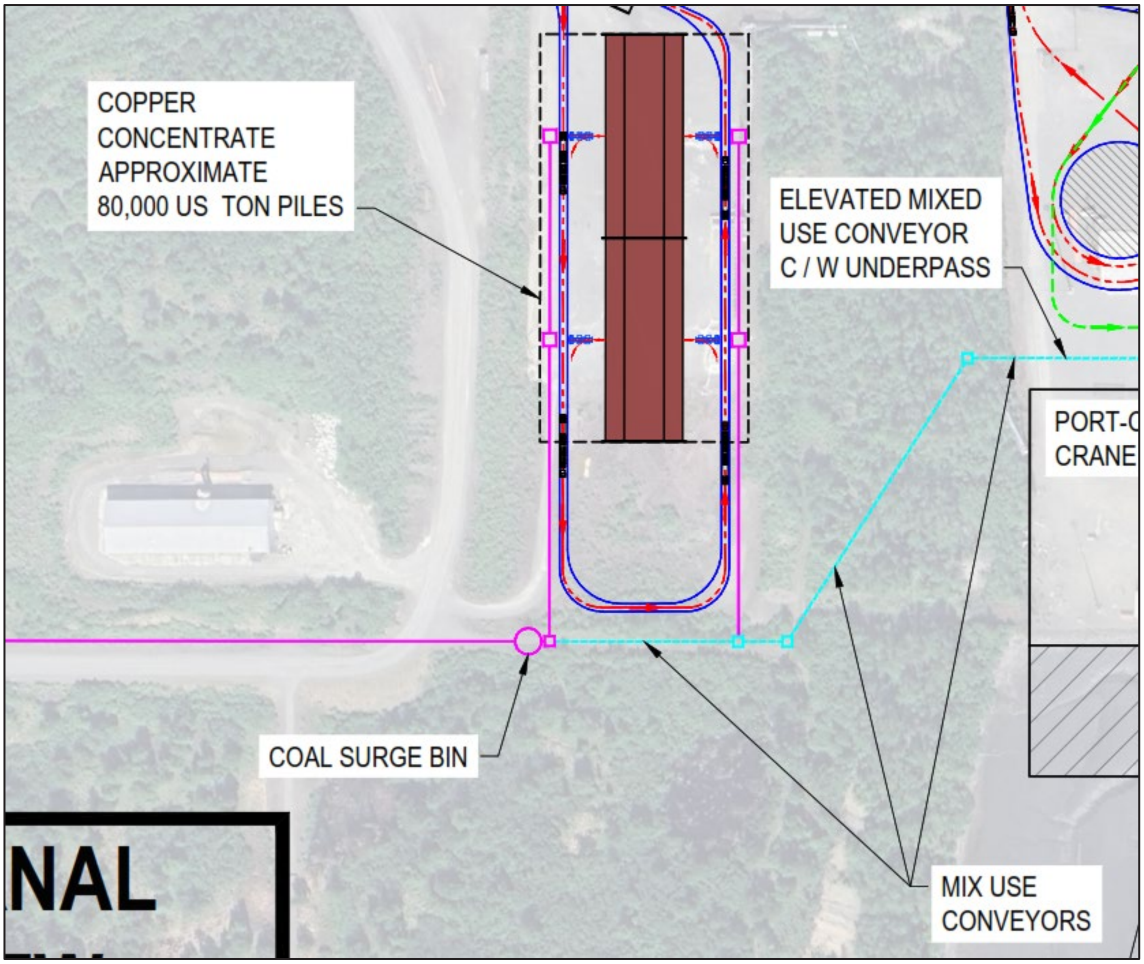


7.2 Bulk Concentrates

Outload of bulk concentrates is presumed to be in 30,000 t parcels, same as the original study. Concentrates will be reclaimed from the bulk concentrate storage building by FELs loading into hoppers, and moved out of the building via outloading conveyors, see Figure 7-2. It ties in with the coal conveyors that descends the bluff onto a trestle conveyor and ultimately the shiploader. The achievable outloading rate from the storage building is sized at 1,000 mtph with two FELs working at the same time.

For the design 2,117,000 ton/a throughput and 30,000 t parcels, 78 vessels will visit Port MacKenzie per year. Considering berthing, deberthing, hatch change, shift change and other operational delays, each ship would be at berth for approximately 45 hours. Annually, the berth utilization rate of all bulk concentrate ships is estimated to be at 44% of the total available time of the berth (full year less 1 month of winter shut down). The last ship of the year prior to shut down would empty the complete bulk concentrate inventory in the building, thereby availing space for 2 more weeks of concentrate arrivals.

Figure 7-2: Bulk Concentrates Outloading Concept



7.3 Containerized Concentrates

Outload of containerized concentrates is also presumed to be in 30,000 t parcels, same as the original study. Concentrates will be shuttled from the container storage yard with terminal shuttle trucks, to a loading hopper that intercepts the outloading conveyor, see Figure 7-3. Two reach stackers working in tandem, each equipped with a revolver attachment, would tip each container into the hopper, then cargo moved onto the trestle conveyor and ultimately the shiploader, see Figure 7-4. The achievable outloading rate is approximately 660 mtph with two FELs working at the same time.

» CLICK TO RETURN TO TABLE OF CONTENTS

Figure 7-3: Containerized Concentrates Outloading Concept

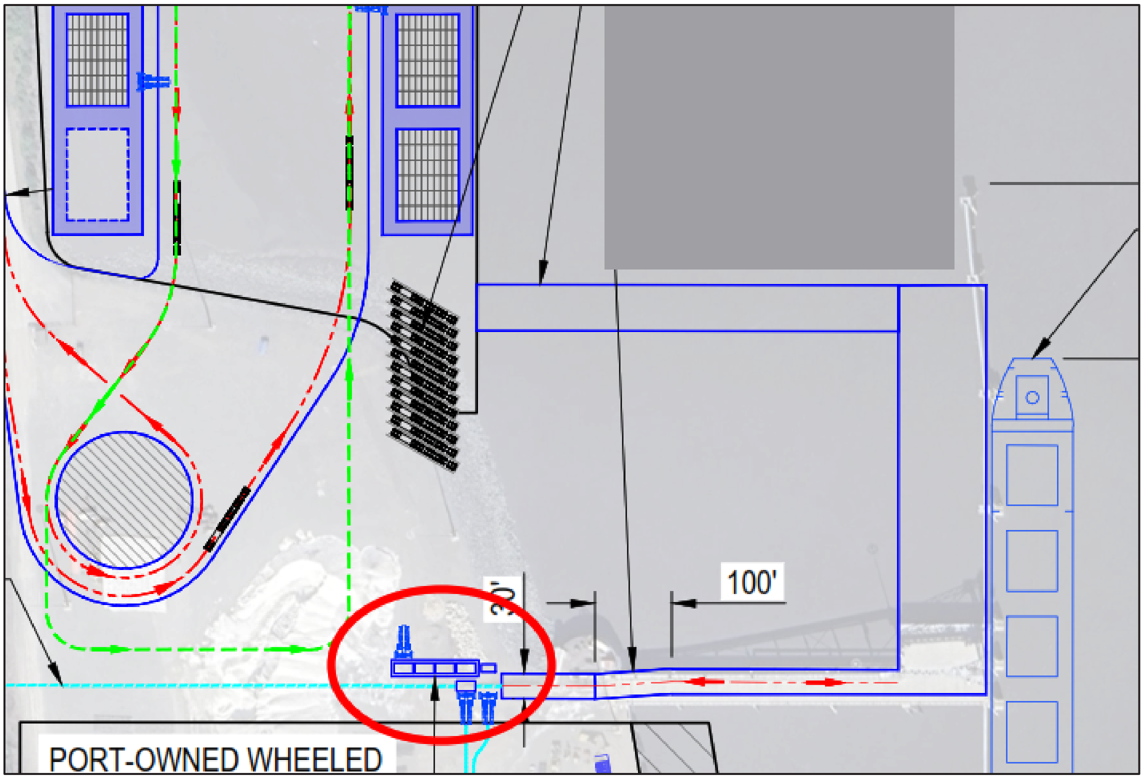


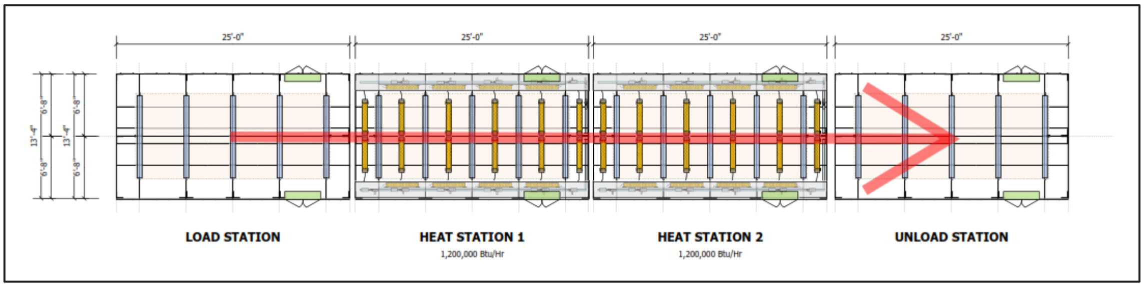
Figure 7-4: Revolver Attached to a Reach Stacker

7.3.1 Winter Operations with Containers

Concentrates with inherent water moisture content of 5% to 9% may freeze in the containers if exposed to extreme cold for prolonged periods of time without an adequate opportunity to thaw out prior to shiploading. Upon tipping some concentrates (up to 10%) may be stuck to the walls of the container resulting in carry back and loss of cargo. This challenge applies to the MacKenzie/Anchorage area for approximately six months per year, including two shoulder months and four winter proper months.

During these months, any containers holding known or suspected frozen cargo will need to undergo a thawing process prior to being tipped. APEC Thermal provided a concept for a continuous container thawing system, see Figure 7-5. For this system, a 'cold' container would be placed at the inlet of the station by a reach stacker; the station would automatically advance the container through heating stations and be discharged at the other end thawed and ready for tipping into a hopper. The total cycle time for each container to be heated to an extent that the perimeter is thawed may be four minutes during a milder shoulder month, and eight minutes during a winter month. As a result, loading durations may reduce to as low as 320 mtph for shoulder months, and 160 mtph for deep winter months. At Port MacKenzie there is presently no natural gas service, so most likely an electrically powered variant will be specified.

Figure 7-5: Conceptual Continuous Container Thaw Station



Thawing durations are indicative only. Exact thawing durations for a successful release will need to be empirically learned through experience, taking into account a wide set of factors such as a container's time spent in deep cold (at the mines), in transit, in port, and even in sun or rain exposure. A variant of the APEC thermal container thawing station is being installed in Quebec Canada and should be studied later for its field performance.

For the design 706,000 ton/a throughput and 30,000 t parcels, 26 vessels will visit Port MacKenzie per year. Considering berthing, deberthing, hatch change, shift change and other operational delays, each ship would be at berth for approximately 62 hours in the summer, worsening to 110- and 204-hours during shoulder and deep winter months respectively. The long times at berth are wholly attributable to container thawing bottlenecks. Annually, the berth utilization rate of all concentrate ships receiving de-containerized cargo is estimated to be at 28% of the total available time of the berth (full year less 1 month of winter shut down). The last ship of the year prior to shut down would empty the complete containerized concentrate inventory in the storage yard, thereby availing space for two more weeks of concentrate arrivals.

7.4 Bulk Concentrates Import and Project Cargo

Imported bulk concentrates for local smelting and project cargo are both envisaged to be trucked away from port. This is considered incidental traffic and has not been analysed in depth. An opportunity exists to utilize empty mining containers on trains, now void of cargo to backhaul mining consumables back up to the mine. A separate operation is required for container stuffing operations.

7.5 Cargo Outloading Summary

Table 7-1 provides a tabularized summary of key metrics for all cargo and traffic departing Port MacKenzie discussed in the above sections.

» CLICK TO RETURN TO TABLE OF CONTENTS

Table 7-1: Port MacKenzie Cargo Outload Summary and Key Metrics

	Coal Export	Bulk Concentrates Export	Containerized Concentrates Export	Bulk Concentrates Import	Project Cargo
Design Tonnage (ton/a)	2,400,000	2,117,000	706,000	500,000	Unknown
Departure Transportation Mode	75,000 mt parcels	30,000 mt parcels (10,000 mt per hold)	30,000 mt parcels (10,000 mt per hold)	16 axle tandem tractor trailers, 51-ton cargo	General Purpose Tractor Trailers or Container Train Backhaul
Departures Frequency	485 trains per year	119 trucks per day	180 trains per year	55 ships per year	Incidental
Total Time in Port (per)	41 hours	45 hours	62 hours summer 204 hours winter (with container thawing)	15 minutes	Incidental
Deepwater Berth Utilization (%)	18%	44%	28%	17%	Barge dock only (Note 1)
Deepwater Berth Utilization Total (%)	90% (See Section 0)			See Section 0	N/A

Note 1: Barge dock is a distinctly separately facility than the deepwater berth. Its utilization does not contribute to the utilization % of the deepwater berth.

7.5.1 Deepwater Berth Utilization Analysis

Total deepwater berth utilization sums the total traffic of coal, bulk concentrate and containerized concentrate exports of 18%, 44% and 28% respectively, to a total of 90% utilization. The berth utilization by concentrate imports of 17% are not assumed to be additive to this 90% figure as export concentrates volumes can be expected to decrease with the start up of a local smelter that simultaneously commands the increase of imported volumes. Therefore, the 17% would be considered in lieu of a portion of concentrate export berth utilization.

A 90% berth utilization approaches and marginally exceeds a customary upper limit of berth utilization of 85%-90%. Beyond this limit there is historically-proven, worsening difficulty in a port's ability to accommodate delays and catch up, resulting in worsening vessel wait times until the operation becomes untenable. At this time as much of the projected cargo volumes are high level and were deliberately optimistic at the outset, Ausenco recommends no major investments in a second berth unless such high cargo volumes are proven and solidified.

8 Capital Development Quantity Estimates

Quantities developed by Ausenco have been included in Appendix B.

8.1 Basis of Estimate

The basis of estimate details are as follows:

- General accuracy of AACE Class V.
- All items identified in the previous study continue to be listed in original 2023-2024 pricing.
- All items newly identified as part of this study has allowed for 2025 pricing.
- CBH Containers (Rotainers) are assumed to be owner-supplied by each individual producer, or from a pooled fleet co-owned by a consortium of producers. In any case, container costs are not born this project and excluded from this estimate.
- Ausenco provided reference costs for specialist items within Ausenco's area of speciality, for acceptance by PND. These include material handling installations and process-related installations such as scales, wash stations, vacuum stations, and RFID systems.
- Reference costs in Canadian dollars have been converted to US dollars at 1 USD to 1.33 CAD
- Excludes owner's costs, land leases, taxes, tariffs, duties, contingency and EPCM.

9 Concurrent Initiatives – Alaska DOT Port MacKenzie Expansion

Concurrent but distinctly separate from this study, Alaska DOT was in the process of applying for a US Maritimes Association's (MARAD) Port Improvement Development Program Grant (PIDP) culminating in the issuance of a formal application (Application) to MARAD on September 10, 2025. This application was provided to this study for peripheral consideration on September 16.

Whilst formally outside of the scope of this present study, Ausenco conducted incidental, high level review of the approach, scope and facilities proposed in this Application. The improvements focused on facilities and infrastructure to support potential Alaska LNG projects (AKLNG) that would reach construction peak in 2027-2029, with a proposed piping component tonnage of up to 600,000 tons to be imported via Port MacKenzie, or 200,000 tons per year for 3 years. It also discusses supporting a future Sustainable Aviation Fuel (SAF) storage and refinery facility. It proposes major improvements that chiefly include but are not limited to:

- substantial road and civil improvements for heavy haulage,
- new uplands laydown areas cut from primarily undeveloped terrain;
- completion of the Port MacKenzie rail loop.

This volume of outsized piping materials is expected to arrive by ship and be taken in via the sole existing deep water berth and staged. They will then be moved to the construction by rail, or failing successful rail completion, by truck. Rail and truck traffic is projected to be significant with 25-50 trains a year (50-car, 8000 tons per) or 70-80 trucks daily. The SAF is also described as requiring 'continuous inbound vessel calls that carry bulk liquids or biomass…' and '…multimodal transfer capabilities (rail and truck)…"

Initial review of the master plan included with the application, excerpted as Figure 9-1 shows that the proposed improvements are generally adjacent to, but generally do not overlap with those proposed in this study for mining cargo import-export. A minor exception to this may be the competing demand for laydown area in the immediate updates from the trestle.

It is noted however that the transportation traffic as a result, both inbound to the port by ship and outbound traffic by truck and / rail, are significantly and substantively additive to those mining tonnages analysed in this study, which already identified near-saturation conditions to both the existing berth and the single rail. Our study recommended one (1) additional spare track to alleviate the trackage overcommitment due to mining tonnages only, which may lend incidental availability to some cargo demands of this Application. However, this study categorically made no specific considerations for of the cargos implied in this Application.

In the event that all demands from AKLNG, SAF and mining cargo volumes reach peak simultaneously, Port MacKenzie is likely to become overcommitted. Ongoing assessments as to the projected timeline and likelihood of tonnages coming through the port should be conducted to predict tonnages so improvements and expansions to Port MacKenzie can be planned and executed accordingly.

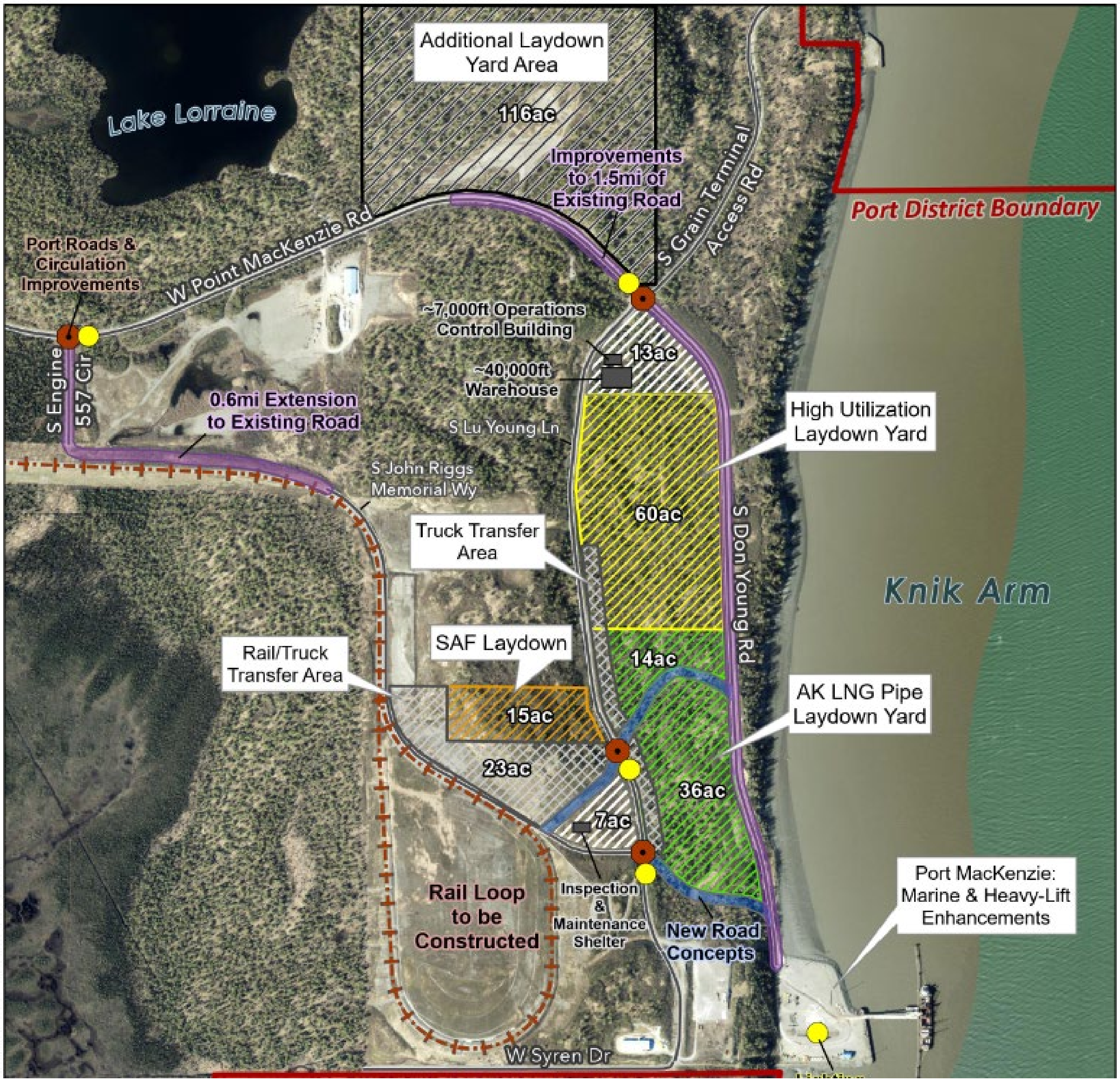


Figure 9-1. Alaska DOT PIDP Master Layout Plan (excerpt).

Appendix A – List of Mining Assets

Region	Owner	Property Name
Ambler	Teck Resources Limited	Lik
Ambler	Teck Resources Limited	Red Dog
Ambler	Valhalla Metals Inc.	Sun
Ambler	Trilogy Metals Inc.	Upper Kobuk Mineral Projects
Interior	Resolution Minerals Ltd	64North
Interior	Contango Ore, Inc.	Amanita
Interior	Felix Gold Limited	Ester Dome
Interior	Tectonic Metals Inc.	Flat
Interior	Kinross Gold Corporation	Fort Knox
Interior	Grid Battery Metals Inc.	Galleon
Interior	Freegold Ventures Limited	Golden Summit
Interior	Newmont	Healy
Interior	Alaska Silver Corp.	Honker
Interior	Alaska Silver Corp.	Illinois Creek
Interior	Boot Hill Gold, Inc.	Liberty Bell
Interior	Felix Gold Limited	MHT
Interior	J2 Metals Inc.	Napoleon
Interior	Waterton Global Resource Management, Inc.	Nixon Fork
Interior	Northern Star Resources Limited	Pogo
Interior	Tibbs Creek Gold, LLC	Rob
Interior	South32 Limited	Roosevelt
Interior	Alaska Silver Corp.	Round Top
Interior	Unnamed Owner	SAM
Interior	Doyon, Limited	Seventymile
Interior	Freegold Ventures Limited	Shorty Creek
Interior	Sumitomo Metal Mining Co., Ltd.	Stone Boy
Interior	Kenorland Minerals Ltd.	Tanacross
Interior	Tectonic Metals Inc.	Tibbs
Interior	Felix Gold Limited	Treasure Creek

Region	Owner	Property Name
Interior	Usibelli Coal Mine, Inc.	Usibelli
Seward	Bering Straits Native Corporation	Bluff
Seward	Tubutulik Mining Company LLC	Boulder Creek
Seward	Bering Straits Native Corporation	Council
Seward	Graphite One Inc.	Graphite Creek
Seward	Bering Straits Native Corporation	Rock Creek
South	PolarX Limited	Caribou Dome
South	Discovery Alaska Limited	Chulitna
South	NovaGold Resources Inc.	Donlin
South	Nova Minerals Limited	Estelle
South	Flatlands Energy	Flatland Coal
South	New Age Metals Inc.	Genesis
South	Contango Ore, Inc.	Golden Zone
South	Contango Ore, Inc.	Johnson Tract
South	Contango Ore, Inc.	Lucky Shot
South	Alaska Energy Metals Corporation	Nikolai
South	Private Interest	Rainbow Hill
South	PolarX Limited	Stellar
South	WestMountain Gold, Inc.	Terra
South	GoldMining Inc.	Whistler
South	Usibelli Coal Mine, Inc.	Wishbone Hill
Southeast	Alaska Energy Metals Corporation	Apex
Southeast	Ucore Rare Metals Inc.	Bokan Mountain
Southeast	NeXGold Mining Corp.	Cantoo
Southeast	Stillwater Critical Minerals Corp.	Duke Island
Southeast	Hecla Mining Company	Greens Creek
Southeast	Coeur Mining, Inc.	Kensington
Southeast	Grande Portage Resources Ltd.	New Amalga
Southeast	NeXGold Mining Corp.	Niblack
Southeast	American Pacific Mining Corp.	Palmer

Region	Owner	Property Name
Southeast	Galleon Gold Corp.	Salt Chuck
Southeast	Alaska Energy Metals Corporation	Snettisham
Southeast	NeXGold Mining Corp.	Texas Creek
Southwest	Lion Copper and Gold Corp.	Groundhog
Southwest	Northern Dynasty Minerals Ltd.	Pebble
Southwest	Northern Dynasty Minerals Ltd.	Pebble South
Southwest	The Aleut Corporation	Pyramid
Southwest	Mamba Minerals LLC	Quicksilver North
Southwest	TNR Gold Corp.	Shotgun
Southwest	Mamba Minerals LLC	Southwest Kuskokwim
Southwest	Heliostar Metals Ltd.	Unga

Appendix B – Capital Development Quantity Estimates (Appendix F.2 in Alaska Mineral Production, Transportation, and Port Capacity Study)

Appendix C – Port MacKenzie Multi-commodity Conceptual Terminal Layout (Appendix G in Alaska Mineral Production, Transportation, and Port Capacity Study)

APPENDIX C – PORT MACKENZIE SITE FIGURES

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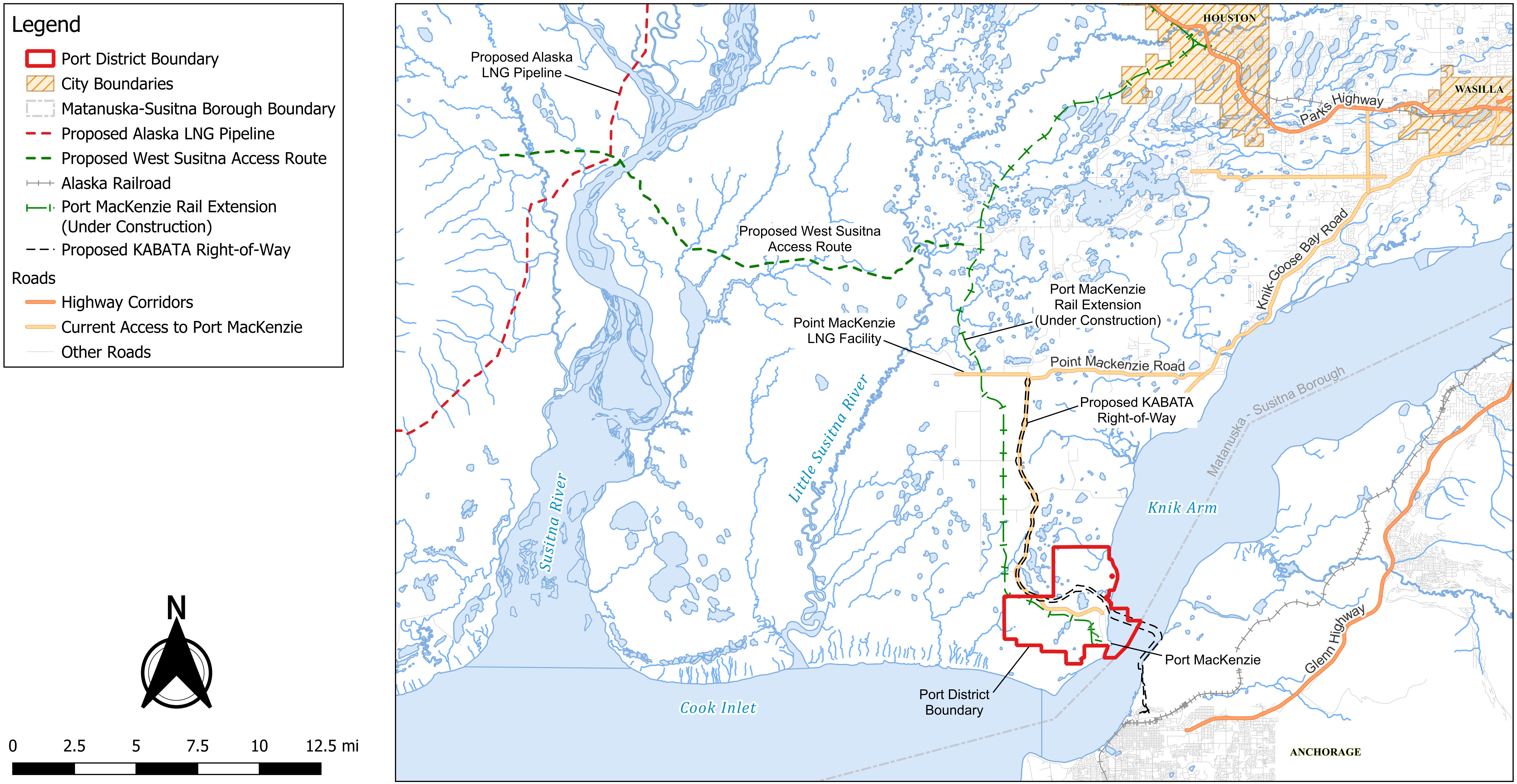

NOTE:
BACKGROUND MAP PROVIDED BY MATANUSKA-SUSITNA BOROUGH AND ALASKA DEPARTMENT OF TRANSPORTATION GIS.

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PND ENGINEERS, INC.

AIDEA PORTS STUDY
PORT MACKENZIE

OVERVIEW MAP

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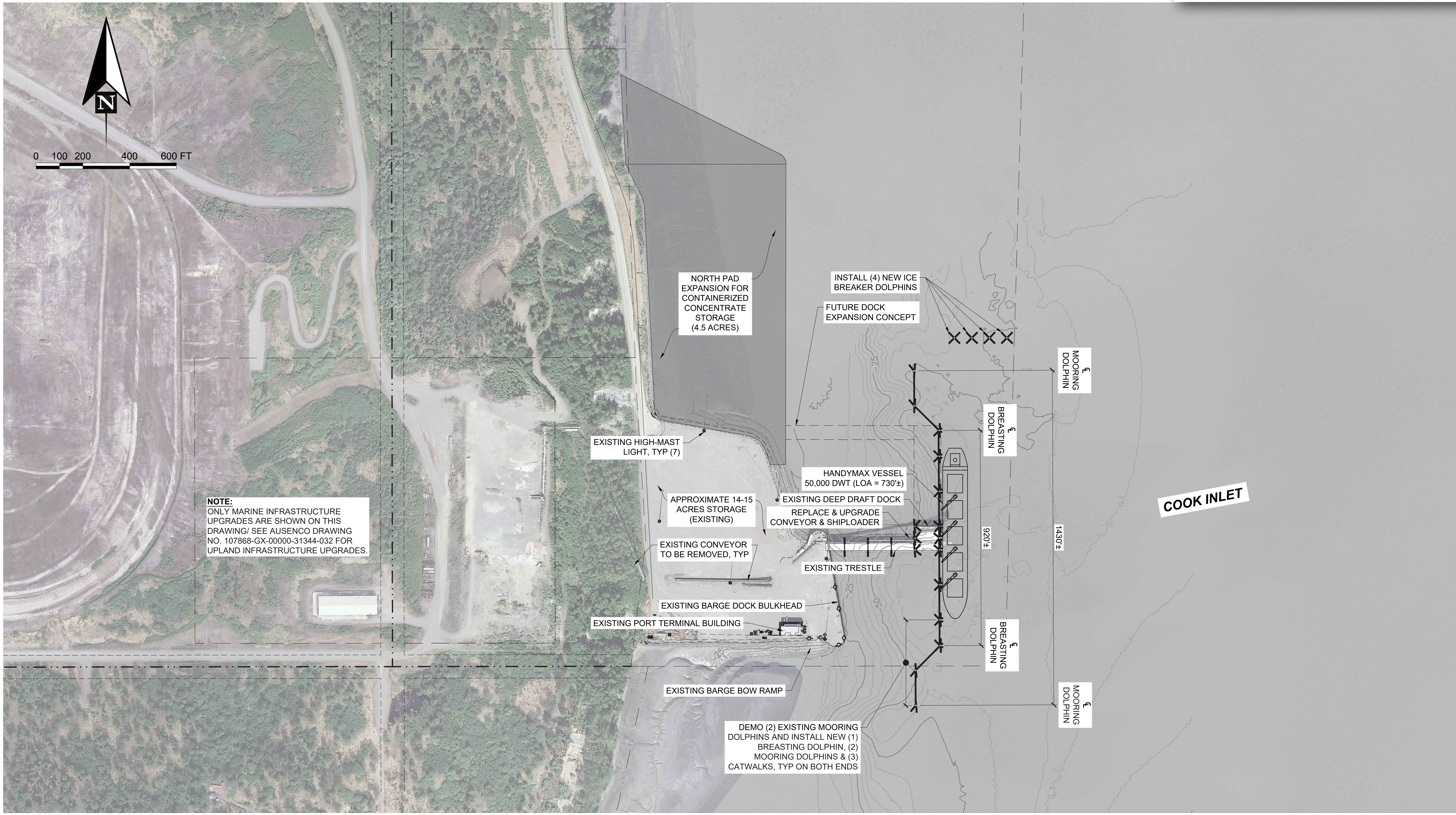

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PND ENGINEERS, INC.

PROJECT:
AIDEA PORTS STUDY

TITLE:
PORT MACKENZIE INFRASTRUCTURE UPGRADES

DESIGNED BY:	JAC	DATE:	9/26/2025
CHECKED BY:	CDC	PROJECT NO:	231099

SHEET NO: 1 OF 1

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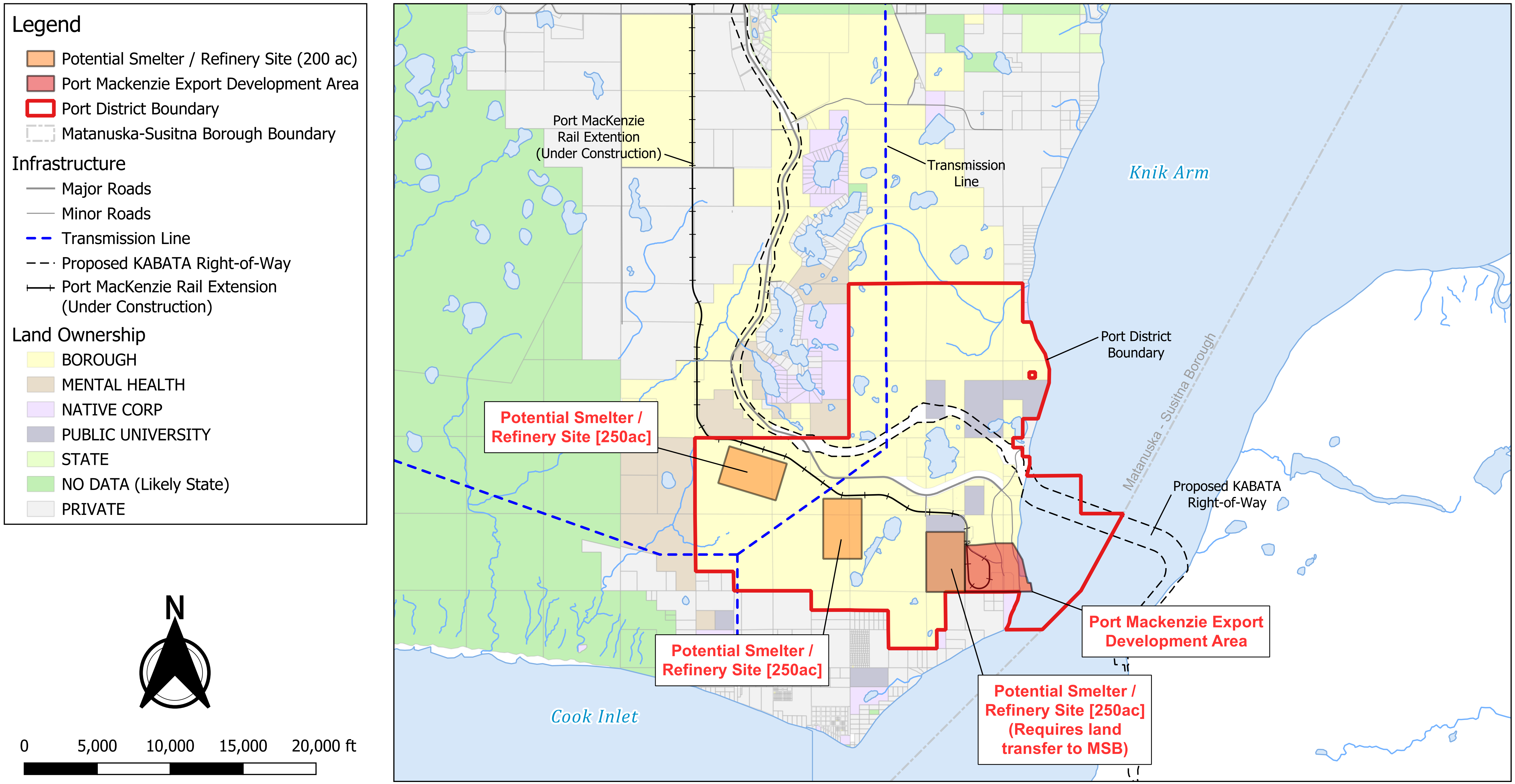

NOTE:
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AIDEA PORTS STUDY
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POTENTIAL SMELTER / REFINERY
SITE LOCATIONS

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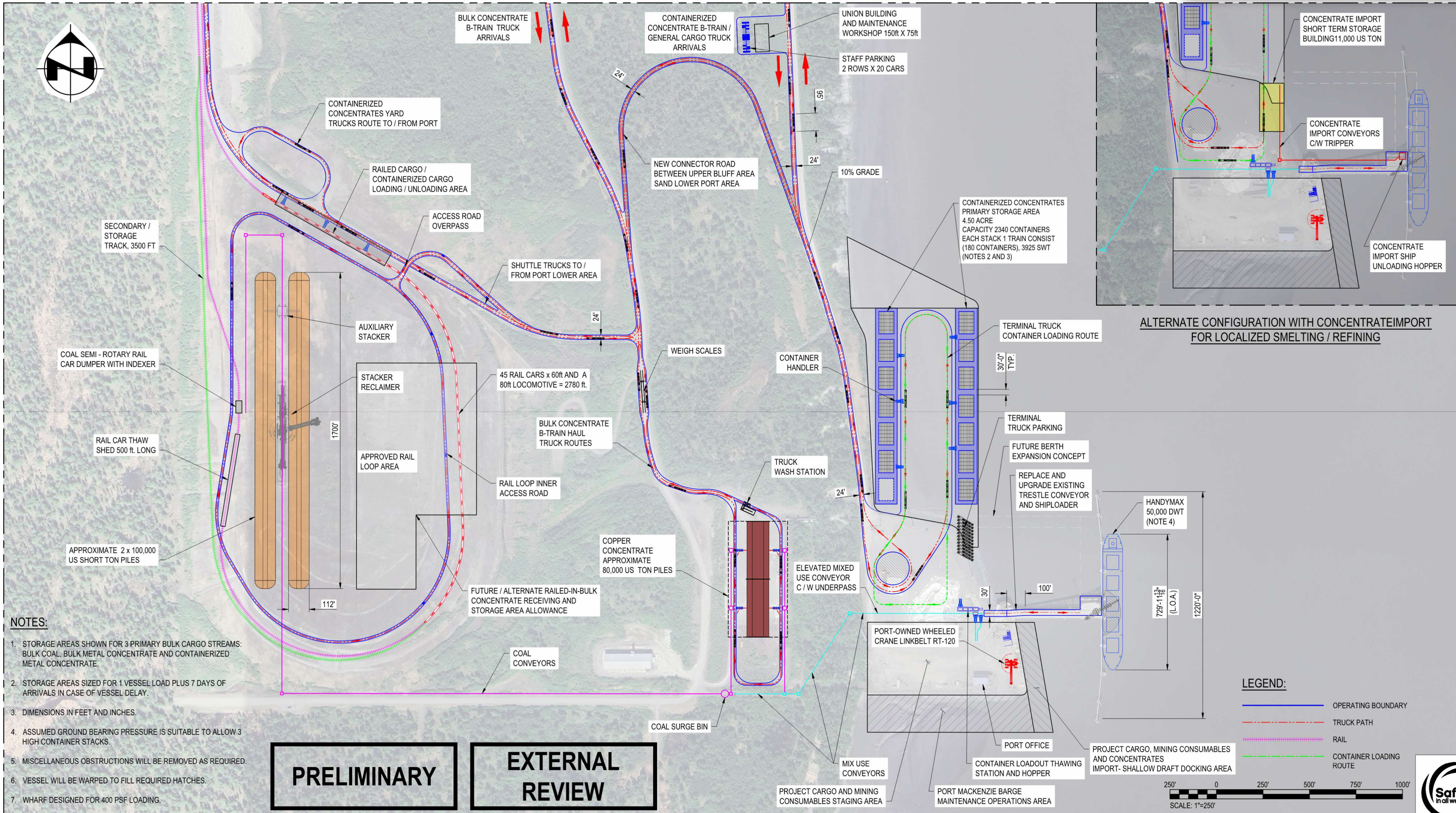

NOTES:

1. STORAGE AREAS SHOWN FOR 3 PRIMARY BULK CARGO STREAMS: BULK COAL, BULK METAL CONCENTRATE AND CONTAINERIZED METAL CONCENTRATE.
2. STORAGE AREAS SIZED FOR 1 VESSEL LOAD PLUS 7 DAYS OF ARRIVALS IN CASE OF VESSEL DELAY.
3. DIMENSIONS IN FEET AND INCHES.
4. ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
5. MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.
6. VESSEL WILL BE WARPED TO FILL REQUIRED HATCHES.
7. WHARF DESIGNED FOR 400 PSF LOADING.

AIDEA Alaska Industrial Development and Export Authority

REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
			D	AL	22AUG2025	RE-ISSUED FOR CLIENT REVIEW	LC	LC	LC
			C	AL	12AUG2025	ISSUED FOR CLIENT REVIEW	LC	LC	LC
			B	AL	11AUG2025	REVISION IN PROGRESS	LC	LC	LC
1	107868-GX-00000-31344-001	TYPICAL CONTAINER STACK	A	AL	16JUL2025	ISSUED FOR INTERNAL REVIEW	LC	LC	LC

DRAWN	A. LOW	02JUL2015
DWG. CHECKED	L. CHAN	
DESIGNED	A. LOW	
DES. APPR.	L. CHAN	
PROJ. APPR.	L. CHAN	

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CLIENT
ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY

TITLE
AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
PORT MACKENZIE
GENERAL ARRANGEMENT

PROJECT No.	SCALE	SIZE
107868-01	1" = 250'	D

DRAWING No.	REV
107868-GX-00000-31344-032	D

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APPENDIX D.1 – AAP SCREENING CRITERIA

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Project: Ambler Port Studies **PND Project No.:** 231099
Client: Alaska Industrial Development and Export Authority (AIDEA)

PROJECT LIFE

Projected mine life 35+ years

CODES AND REFERENCES

AASHTO LRFDBDS-9 LRFD Bridge Design Specifications (2020)
ACI 318-14 Building Code Requirements for Structural Concrete
ANSI/BICSI 007-2020 Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
ASCE/SEI 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures
ASCE 61-14 Seismic Design of Piers and Wharves
AWS D1.1:2015 Structural Welding Code – Steel
CITY OF ANCHORAGE Building Code Requirements
CITY OF SEWARD Building Code Requirements
CITY OF WHITTIER Building Code Requirements
IBC 2018 International Building Code
MATANUSKA-SUSITNA BOROUGH Building Code Requirements
NACE SP0176-2007 Corrosion Control of Submerged Areas of Permanently Installed Steel Offshore Structures Associated with Petroleum Production
NCHRP Report 611 Seismic Analysis and Design of Retaining Walls
NFPA 14-16 Standard for the Installation of Standpipe and Hose Systems
NFPA 70 National Electrical Code
PIANC Guidelines for the Design of Fender Systems
UFC 4-159-03 Design: Moorings
UFC 4-152-01 Design: Piers and Wharves
USACE EM 1110-2-2906 Design of Pile Foundations
USACE EM 1110-2-2504 Design of Sheet Pile Walls

REFERENCE REPORTS

Ambler Metals Arctic Mine Logistics Simulation Study (2021)
Trilogy Metals NI 43-101 Technical Report and Feasibility Study – Ambler Mining District, Alaska (2023)
Trilogy Metals S-K Technical Report and Feasibility Study – Ambler Mining District, Alaska (2023)
US Department of the Interior Ambler Road – Environmental Impact Statement (2020)

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MINESITE PRODUCTION

Anticipated Timeframe

See Table 1 for Estimated Mine Operation Schedule.

Table 1. Estimated Mine Operation Schedule (Table 2-2 from Appendix H of Ambler Road EIS)

Project Phase	Typical Timeframe	Projected Activities
Prospecting and Staking	2 years	Geological data and map review, airborne geophysics, non-invasive exploration. Completed for the initial 4 projects.
Exploration	2-6 years	Subsurface investigations that include drilling and bulk sampling. This phase can continue for many years and be concurrent with multiple feasibility studies. This timeframe shown assumes an aggressive exploration schedule. Exploration has been largely completed for the 4 projects.
Feasibility Studies and Permitting	6-8 years	Prepare increasingly rigorous feasibility studies, enter into the NEPA process, and obtain permits for mine development.
Development	2-4 years	Development of the mining facility to bring the mine into production.
Production	5-35 years	Mine lifespans vary depending on the extent of the deposits and market conditions. The Arctic Project has indicated a minimum lifespan of 12 years. Production of each mine would vary, but it is estimated between 5 and 35 years based on production rates anticipated for the Arctic Project and applied to the total anticipated mineral resource in the District.
Closure and Reclamation	2-5 years	Closure of the mine, including removing equipment and some roads, and reclamation of the area.
Long-term Monitoring and Management	50+ years	Following closure and reclamation, the site in monitored until physical and chemical stability is achieved, and typically includes post-closure water management and treatment. This timeframe varies and can be perpetual. The relatively small amounts of fuel, personnel, and supplies needed for monitoring effort are assumed to be delivered by air during this period.

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Production and Transportation Requirements

See Tables 2 through 5 for Ambler Mine-specific production and transportation requirements.

Table 2. Mine Characteristics and Resulting Traffic Generated by the 4 Mining Projects During Production (Table 2-5 from Appendix H of Ambler Road EIS)

Item	Arctic	Bornite	Sun	Smucker
2018 resource (tonnes)	43 million	182 million	11 million	11.6 million
Product recovered in concentrate	Cu, Zn, Pb, Ag, Au	Cu, Co	Cu, Zn, Pb, Ag, Au	Cu, Zn, Pb, Ag, Au
Mill throughput (tonnes/day)	10,000	14,250	5,000	5,000
Production rate (short wet tons/day)	1,507	784	548	548
Mine life (years)	12	35	6	5
Annual/daily concentrate production (short wet tons)	550,000/1,507	286,000/784	200,000/548	200,000/548
Ore concentrate containers filled per day for transport	46	24	16	16
Daily double-trailer trips: Ambler Road (total of full outbound and empty return)	46	24	16	16
Daily single-trailer trips: Dalton Highway (total of fill outbound and empty return)	92	48	32	32
Annual mill and maintenance supplies (short tons)	11,000	9,000	6,000	6,000
Mill and maintenance daily trips	2	2	2	2
Daily fuel and other supply trips	12	12	6	6
Daily incidental trips	2	2	2	2
Daily trip total: Ambler Access Road	62	40	26	26
Daily trip total: Dalton Highway	108	64	42	42

Table 3. Yearly Production Rates of the Four Sites (Provided by Ausenco)

Year	Arctic (ton/year)	Bornite (ton/year)	Sun (ton/year)	Smucker (ton/year)	Totalized (ton/year)
2028	550,000				550,000
2029	550,000				550,000
2030	550,000	286,000			836,000
2031	550,000	286,000			836,000
2032	550,000	286,000			836,000
2033	550,000	286,000			836,000
2034	550,000	286,000			836,000
2035	550,000	286,000			836,000
2036	550,000	286,000			836,000
2037	550,000	286,000			836,000
2038	550,000	286,000			836,000
2039	550,000	286,000			836,000
2040		286,000	200,000		486,000
2041		286,000	200,000		486,000
2042		286,000	200,000		486,000
2043		286,000	200,000		486,000
2044		286,000	200,000		486,000
2045		286,000	200,000		486,000
2046		286,000		200,000	486,000
2047		286,000		200,000	486,000
2048		286,000		200,000	486,000
2049		286,000		200,000	486,000
2050		286,000		200,000	486,000
2051		286,000		200,000	486,000
2052		286,000			286,000
2053		286,000			286,000
2054		286,000			286,000
2055		286,000			286,000
2056		286,000			286,000
2057		286,000			286,000
2058		286,000			286,000
2059		286,000			286,000
2060		286,000			286,000
2061		286,000			286,000
2062		286,000			286,000
2063		286,000			286,000
2064		286,000			286,000

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Table 4. Estimated Concentrate Proportions (Arctic Mine Logistics Simulation Study)

Item	Unit	Copper	Zinc	Lead
Proportion of Yearly Throughput				
Arctic	%	52.9	40.8	6.3
Bornite	%	100	NA	NA
Sun	%	52.9	40.8	6.3
Smucker	%	52.9	40.8	6.3
Material Properties				
Moisture Content	%	6	6	6

Table 5. Estimated Rail Traffic to Haul Processed Ore for the District from Fairbanks to a Port (Table 2-7 from Appendix H of Ambler Road EIS)

Project	Production Rate per Day (short wet tons)	Containers Required for 1 day of Production (outbound only)	Weekly Frequency of 75-Car-Trains (both directions)
Arctic	1,507	46	4.3
Bornite	784	24	2.2
Sun	548	16	1.5
Smucker	548	16	1.5

***Note**: The above rail traffic is based on two (3) containers per car; from discussion with ARRC, up to four (4) containers per car may be possible.*

TRANSPORTATION - GENERAL

Containerized transportation of ore concentrate from mine site(s) to export marine terminal during all seasons is required.

TRANSPORTATION CONTAINERS

Container Type:	Sealed Intermodal Bulk Shipping Containers (Rotainers)
Dimensions:	20-ft-long x 8-ft-wide x 7.2-ft-tall
Stacking Capacity:	6-high (design limit); 5-high (study limit)
Payload Mass:	30 metric-tn
Weight:	33.5 metric-tn (36.9 short-tn) gross
Specialized revolving container spreader:	Ram Spreader, 10-tonne tare, 35-tonne SWL

TRUCK TRANSPORTATION

Design Vehicle –AAP

Design vehicle is based on truck traffic towing double trailers on the Ambler Access Road to the intersection with the Dalton Highway (provided by Ambler Metals – Ref AAP Concentrate Truck Specifications), shown in Figure 1:

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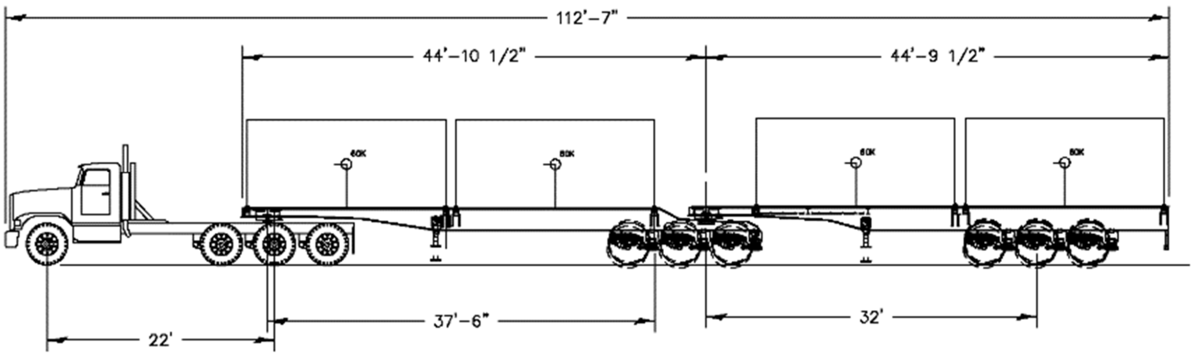
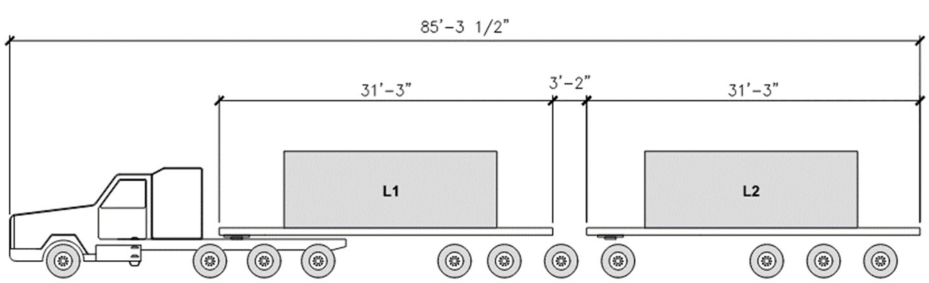


Figure 1. AAP Concentrate Truck (Provided by Ambler Metals)

Double Trailer Design Vehicle – Outside AAP

This design vehicle is based on truck traffic towing double trailers from the Ambler Access Road intersection with the Dalton Highway southbound, shown below in Figure 2. The vehicle is an approximation based on heavy-haul vehicles used at other mines and based on discussions with trucking companies. Note: this vehicle is outside the highway legal loads defined in 17 AAC 25 and would not be permissible for unrestricted (non-permitted) use on public roads without changes to statutes and upgrades to both road and bridges along respective transportation corridors.



AXLE LOADS:	#1 (LBS)	#2 (LBS)	#3 (LBS)	#4 (LBS)	#5 (LBS)	TOTAL (LBS)
ESTIMATED TARE:	17000	28000	0	23000	21000	89000
ESTIMATED PAYLOAD:	1000	39000	10000	53000	48000	151000
ESTIMATED TOTAL:	18000	67000	10000	76000	69000	240000

Figure 2. Double Trailer Design Axle Loading

Single Trailer Design Vehicle – Outside AAP

Design vehicle is based on truck traffic towing single trailers from the Ambler Access Road intersection with the Dalton Highway southbound to Fairbanks and beyond, shown below in Figure 3:

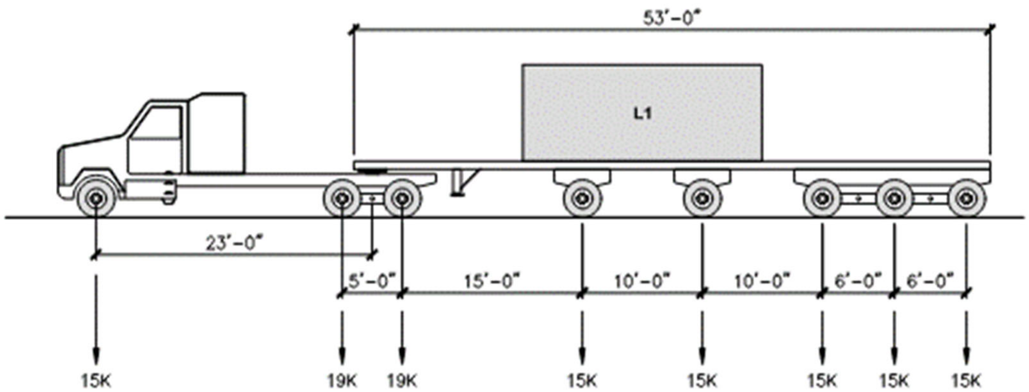


Figure 2. Single Trailer Design Axle Loading

Table 6. Design Trailer Turning Radii

		Sweep Path Approx Radius
Minimum CL turning radius	54-ft	n/a
CL turning radius @ 5MPH	55-ft	62-ft
CL turning radius @ 10MPH	93-ft	100-ft
CL turning radius @ 50MPH	637-ft	643-ft

Driver Hours

Max Hours Worked: 80 hours over 8 consecutive days or;
20 hours in 1 day following 10-hour rest
Max Hours Driving: 15 hours in one day followed by a 10-hour rest

Ambler Mine Access Road and Bridges

Design Speed: 50 mph
Roadway Section: 32-ft-wide (12-ft travel lanes and 4-ft shoulders @ 3H:1V)
Design Live Load: AASHTO HL-93 and AAP Concentrate Truck

Dalton Highway and Bridges

Design Speed: 50 mph

Dalton Highway and Bridges (continued)

Roadway Section:	Varies, New Construction is 36-ft-wide (12-ft travel lanes and 6-ft shoulders @ 3H:1V) with maximum grade of 6% for double trailer transport.
Design Live Load:	AASHTO HL-93, Permitted Overload Vehicles and restrictions per 17 AAC 25
Design Bridge Code:	AASHTO LRFD Bridge Design Specifications

Fairbanks Inner City and Southward

Design Vehicle:	AASHTO HL-93 and Permit Overload Vehicles and restrictions per 17 AAC 25

RAIL TRANSPORTATION

Code and Route Requirements

Design Speed:	40 mph
Degree of Curvature:	Max: 6° (Radius = 955.36 ft) Preferred: 5° (Radius = 1146.28 ft)
Superelevation:	Max: 4.75 (6° Curve) Preferred: 3.75 (5° Curve)
Design Live Load:	Cooper E-20
Grade Limitations:	Level: 0-0.5% Rolling: 0.5-1.0% Mountainous: 1.0-5.0%

ARRC Capacity

Annual Tonnage:	<10,000,000-gross-tn
Annual Train Count:	<700 per year
Car (Flat) Capacity:	110-tn (FBX-ANC), 100-tn (ANC-SWD) 3 max Containers per wagon 70-ft wagons
Train Capacity:	6000-tn (Limited to 5000-tn for Seward route)

Estimated Cycle Times

See Table 6 for ARRC estimated return cycle times to each port from Fairbanks.

Table 7. ARRC Estimated Return Cycle Per Port (Provided by ARRC)

Action	POA (hours)	Port Mackenzie (hours)	Port of Whittier (hours)	Port of Seward (hours)
Loading @ FBX	6	6	6	6
Travel to Port	12	11	16	23
Delays/Waiting	1	1	1	1
Unloading @ Port	6	6	6	6
Delays/Waiting	2	2	2	2
Loading (Empty) @ Port	6	6	6	6

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Travel to Fairbanks	12	12	16	18
Delays/Waiting	2	2	2	2
Unloading (Empty) @ FBX	6	6	6	6
Total Cycle Time	**53**	**52**	**61**	**70**
Distance (mi) from Container Storage to Loading Point	**1.3**	**2.3**	**0.2**	**0.8**

PORT REQUIREMENTS

All-season access required. No seasonal restrictions due to icing or inclement environmental conditions.

Storage Capacity

Container Capacity: 1,000 min containers (a 30,000 DWT ship load)
Additional Storage Capacity: Minimum - One loaded and one empty unit train

Loading Rates (Typical)

On-Ship Loading Gear: 450 metric-tn/hour (15 containers/hour)
Mobile Harbor Crane: 600-750 metric-tn/hour (20-25 containers/hour)
Ship to Shore Gantry Crane: 700-900 metric-tn/hour (25-30 containers/hour)

Vessels

See Table 7 for anticipated Design Vessel properties.

Table 8. Design Vessels

Vessel/Class	Type	LOA (ft)	Beam (ft)	Draft (ft)	Displacement (DWT)
Handymax	Bulk Carrier	728	106	41	50,000

Note: Draft limitations at port facilities may require smaller vessels or reduction in vessel displacement/draft. Smaller vessels may be used based on export requirements and type of concentrate being shipped.

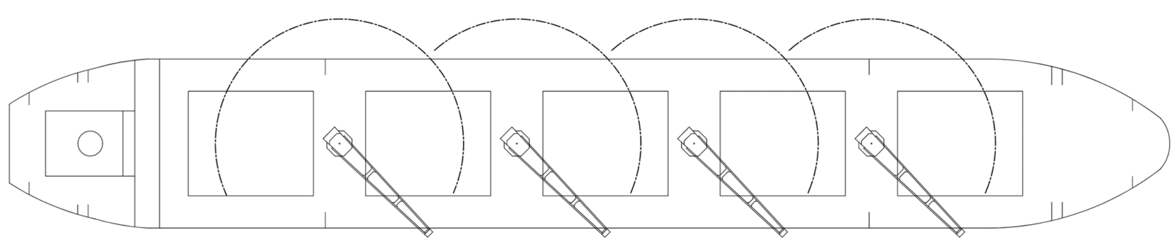

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Figure 2. Design Vessel (Provided by Ausenco)

Under Keel Clearance

10% of vessel draft or minimum of 5 ft.

Cargo and Vehicle Loads

Table 9: Cargo and Vehicle Loads

Dock Cargo and Loading Criteria	
Port of Alaska (Current)	
Uniform	600 psf (T1, T2, Trestle 3C) 650 psf (T2 Extension, T3) 200 psf (all other vehicle trestles) 350 psf (T1 Crane Turnout)
Truck	AASHTO HS20-44 (all other areas) AASHTO HS25 (Trestle 3C)
Mobile Crane	30-ton capacity truck crane (T1) 140-ton capacity truck crane (Trestle 3C)
STS Gantry Crane, 38-ft gauge	38 kips/wheel, 3 wheels at 2'-11" OC (T1 Crane Turnout) 72 kips/wheel, 3 wheels at 2'-11" OC (T1 Crane Turnout, Bents A & D only) 71 kips/wheel, 6 wheels at 5'-0" OC 72 kips/wheel, 3 wheels at 2'-6" OC (T2, T2 Extension, T3)
Port of Alaska (Future PAMP)	
Uniform (T1, T2)	1,000 psf
Truck (T1, T2)	AASHTO HS25
Container Handler (T1, T2)	304-kip max axle load, based on Taylor TETCP 1100L
Mobile Crane (T2 only)	**Crawler Crane:** 275-ton capacity, based on Manitowoc 999 **Truck Crane:** 275-ton lift, based on Grove GMK7550 (550-ton capacity) **Mobile Harbor Crane:** 158-ton capacity, based on Liebherr LHM 550
STS Gantry Crane, 100-ft gauge (T1 only) Configuration: • 8 wheels at 4'-11" OC per corner • Corner spacing = 47'-10"± • Length of equivalent uniform load = 39'-4"± (8 x wheel spacing)	**Operating Vertical Service Load:** 32 kips/ft (landside), 35 kips/ft (waterside) **Operating Lateral Service Load:** 1.8 kips/ft (landside and waterside) **Stowed Vertical Service Load:** 43 kips/ft (landside), 39 kips/ft (waterside) **Stowed Lateral Service Load:** 3.4 kips/ft (landside and waterside) **Tie-Down Uplift Service Load:**

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	485 kips at each corner **Stowage Pin Service Load:** 280 kips at each rail
Roll-On Roll-Off Ramp (T2 only)	**Forward Ramp:** 96-kip axle load, 2 axles at 12'-0" OC **Mid Ramp:** 58-kip axle load, 3 axles at 4'-0" OC
Port MacKenzie (Deep Draft Dock)	
Uniform (Trestle & Dock)	400 psf
Truck (Trestle & Dock)	AASHTO HS25
Container Handler (Trestle & Dock)	200-kip max axle load (12-ft gauge) 100-kip max wheel load (110-psi inflation)
Seward Freight Dock (Current & Future Expansion)	
Uniform	1,000 psf
Rail	AREMA Cooper E80 on 2 tracks that run parallel and adjacent to the dock face
Proposed Whittier Marginal Wharf (Future)	
Uniform	1,000 psf
Truck	AASHTO HS25
Container Handler	304-kip max axle load, based on Taylor TETCP 1100L
Mobile Crane	**Crawler Crane:** 275-ton capacity, based on Manitowoc 999 **Truck Crane:** 275-ton capacity, based on Grove GMK5275 **Mobile Harbor Crane:** 158-ton capacity, based on Liebherr LHM 550

METEOROLOGICAL & OCEANOGRAPHIC DATA

Tides

ANCHORAGE - Refer to Table 9 below for datums at NOAA/NOS Station #9455920, Anchorage, AK (1983-2001 epoch, published on 06/03/2019).

Table 10. Anchorage Tidal Datums

Datum	Elevation (ft MLLW)
Highest Observed Tide (11/06/2002)	+34.86
Highest Astronomical Tide (HAT)	+33.78
High Tide Line (HTL)	+34.70
Mean Higher High Water (MHHW)	+29.16
Mean High Water (MHW)	+28.43
Mean Sea Level (MSL)	+16.47
Mean Tide Level (MTL)	+15.34
Mean Low Water (MLW)	+2.25

Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-5.04
Lowest Observed Tide (12/25/1999)	-6.39

PORT MACKENZIE - Refer to Table 10 below for datums at NOAA/NOS Station #9455934, Port Mackenzie, AK (1983-2001 epoch, published on 05/08/2003).

Table 11. Port MacKenzie Tidal Datums

Datum	Elevation (ft MLLW)
Highest Observed Tide	-
Highest Astronomical Tide (HAT)	+35.22
High Tide Line (HTL)	+35.20
Mean Higher High Water (MHHW)	+29.10
Mean High Water (MHW)	+28.38
Mean Sea Level (MSL)	+16.25
Mean Tide Level (MTL)	+15.30
Mean Low Water (MLW)	+2.23
Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-6.47
Lowest Observed Tide	-

SEWARD - Refer to Table 11 below for datums at NOAA/NOS Station #9455090, Seward, AK (1983-2001 epoch, published on 09/29/2011).

Table 12. Seward Tidal Datums

Datum	Elevation (ft MLLW)
Highest Observed Tide (01/01/1987)	+15.70
Highest Astronomical Tide (HAT)	+13.95
High Tide Line (HTL)	+13.80
Mean Higher High Water (MHHW)	+10.63
Mean High Water (MHW)	+9.71
Mean Sea Level (MSL)	+5.56
Mean Tide Level (MTL)	+5.55
Mean Low Water (MLW)	+1.38
Mean Lower Low Water (MLLW)	0.00

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Lowest Astronomical Tide (LAT)	-3.53
Lowest Observed Tide (12/14/2008)	-5.01

WHITTIER - Refer to Table 12 below for datums at NOAA/NOS Station #9454949, Whittier, AK (1983-2001 epoch, published on 09/08/2008).

Table 13. Whittier Tidal Datums

Datum	Elevation (ft MLLW)
Highest Observed Tide	-
Highest Astronomical Tide (HAT)	+15.83
High Tide Line (HTL)	+15.80
Mean Higher High Water (MHHW)	+12.19
Mean High Water (MHW)	+11.27
Mean Sea Level (MSL)	+6.52
Mean Tide Level (MTL)	+6.38
Mean Low Water (MLW)	+1.49
Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-3.95
Lowest Observed Tide	-

Wind

Buildings: ASCE 7-16, 3-Sec Peak Wind Gust

Moorings: Per UFC 4-159-03 Type 1 mild weather mooring. Sustained winds (one-minute averaged) of 35 knots or less. Operational procedures will be implemented for the vessels to leave the berth during any wind event of forecast that exceeds these conditions.
For the purposes of UFC 4-159-03, a 30-second wind duration at a 33-foot (10-meter) elevation is recommended for the design for "stationary" winds.

Ship Movement: Maximum wind for 0.5-meter sway and surge.

Wave Loads for Moorings

Design Wave: 5-Year Return Period
30-Sec Wind Gust

Design Wave for Shore Protection

Design Wave: 50-Year Return Period

Tidal Current Loads

Site specific.

Snow

Ground Snow Load = Per ASCE 7-16 with reasonable assumptions based on site-specific snow removal operations.

Ice

Per AASHTO LRFD Bridge Design Specifications with site-specific ice thickness and crushing strength.

Seismic

Per ASCE 61-14. Minimum seismic design classification: Low - Life Safety Protection

APPENDIX D.2 – AAP TRANSPORTATION OPTIONS

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1. TRANSPORTATION OPTIONS

This study investigates the details of several combinations of road and rail cargo transport to each of the identified ports. All combinations involve a road capable of supporting double-trailer trucks (doubles) extending from the Ambler mine sites to an intersection with the Dalton Highway. From that point, the routes may diverge into combinations of single-trailer trucks (singles), double-trailer trucks (doubles), and rail transport, depending on the development of certain transfer hubs and access routes. Where there is a need to transfer the cargo intermodally from truck to rail for onward transport to the ports, the transfer will take place either in Fairbanks, leveraging ARRC's Fairbanks premises, or, in a new, purpose-built intermodal yard in Livengood, also on ARRC premises but currently barren. The scope of the capital projects and expenditures required to support concentrate transportation varies with the options under consideration. Alternatives using doubles outside of the AAP will require significant upgrades to the Dalton road corridor, and alternatives using rail originating from Livengood would require the construction of the Dunbar-Livengood rail extension. Five general transportation options to each of the port candidates were identified in this study, as shown in **Figure 1-1** and displayed on a map in **Figure 1-2** below.

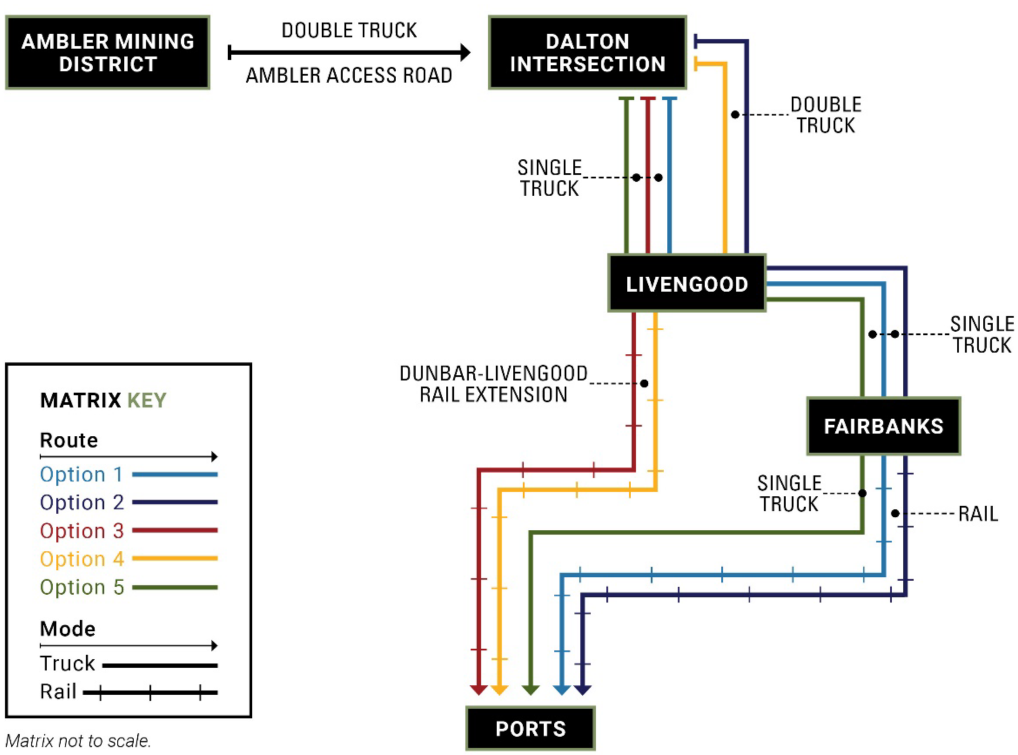

Figure 1-1. AAP Port Transportation Matrix

OPTION 1: Base transportation scenario contained in previous studies and the AAP EIS. A single-trailer truck from the Dalton Transfer Yard to Fairbanks rail yard, then rail transport to ports.

OPTION 2: Double-trailer truck from the Dalton Transfer Yard to Livengood, single-trailer truck to Fairbanks rail yard, then rail transport to ports.

OPTION 3: Single-trailer truck from the Dalton Transfer Yard to Livengood, then rail transport to ports using a newly constructed Dunbar-to-Livengood rail segment that bypasses Fairbanks.

OPTION 4: Double-trailer truck from the Dalton Transfer Yard to Livengood, then rail transport to ports using a newly constructed Dunbar-to-Livengood rail segment that bypasses Fairbanks.

OPTION 5: Single-trailer trucks from the Dalton Transfer Yard directly to the respective ports.

Two additional sub-options were evaluated for transport to Port MacKenzie: (1) rail directly to the Port enabled by fully completing the Port Mackenzie rail extension project, or, (2) rail to Houston, then trucking from Houston to the Port using the existing semi-completed rail embankment upgraded to be a road.

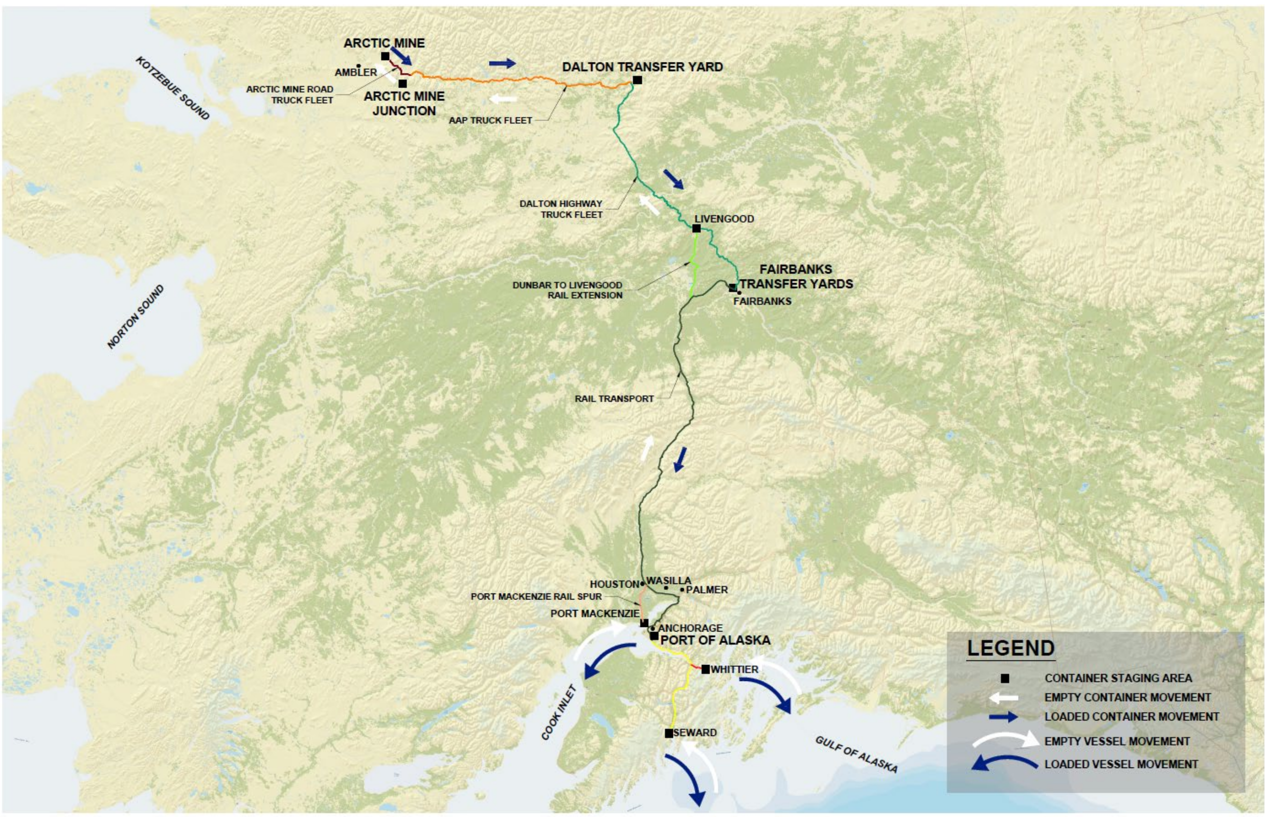

Figure 1-2. AAP Route Map

1.1 EXISTING ROAD INFRASTRUCTURE

There are seven distinct sections of road along the transport route between the Ambler Mining District and the potential ports. PND has identified the basic physical capacities and constraints of each road section below.

Dalton Highway – Hwy 11

The Dalton Highway (also known as the "Haul Road") is a public road that is owned and maintained by ADOT&PF and runs 414 miles from Livengood (MP 0) north to Prudhoe Bay (MP 414). The road is predominately unpaved, with some paved sections near developed areas. The highway was originally constructed to provide access to the oil fields of Prudhoe Bay on the North Slope of Alaska and routinely supports heavy industrial loads. The highway is two-lane with a plan width of nominally 32 feet.

The AAP roadway proposes to connect to the Dalton Highway at approximately MP 161. Proposed transportation for the Ambler project would occur from MP 161 to Livengood (MP 0). Along this section of highway, 14 National Highway System (NHS) bridges and eight culverts will be crossed. Seasonal weight restrictions applied to the Dalton Highway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25).

Based on correspondence with ADOT&PF and trucking industry representatives, existing geometric constraints including vertical and horizontal curves on the Dalton currently restrict haul units to a single trailer without assistance from push trucks or support vehicles. Loads exceeding 36 tons generally require a push truck due to steep grades along the highway. 36 tons coincides with the currently assumed gross weight of each concentrate container.

Elliott Highway – Hwy 2

The Elliott Highway is a public road that runs 152 miles from Fox (MP 0) to Manley Hot Springs (MP 152). The highway is paved from Fox (MP 0) to the intersection with the Dalton Highway (MP 72) and unpaved for the remainder of the road. Proposed transportation for the Ambler project would occur from the Dalton Highway intersection (MP 72) to Fox (MP 0). Seasonal weight restrictions applied to the Elliot Highway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25). Six NHS bridges, one non-NHS bridge, and three culverts would be crossed on the Elliot Highway along the proposed transportation route.

Steese Highway – Hwy 2

The Steese Highway is a public road that runs 161 miles from Fairbanks (MP 0) to Circle (MP 161). The highway is paved from MP 0 to MP 44 and unpaved for the remainder of the road. Proposed transportation for the Ambler project would occur from the intersection with the Elliott Highway at Fox (MP 11) to Fairbanks (MP 0). This section of road is paved, and seasonal weight restrictions applied to the highway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25). Along this section of highway, two NHS bridges will be crossed.

Johansen Expressway

The Johansen Expressway is a 4.2-mile expressway located in Fairbanks. It is primarily a four-lane road system that serves as a northern route across Fairbanks, connecting the Steese Highway to Geist Road and subsequently the Parks Highway. This road corridor would be used for transportation from the Steese Highway to the ARRC yard through an interchange at Peger Road. The entirety of the expressway is paved, and seasonal weight restrictions applied to the expressway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25). Along this section of highway, three NHS bridges will be crossed.

Parks Highway – Hwy 3

The Parks Highway is a public road that runs 323 miles from the Glenn Highway (MP 35) near Wasilla to Fairbanks (MP 358). The majority of the Parks Highway would be used for truck-based transport from Fairbanks to all of the identified Southcentral Alaska ports. Double-trailer units with a maximum total cargo carrying length of 95 feet are permitted on the highway. Based on discussions with trucking companies, the Parks Highway has a practical payload limit of approximately 95,000 pounds for unassisted haul units due to steep grades along the road corridor. Vehicle combinations with payloads above 95,000 pounds typically require a push truck to traverse steep grades. This section of road is paved, and seasonal weight restrictions applied to the highway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25).

Glenn Highway – Hwy 1

The Glenn Highway is a public road that runs 179 miles from Anchorage (MP 0) to Glennallen (MP 179). The Glenn Highway is a four- to six-lane paved road. Road-based transport to the Port of Alaska, Seward, and Whittier would occur on the section of road from MP 0 to MP 35 where the highway intersects with the Parks Highway. This section of road is paved, and seasonal weight restrictions applied to the highway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25).

Municipality of Anchorage Roads

The Seward and Glenn Highways terminate or begin, respectively, within the Municipality of Anchorage (MOA) and are connected at the junctions of 5th and 6th Avenue (east-west arterials) with Gambell and Ingra Street (north-south arterials). All the connecting roads within Anchorage's downtown area are owned and maintained by ADOT&PF. Trucks navigating from the highways to the POA would exclusively use State-owned roads.

Seward Highway

The Seward Highway is a public road that is owned and maintained by ADOT&PF. It runs 127 miles from Seward (MP 0) to Anchorage (MP 127), beginning as a two-lane paved highway from Seward to the southern edge of Anchorage, where it expands into a four- to six-lane divided highway until it terminates in the northern part of Anchorage. This section of road is paved, and seasonal weight restrictions applied to the highway typically restrict loading to 100% of legal axle loads (as defined by 17 AAC 25).

1.2 EXISTING BRIDGE INFRASTRUCTURE

Existing bridges within the public road network are owned and maintained by the ADOT&PF. As described in Section 3.3, loads proposed to cross these bridges are restricted per 17 AAC 25 to prevent overloading or damage to the structures. Bridges are designed to support standard design vehicles established by FHWA/AASHTO for serviceability and fatigue load cases, with select overload vehicles that are allowed on a case-by-case basis with the appropriate overload or overlength permits. The proposed single-trailer truck falls within the current AAC standards for bridge crossings and would be free to traverse the existing bridges with no modifications. When the loads exceed the AAC standards they must enter the ADOT&PF bridge permit program to determine if it can safely traverse each designated bridge and require permitting as an overload. ADOT&PF bridge engineers have stated that the current proposed double-trailer truck would not meet permitting standards given the proposed daily truck traffic volume. The frequent overloading will greatly reduce the life of the bridges on the highway system. To support the proposed double-trailer truck, all NHS bridges along the corridor under consideration would need to be replaced, and ADOT&PF has stated that replacement of these bridges would likely be ineligible for FHWA or Federal Transit Authority (FTA) funding since design vehicle loads would greatly exceed federal standards. Maintenance of the replaced bridges would also need to be funded outside of FHWA/FTA funds. This applies to the NHS bridges along the route from the AAP intersection with the Dalton Highway to the ARRC yard in Fairbanks.

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1.3 CAPITAL IMPROVEMENTS

Capital improvements to the existing road corridors will vary based on the transportation alternative under consideration and, more specifically, the design truck to be used for transport. The existing road system is capable of supporting the single-trailer design vehicle without requiring major improvements. Transport using the double trailer configuration will require significant modifications to the road geometry (horizontal/vertical curves and grade) and upgrade or replacement of all bridges along the corridor under consideration.

Evaluation of capital improvements required to support double-trailer design trucks was limited to the Dalton Road corridor for this study. This limitation was applied due to the significant cost and various impacts (environmental, social, political) required to upgrade other road transportation corridors.

Dalton Transfer Yard

The Dalton Transfer Yard (DTY) was not included in the scope of this study. Presuming a typical transfer yard, it would consist of a container staging area and two loading/unloading areas: one for trucks traveling between the Ambler mine site and the DTY and another for trucks traveling the Dalton Highway. There might also be provisions for direct truck-to-truck cross loading, such as through lanes. Each loading/unloading area would have a dedicated forklift for transferring containers to and from the staging area. Construction of the transfer yard is assumed to be completed as part of the AAP.

Dalton Highway Upgrades

Upgrades to the Dalton Highway would focus on improvements necessary to allow the transport of double-trailer trucks along the highway. Improvements would include upgrades to the existing roads to address geometric constraints including maximum grades and horizontal/vertical curves. All bridges along the proposed transportation corridor are assumed to require replacement to accommodate the double-trailer configuration.

Based on discussions with ADOT&PF, several projects are currently in progress to upgrade the section of the highway from MP 0 to MP 32 to meet current NHS standards. For this report, it is assumed that these upgrades would be complete and permit the use of double-trailer trucks. Bridges on this section of the Highway were assumed to require replacement for the double-trailer trucks due to the increased loads.

The potential scope of upgrades between MP 37 and the DTY was assessed by performing high-level identification of areas with geometry outside the target values, most significantly the requirement for 6% maximum grades, using publicly available LiDAR topographical data. Preliminary road corridor modeling identified 27 segments that would require upgrades. Areas identified as likely requiring upgrades are shown in Appendix C. Approximate civil volumes, including cut/fill and structural sections, were calculated from the modeling efforts to support cost estimation.

Replacement bridges were assumed to consist of a steel girder superstructure with a precast concrete deck. Foundations were assumed to consist of driven steel piles with reinforced concrete infill that support a concrete cap. The maximum spacing between piers was assumed at 80 feet. Bridges with overall lengths greater than 200 feet were assumed to require ice breakers at each in-water pier. The required bridge total lengths were assumed to match those contained in the 2019 ADOT&PF Bridge and Tunnel Inventory.

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Livengood Transfer Yard

The Livengood Transfer Yard (LTY) consists of a circa 1.5-acre area that would serve as the transfer location for containers from double-trailer to single-trailer for subsequent transport by road to Fairbanks and beyond, or, as an intermodal transfer site from truck to rail for transport by rail on the Dunbar-Livengood rail extension. The proposed transfer site would consist of a secured gravel and concrete pad area with the required infrastructure to support the concentrate export including scales, load sensing equipment, inventory control systems, administration building, security, refueling station, lighting, and electrical systems. It is noted that ARRC would likely co-develop the site to serve as a new terminal facility for this extension, with suitable maintenance and support infrastructure for rail and rolling stock.

Port MacKenzie Rail Extension and Converted Road

For rail transport directly to Port MacKenzie, completion of the remaining works for the rail extension, currently completed as far as Houston, would be required.

Alternatively, rail service can be assumed to terminate at Houston as-is, and the unfinished section of the embankment (Segment 2) can be converted to a road by surfacing the entire corridor as the embankment and bridge crossings have been constructed. A new intermodal transfer yard – the Houston Transfer Yard (HTY) – will be built to allow the offload, storage, and trans-loading of rail-transported containers onto trucks for the final leg bound for Port MacKenzie. Construction of Segment 2 would include an elevated crossing/bridge over Reddane Avenue. The HTY would consist of a secured gravel pad with the required infrastructure to support the concentrate export including additional tracks installed into the storage yard, administration building, security, refueling station, lighting, and electrical system. **Figure 1-3** and **Figure 1-4** depict the HTY concept.

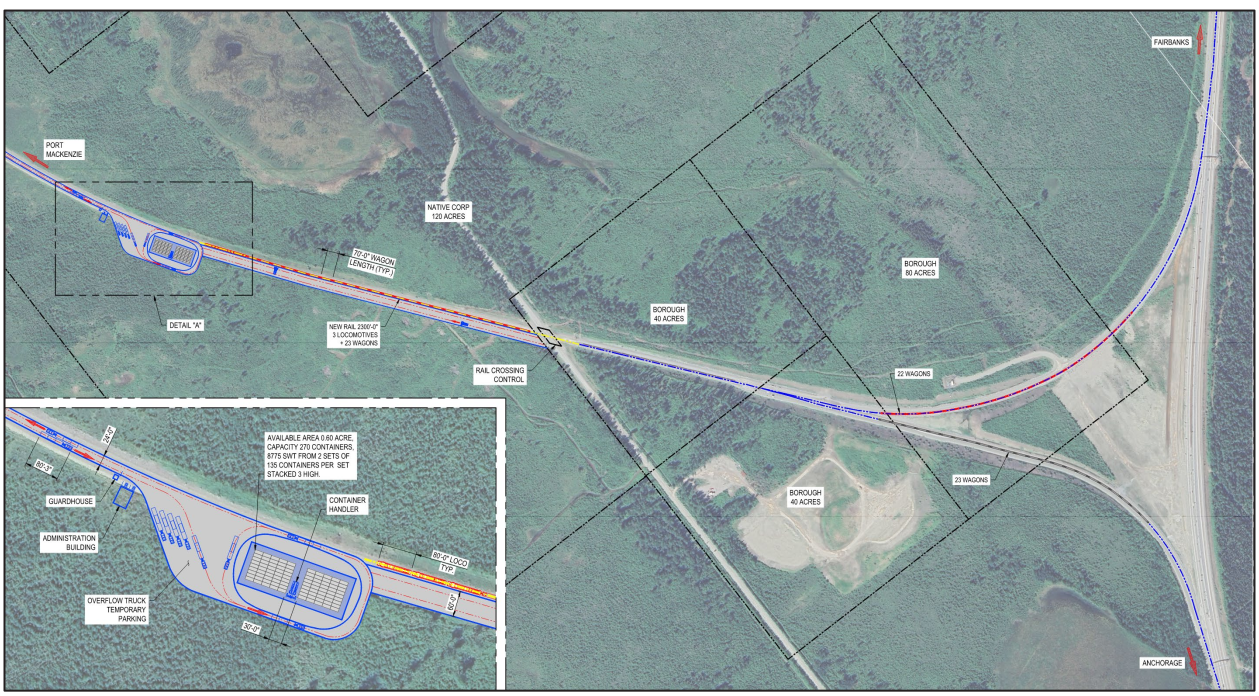

Figure 1-3. Houston Transfer Yard Overview

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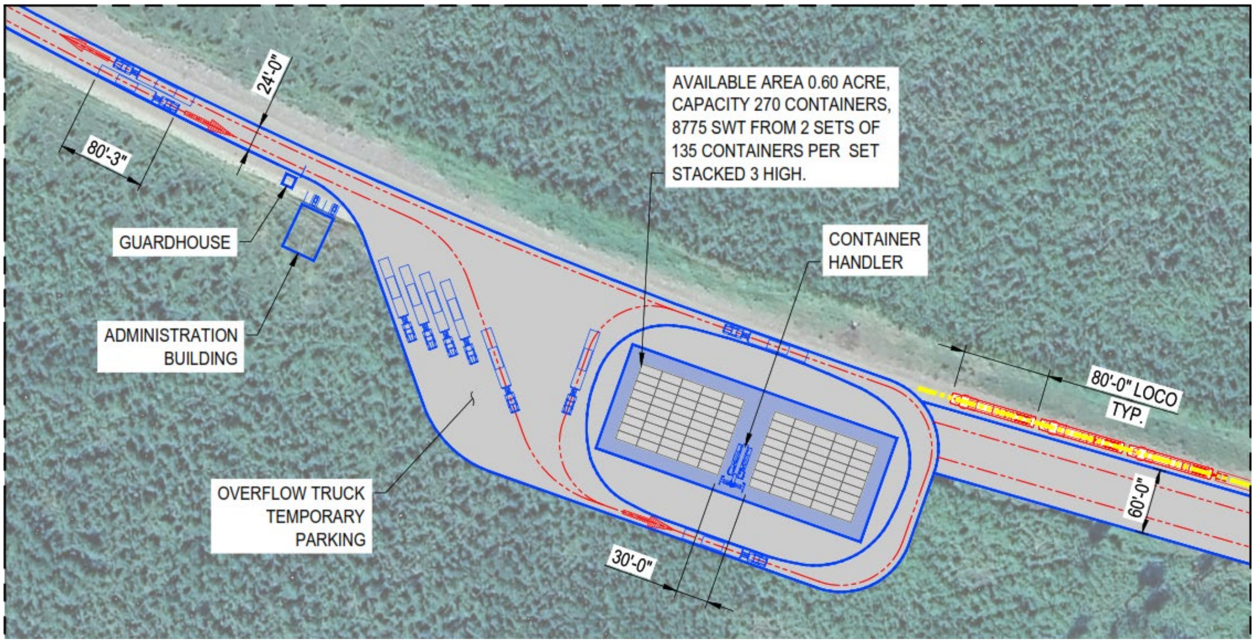

Figure 1-4. Houston Transfer Yard Detail

Remaining Highway System

Based on discussions with ADOT&PF and trucking transporters, the existing highway system can support the highway-legal single-trailer design truck without requiring capital improvements.

Capital improvements necessary to bring the sections of highway, other than the Dalton Highway corridor, to allow transportation of double-trailer trucks was not evaluated in detail. Based on conversations with trucking company representatives, significant improvements would be necessary to bring the road corridors in conformance with the geometric requirements for non-highway legal traffic. Concern was also expressed regarding the combination of unrestricted non-highway legal loads with routine traffic on heavily used public transportation corridors.

1.4 RAIL TRANSPORT

ARRC owns and operates an extensive network of rail extending from Southcentral Alaska to Fairbanks. Rail exists to all the identified ports, except for Port MacKenzie where a rail spur connecting the port to a switch yard in Houston has been partially constructed.

At the other end, a proposed rail extension north of Fairbanks connecting the existing rail network to a new intermodal transfer yard Livengood was also evaluated as part of this study. This section of rail, called the Dunbar-Livengood Rail Extension, would allow rail transport north of Fairbanks, terminating near the beginning of the Dalton Highway near Livengood, at the new Livengood Transfer Yard. This extension increases the distance transported by rail and would provide an operational cost-saving advantage compared to trucking.

1.4.1 EXISTING INFRASTRUCTURE

ARRC Rail Yard

ARRC maintains a rail yard in Fairbanks that has adequate space for container storage, truck approach, turning, and departure for up to double-trailered trucks, in a plot in the northeast sector of the premises, see **Figure 1-5** below, as indicated by the green-shaded area. This area has several access options to and from the Johansen Expressway, via various local industrial roads. A long, narrow snow storage area near the railyard to the west, as indicated by the red-shaded area, is directly accessible by the Johansen Expressway, and could also be used as an alternate site for the intermodal facility. However, it may require significant grade modification. As suggested by ARRC, the green shaded area is most likely to be available and is the primary location to be assessed for this study.

Figure 1-5. Location of Space Available for Container Operations in ARRC Fairbanks Yard

Alaska West Express Rail Yard

Alaska West Express (AWE), a trucking company under Lynden, Inc., maintains a separate rail yard in Fairbanks. AWE's yard contains a two-track rail loop and requires an additional 90 minutes of rail travel time from the ARRC yard. PND and Ausenco's preliminary investigation of the AWE rail yard suggested that the existing rail infrastructure appears to be under-maintained, and connection to the ARRC main line is not apparent, and if reinstated will result in significant and lengthy detours to reach. AWE explains that the rail is currently in use at a low rate with ample ability to expand for mining cargo, however, the present assessment is that, compared to the ARRC yard, the AWE yard would not be well suited to support Ambler project operations.

1.4.2 Capital Improvements

Capital improvements for rail transport will vary based on the transportation alternatives under consideration. The existing mainline rail systems from Fairbanks to the respective ports where rail access currently exists are anticipated to be capable of supporting concentrate transport without requiring further improvements or upgrades. Minor upgrades are anticipated at the existing ARRC Fairbanks Rail Yard and both the Whittier and Seward port terminals. Two potential major rail capital projects were assessed within the transportation alternatives considered: the Dunbar-Livengood Rail Extension and the completion of the Port MacKenzie Rail Extension. These improvements are only necessary for transportation scenarios that include either of the new rail extensions.

Fairbanks Transfer Yard

Capital improvements to the existing ARRC rail yard in Fairbanks to support intermodal operations between truck and train are anticipated to include:

- Upgrades to the existing gravel surfacing.
- Rehabilitation of Track B; including turnouts and switches.
- Installation of concrete hardstands to support container stacking, with a storage area sufficient for seven (7) trains' worth of cargo as a functional buffer.
- Paved access roads and truck turnaround areas.
- Truck scales, load-sensing equipment, and an RFID container inventory control package.
- Administration building, lighting, electrical distribution, and telecommunication systems.
- Augmentation to ARRC's existing yard material handling equipment such as container reach stackers and administrative vehicles.

An indicative layout for a proposed FTY is shown in **Figure 1-6**.

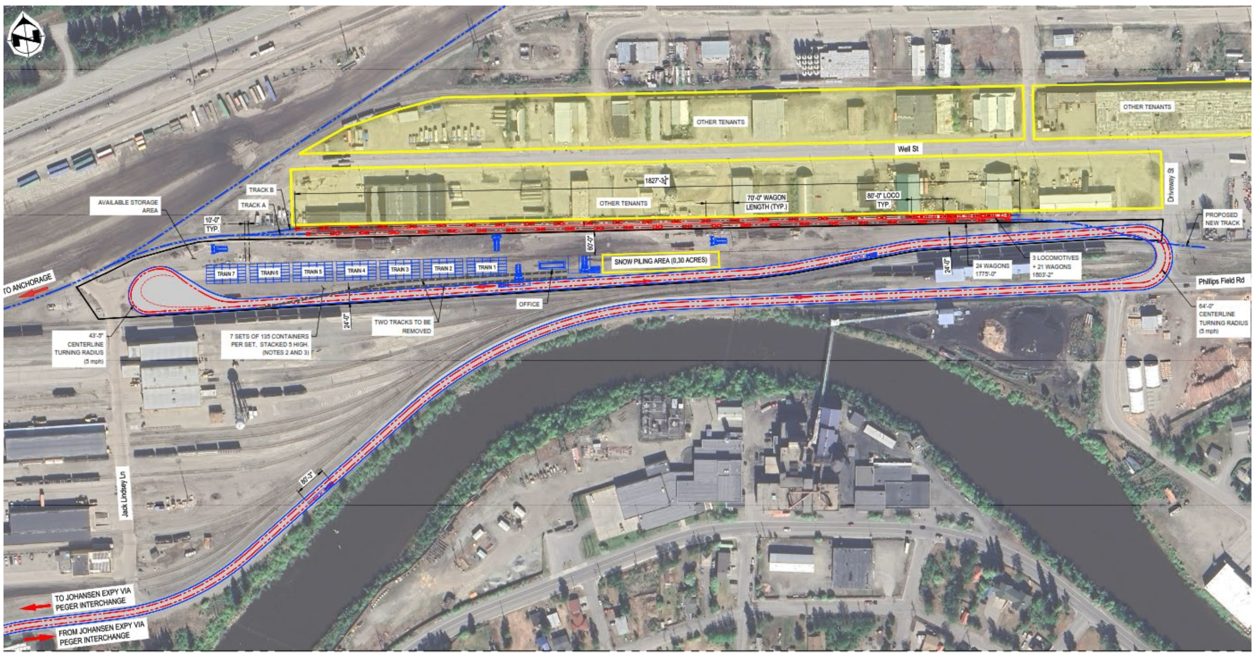

Figure 1-6. Fairbanks Transfer Yard Conceptual Layout

Dunbar-Livengood Rail Extension

The Dunbar-Livengood Rail Extension, shown in **Figure 1-7**, would consist of a new rail line connecting the existing ARRC mainline to Livengood. The extension would depart from the existing mainline rail at Dunbar Siding, about 50 miles west of Fairbanks and 10 miles north-northeast of Nenana, and would generally follow a Revised Statute (RS) 2477 right-of-way known as the "Dunbar-Brooks Terminal Trail" to the north. The nominally 60-mile rail extension would terminate at the LTY where intermodal transfer of concentrate containers between truck and rail would occur.

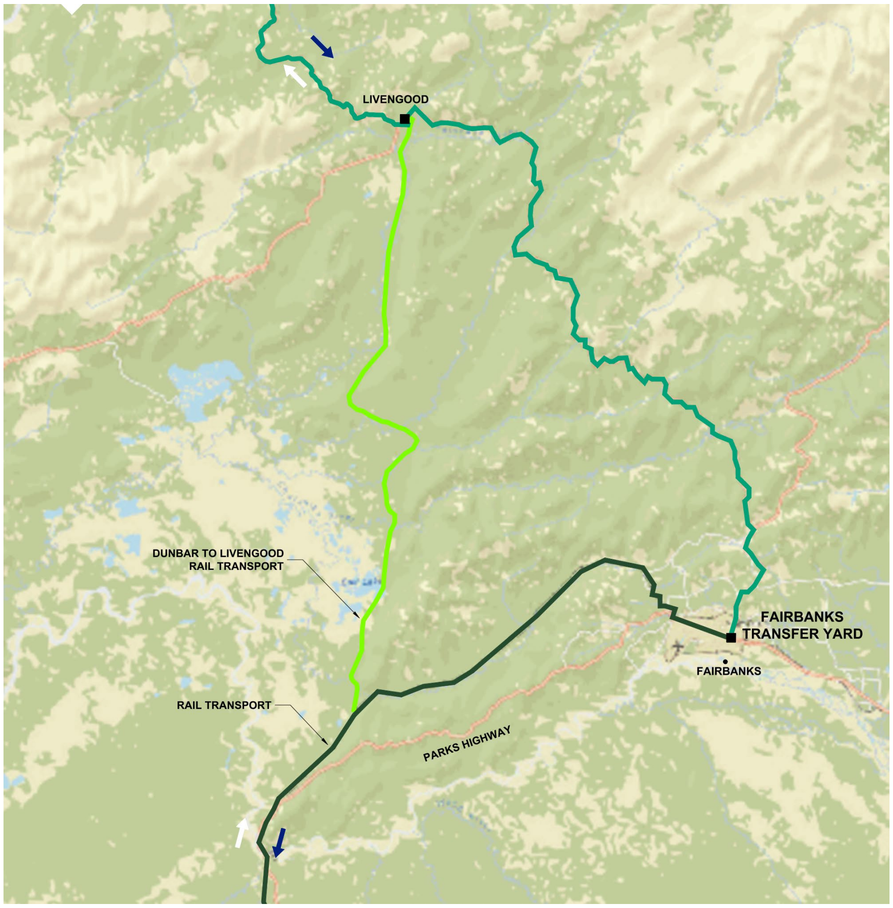

Figure 1-7. Dunbar-Livengood Rail Extension

A conceptual design was developed along the proposed corridor using a standard ARRC rail section. Conceptual drawings are provided in Appendix D (*now Appendix D.3 of the final report Dated January 2026*). Modeling efforts were based on publicly available LiDAR topographical data. The concept alignment was developed using the parameters contained in the Port Study Screening Criteria (*now Appendix D.1 of the final report Dated January 2026*) assuming mountainous grade limitations. Approximate civil quantities, including cut/fill and structural fill volumes, were calculated from the modeling efforts to support cost estimation. Twenty-three potential bridge crossing locations were identified during the assessment of the proposed rail corridor.

As a new development, this segment of rail would require significant engineering, land acquisition, and permitting efforts. Limited previous technical studies (preliminary alignments from the 1960s-70s and a geotechnical investigation) were available to support the design concept. Complete construction of embankment, rail, bridges, and terminal facilities located in Livengood would be required for the development.

Livengood Transfer Yard

Capital improvements to Livengood, to build it out to become a new Livengood Transfer Yard (LTY) to support intermodal operations between truck and train are anticipated to include:

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- Large-scale surveying, clearance, and civil works to an extensive, barren area sufficient for the intermodal yard and a minimum-radii rail loop for the staging and turning around of trains.
- Full-access maintenance road accompanying the rail loop.
- General gravel surfacing of the intermodal yard area, with additional installation of concrete hardstands to support container stacking, with a storage area sufficient for seven (7) trains' worth of cargo as a functional buffer.
- Paved access roads and truck turnaround areas.
- Truck scales, load-sensing equipment, and an RFID container inventory control package.
- Administration building, lighting, electrical distribution, and telecommunication systems.
- New fleet of dedicated container reach stackers and administrative vehicles.
- Security fencing and guardhouse.

An indicative layout for a proposed LTY is shown in **Figure 1-8**.

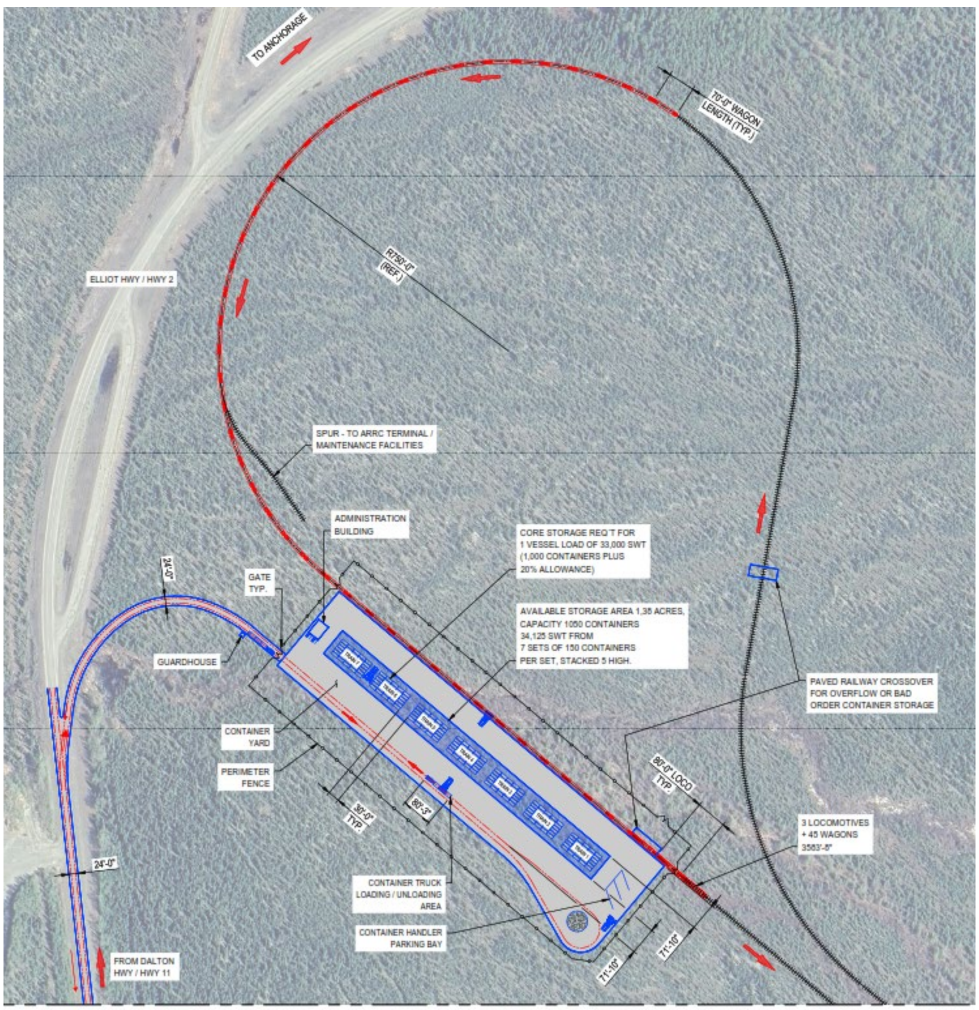

Figure 1-8. Livengood Transfer Yard Conceptual Layout

Port MacKenzie Rail Extension

The Port MacKenzie Rail Extension (PMRE), see **Figure 1-9**, is a multi-phase project to construct a 32-mile rail line from Houston to Port MacKenzie. Construction of the PMRE would need to be completed for direct rail transport to Port MacKenzie. Construction of the project was separated into six embankment segments. Five of the six segments were completed before 2017 when the project was suspended, and the project has remained dormant since. An approximately 8-mile section of embankment (Segment 2) remains to be constructed as well as the sub-ballast, ballast, and trackage along the entire rail corridor. Railway terminal facilities at Port MacKenzie would need to be constructed as well as fiber optics, signals telecommunications along the rail corridor.

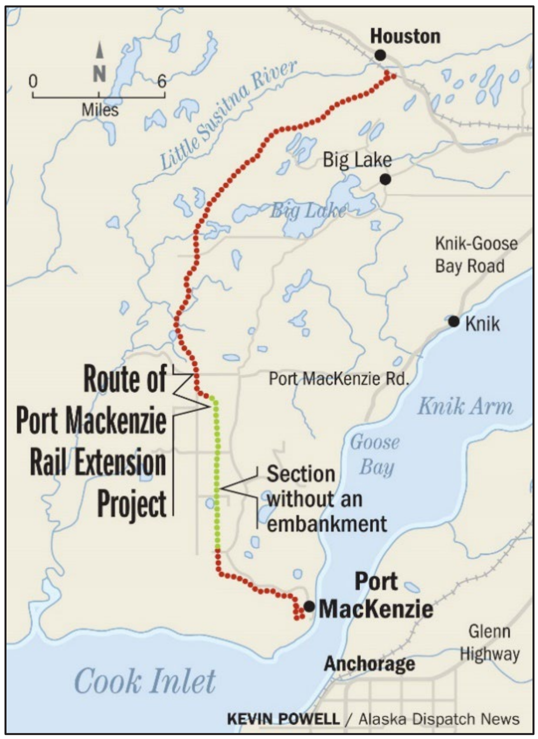

Figure 1-9. Port MacKenzie Rail Extension Concept (Alaska Dispatch News)

APPENDIX D.3 – AAP TRANSPORTATION OPTION CONCEPTS

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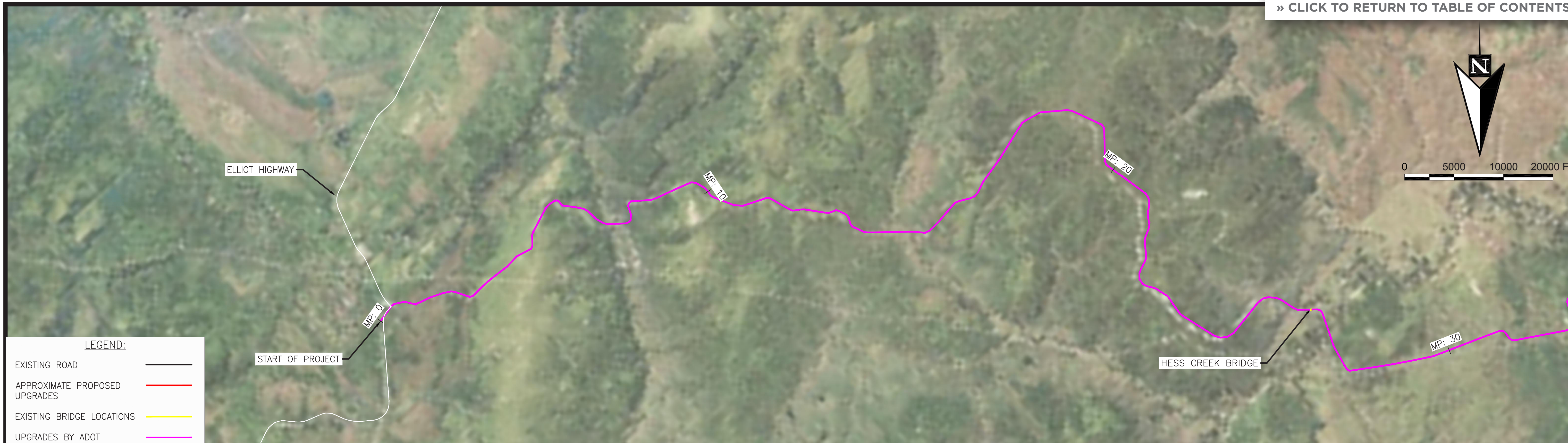

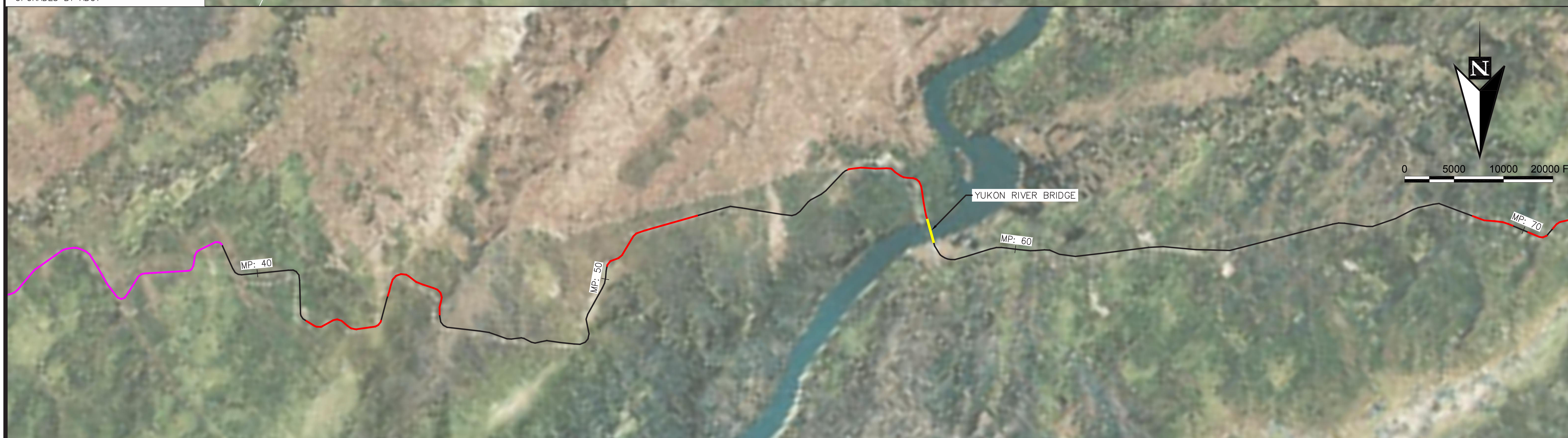

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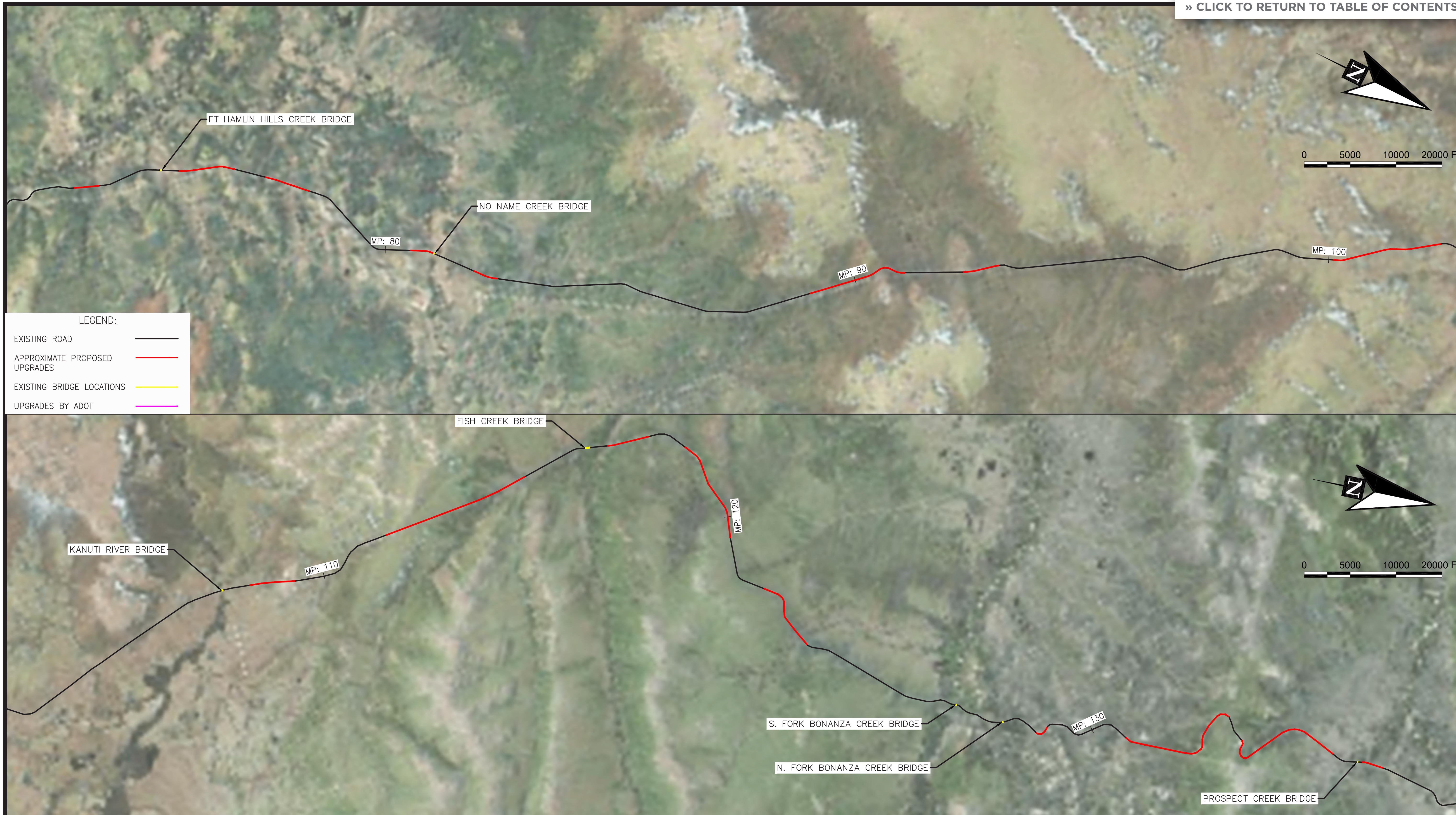

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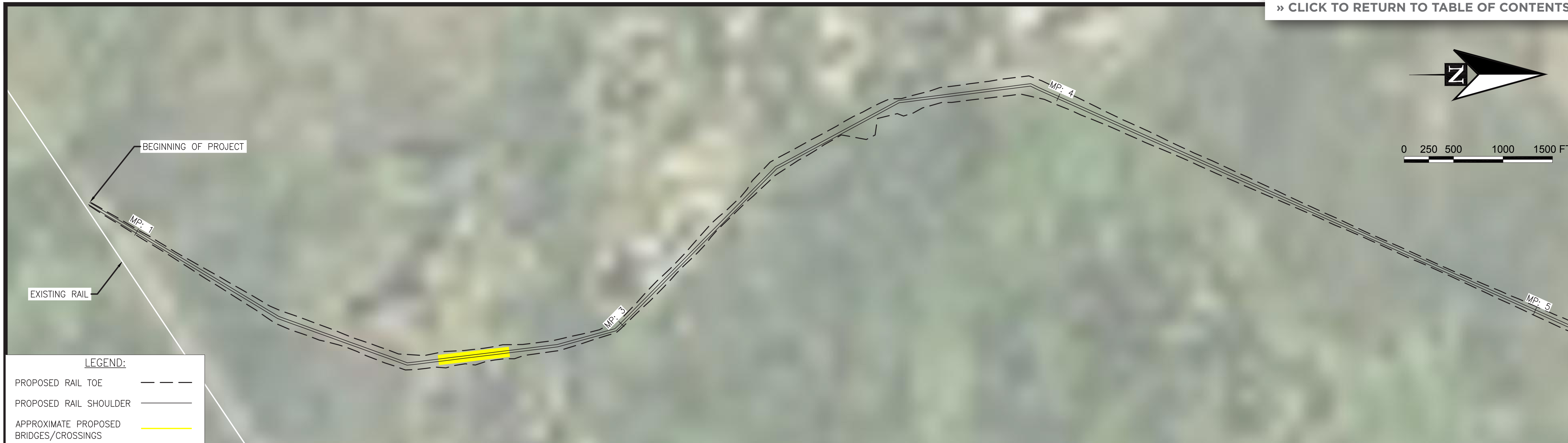

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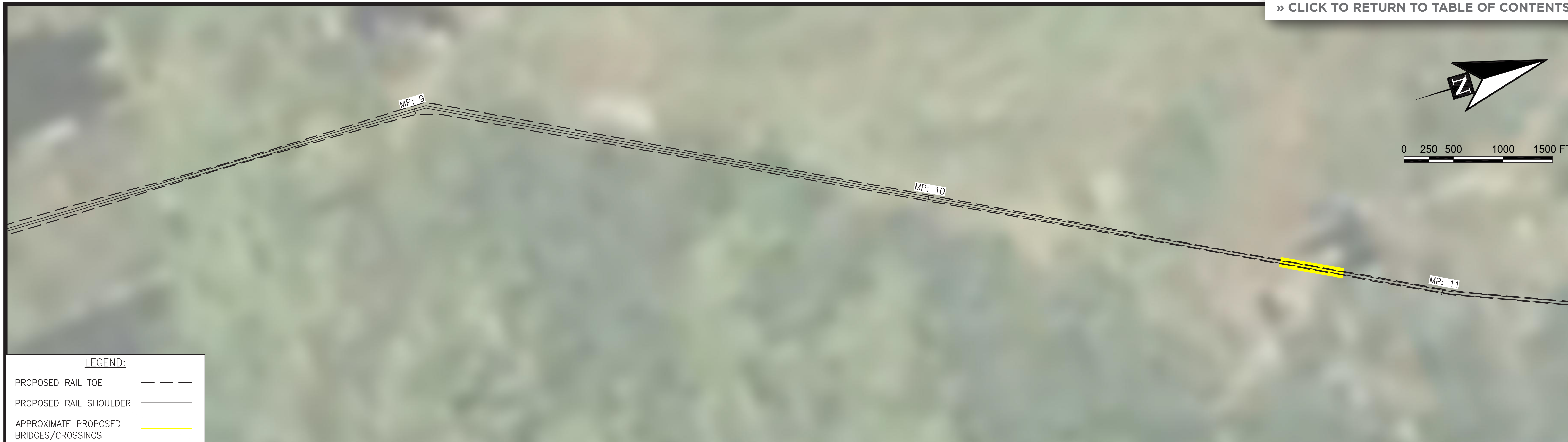

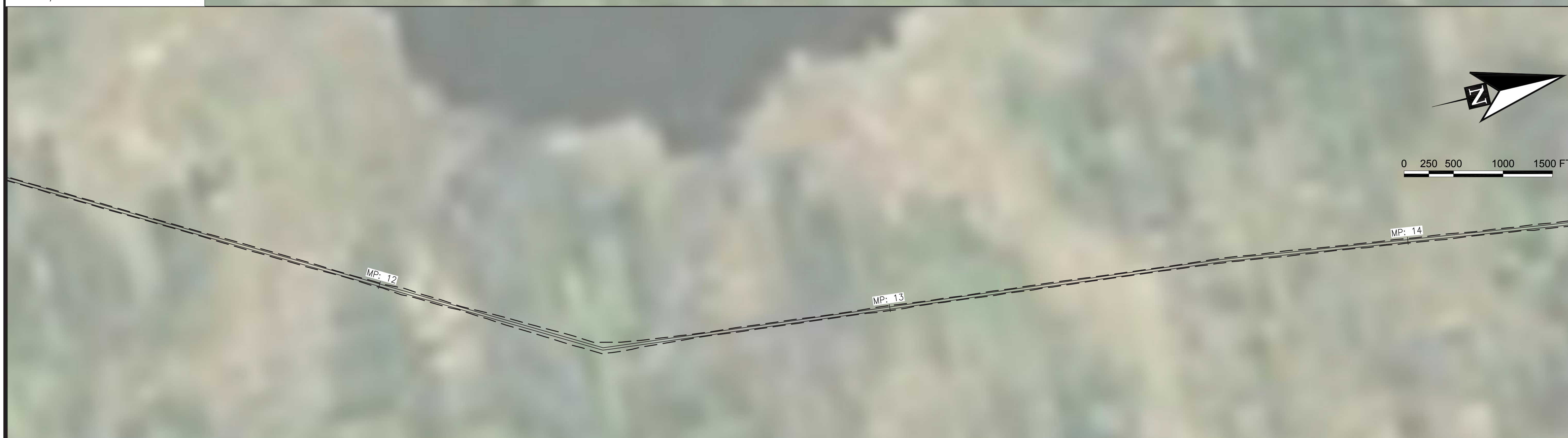

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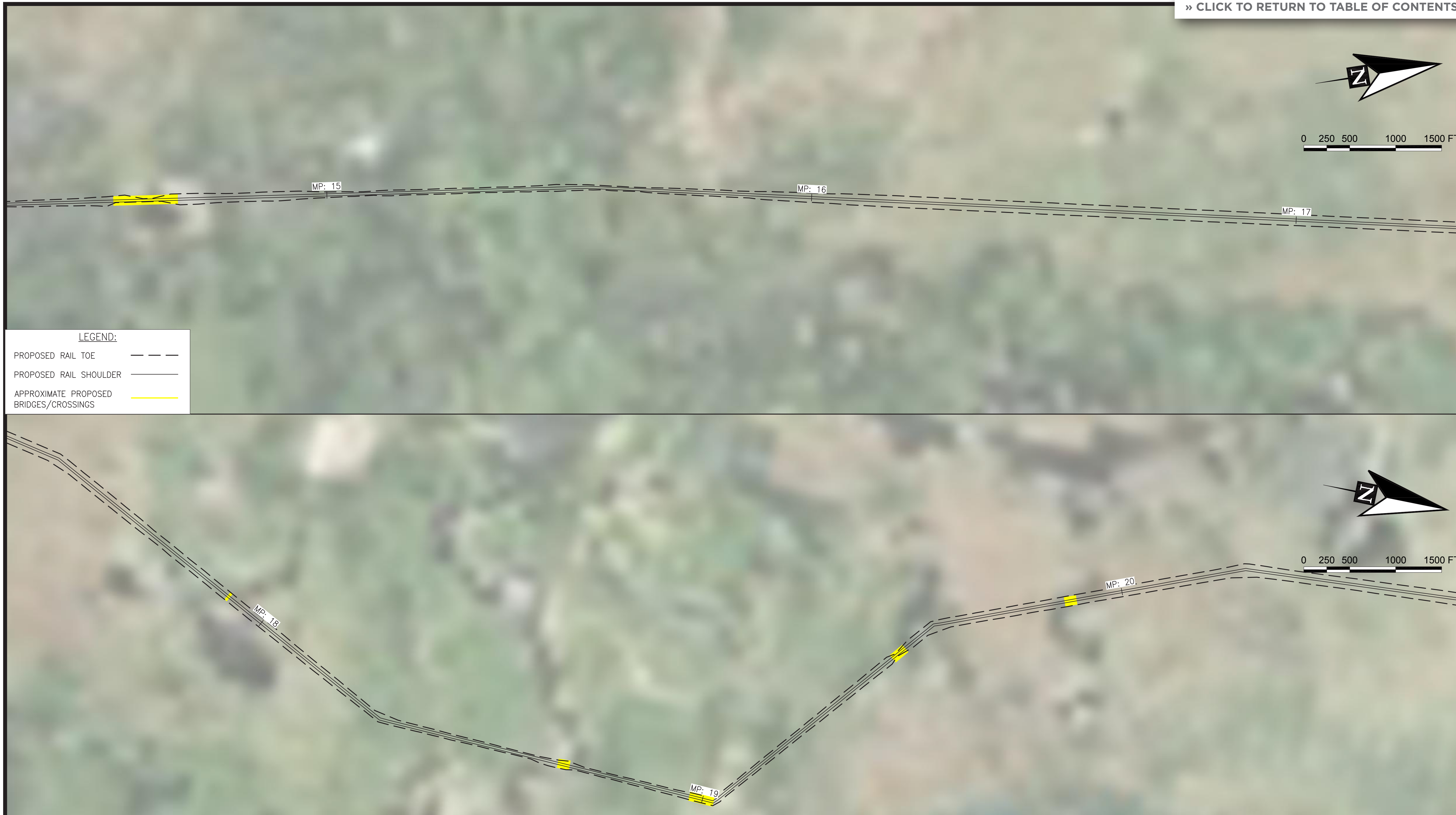

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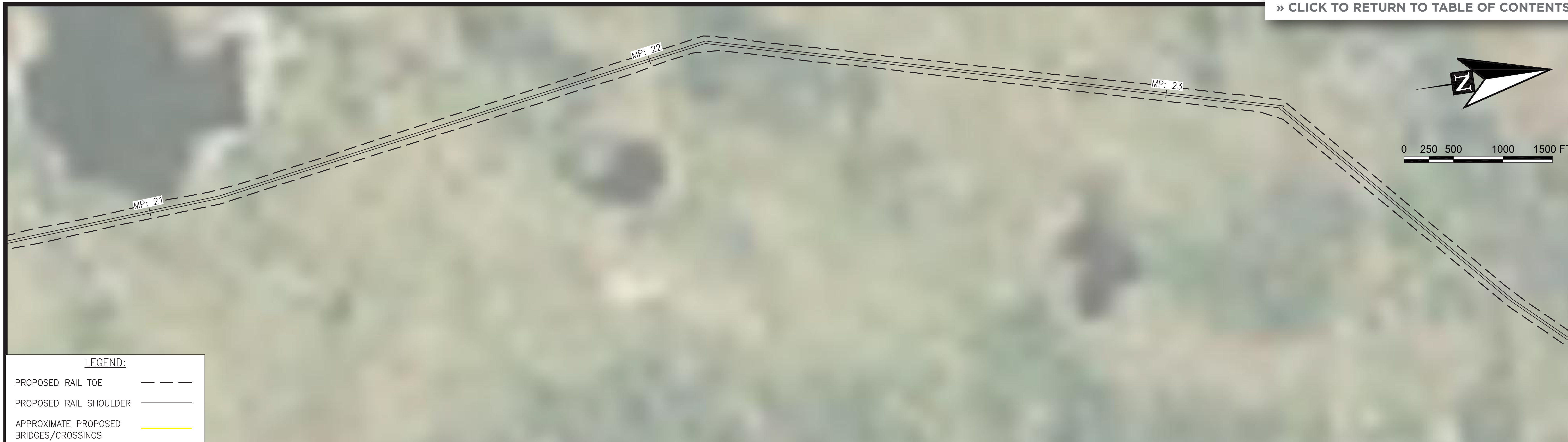

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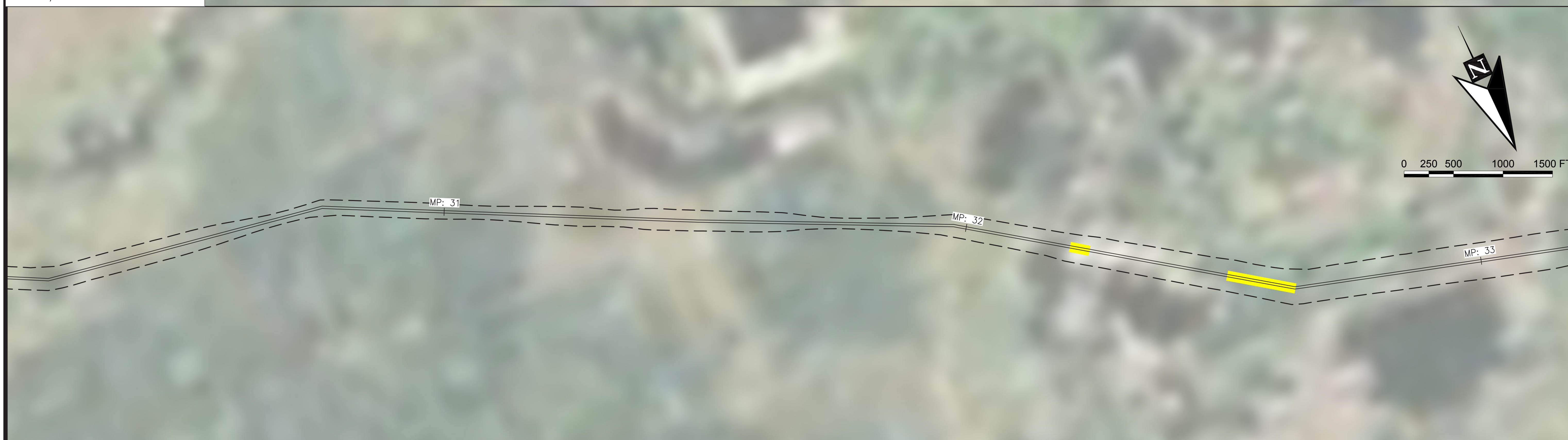

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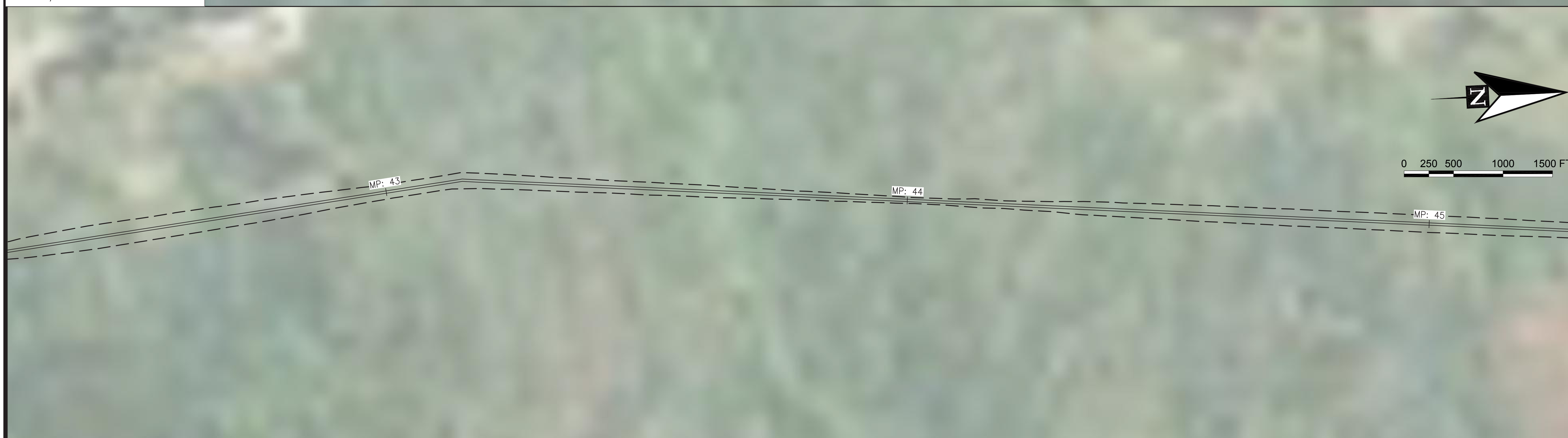

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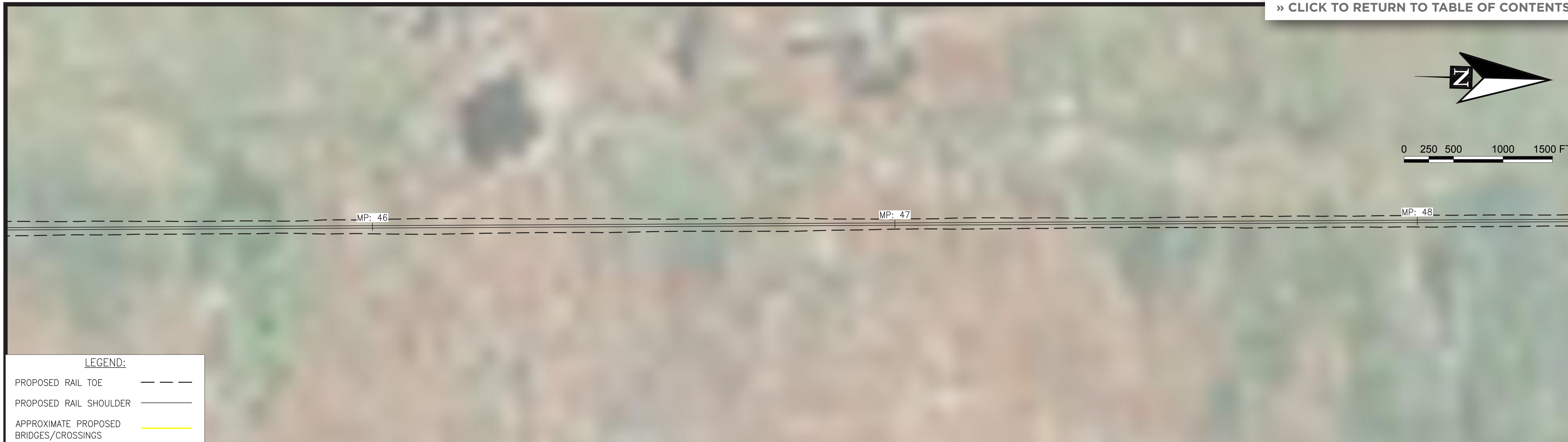
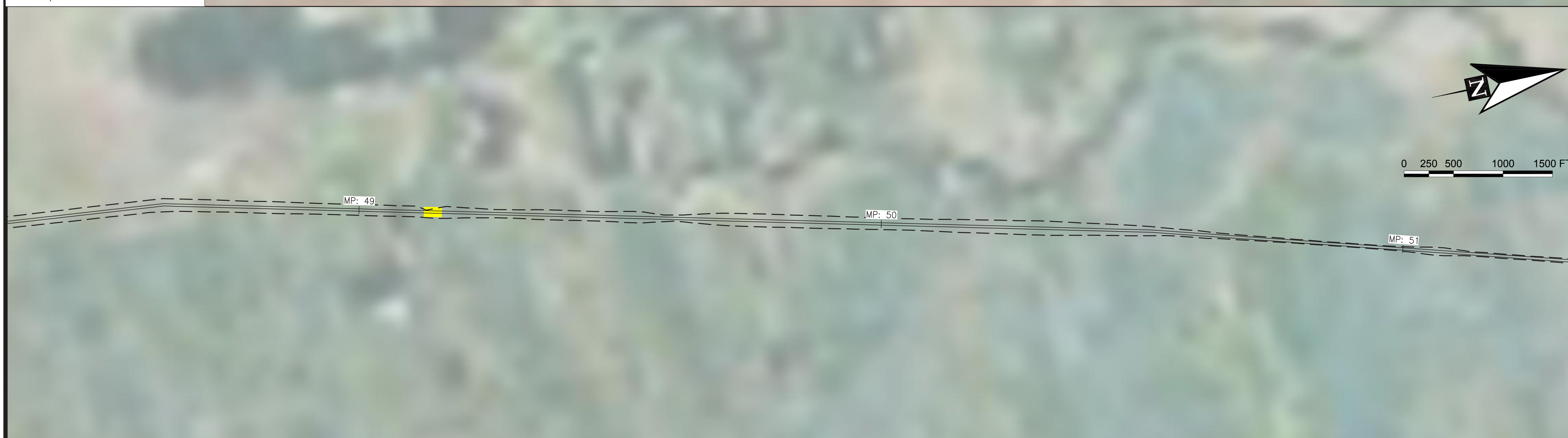


LEGEND:

PROPOSED RAIL TOE

PROPOSED RAIL SHOULDER

APPROXIMATE PROPOSED BRIDGES/CROSSINGS



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PROJECT: **AMBLER PORT STUDY**

TITLE: DUNBAR TO LIVENGOOD RAIL PLAN

DESIGNED BY: CC	DATE: 02/09/2024	SHEET NO: 08 OF 10
CHECKED BY: CC	PROJECT NO: 231099	

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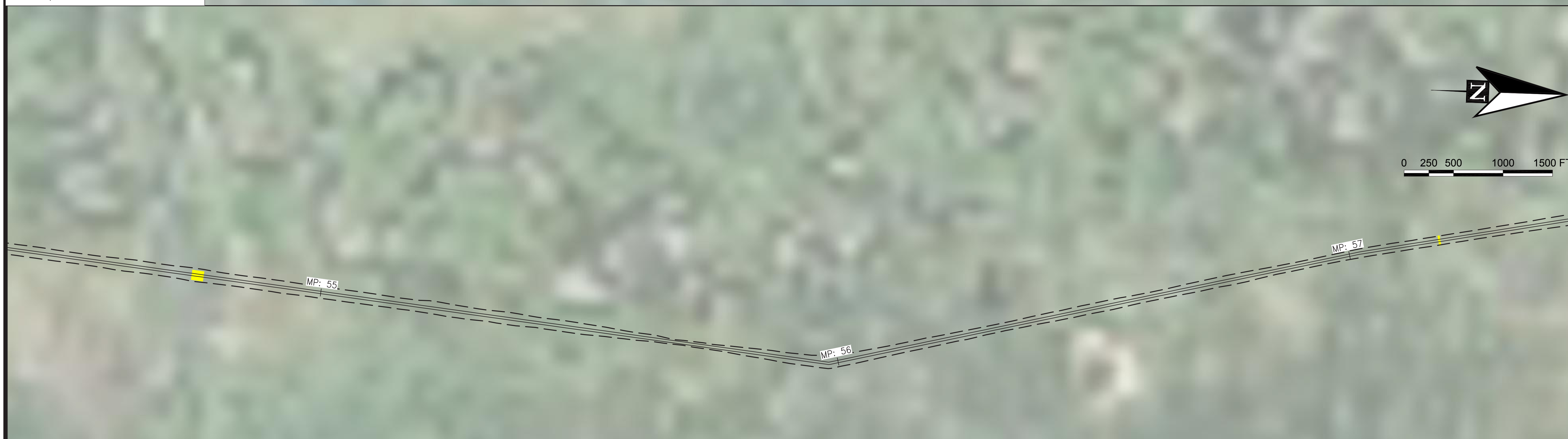

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PND ENGINEERS, INC.

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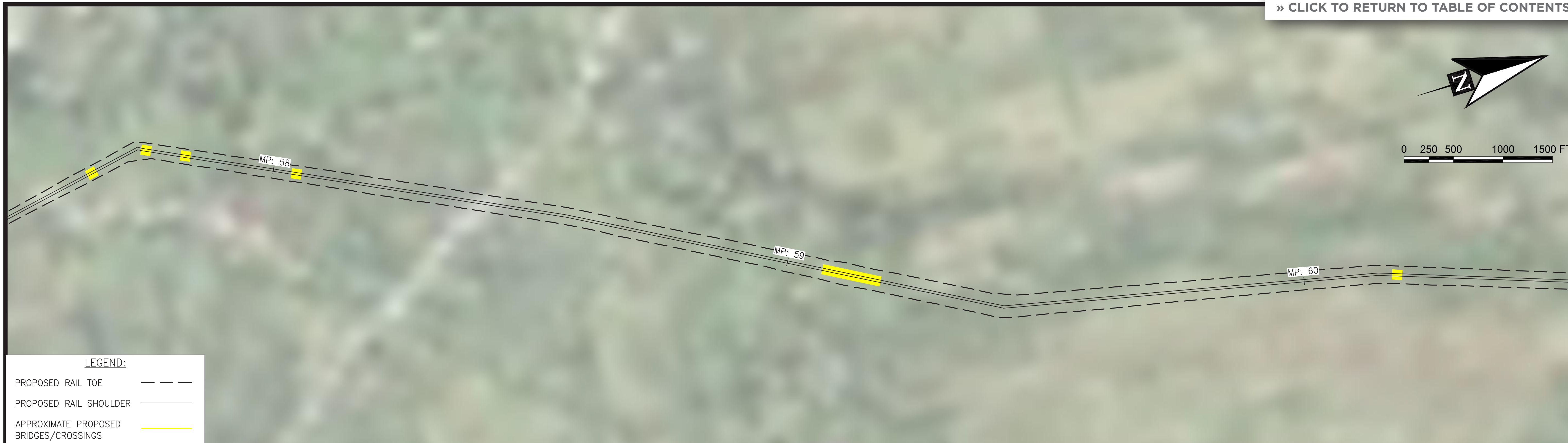

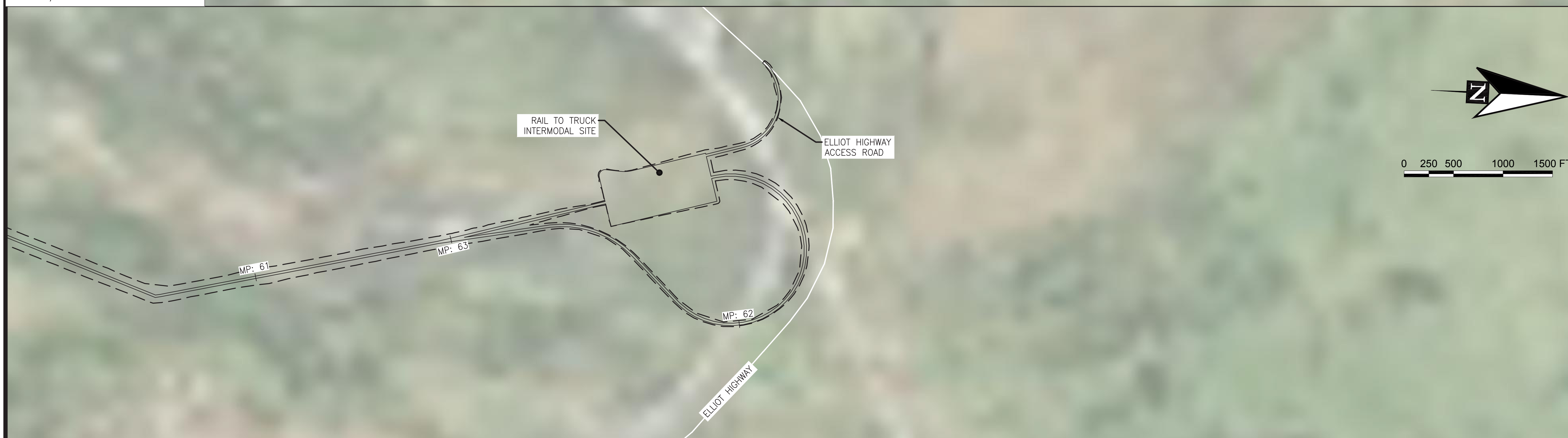

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APPENDIX D.4 – AAP PORT ASSESSMENTS

1. PORT OPTIONS

1.1 PORT OF ALASKA (ANCHORAGE)

1.1.1 HISTORY

The Port of Alaska (POA) opened as the Port of Anchorage in 1961 to serve the state's freight needs. It was the only Southcentral Alaskan port to survive the 1964 earthquake in working condition, though it did require emergency repairs. This pushed it to become the main shipping hub for the state, prompting significant upgrades including more dock frontage, rail yard space, storage and staging, and other facilities described in Section 5.1.2.

ARRC has multiple rail segments passing directly through POA property into its main freight yard, which is directly adjacent to and at grade with POA itself. The Glenn and Seward highways, which allow access to the entire Alaska highway system, both originate/terminate near the port as well.

POA was given its current name in 2017 to better recognize its importance to the entire state. On average, around 4 million tons of cargo cross the dock every year, including 50% of all waterborne freight entering the state and 90% of all refined petroleum products sold near the Railbelt.

1.1.2 EXISTING INFRASTRUCTURE

The railroad tracks within the POA are owned and maintained by the POA itself under the standards set by ARRC. ADOT&PF and ARRC are currently planning a realignment of Ocean Dock Road and the railroad tracks through the POA area. The U.S. Military is a primary, non-exclusive user of the rail within POA and is the only user besides ARRC. Military usage is limited to approximately three periods of 3-4 days each per year.

The Port of Alaska Modernization Program (PAMP), begun in 2014, is focused on replacing deteriorating dock structures that have reached the end of their design life and do not meet current relevant engineering standards. Depending on the timing of project funding, the estimated completion year is 2032 (2030 for new cargo terminals). This study does not include upgrades proposed to occur with the PAMP outside of work already completed or currently obligated to occur; the study assumes that the existing dock and marine infrastructure will be used for offloading the concentrate. Based on a review of current load guidelines, the dock appears to have sufficient capacity to support the proposed loads.

POA's current 3,500 feet of dock frontage includes three general cargo terminals with two 30-ton gantry cranes, one 40-ton gantry crane, and roll-on/roll-off (Ro/Ro) capabilities; it also features two petroleum, oil, and lubricants (POL) terminals and a recently constructed (2022) petroleum and cement terminal (PCT).

The three (3) existing 38-foot gauge gantry cranes, located at Terminal 1 and 2, are owned by POA and operated by Matson, Inc. (Matson); Matson has expressed interest in owning at least one new 100-foot gauge gantry cranes proposed under the PAMP.

POA owns and maintains two miles of rail spur through their uplands that connect to their primary freight yard, which is directly adjacent to POA. Maintenance is performed to ARRC standards.

POA is closely adjacent to both the Glenn and Seward highways, allowing access to the Alaska highway system for truck transport to and from the port.

The MOA owns POA's uplands staging and storage areas and is currently leasing them to TOTE Maritime Alaska, Inc. (TOTE) and Matson, two prominent users of the port facilities. However, the North Extension area of POA could be leased in the future.

Figure 1-1. Port of Alaska Existing Plan

1.1.3 LOCATION AND ACCESS

The truck and rail routes that connect POA and Fairbanks comprise part of the route to every other port addressed in this study. The routes to Seward and Whittier pass directly through Anchorage, and the route to Port MacKenzie is identical between Fairbanks and Houston before it deviates.

Because POA is directly adjacent to ARRC's primary railyard in Anchorage, trains loaded in Fairbanks have an approximately 56-hour cycle time to deliver cargo to POA and return to the Fairbanks railyard.

1.1.4 ENVIRONMENTAL CONDITIONS

All berths are dredged to an elevation of -35 feet Mean Lower Low Water (MLLW). Annual maintenance dredging, performed by the U.S. Army Corps of Engineers (USACE), is required to maintain the required draft at POA.

POA's proximity to the Knik Arm makes it vulnerable to the harsh environmental conditions caused by the flow, such as ice floes and silting. While exposed to ice, the port is generally protected by Cairn Point from ebb flowing from the Knik Arm, resulting in reduced impact on vessels from ice floes. Its location in Upper Cook Inlet protects it from open-sea conditions and tsunamis. Severe weather typical to Southcentral Alaska affects the port frequently, including high winds, heavy snowfall, and sub-zero temperatures.

Vessel transit to POA will require crossing through a narrow channel between Fire Island and Point Woronzof to avoid the shallow Knik Arm Shoal; the current limiting depth of the channel is approximately -38 feet MLLW but is also subject to shoaling. The Southwest Alaska Pilots Association (SWAPA) requires a minimum under-keel clearance of 10 feet for vessels transiting the channel; therefore, due to the extreme tidal range in upper Cook Inlet, vessels at loaded draft must time transit for the appropriate tide level.

Refer to **Table 1-1** below for datums at NOAA/NOS Station #9455920, Anchorage, AK (1983-2001 epoch, published on 06/03/2019).

Table 1-1. Anchorage Tide Data

Datum	Elevation (ft MLLW)
Highest Observed Tide (11/06/2002)	+34.86
Highest Astronomical Tide (HAT)	+33.78
High Tide Line (HTL) *per USACE*	+34.70
Mean Higher High Water (MHHW)	+29.16
Mean High Water (MHW)	+28.43
Mean Sea Level (MSL)	+16.47
Mean Tide Level (MTL)	+15.34
Mean Low Water (MLW)	+2.25
Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-5.04
Lowest Observed Tide (12/25/1999)	-6.39

1.1.5 CAPACITY AND HANDLING CAPABILITIES

The main dock frontage at POA has a total of four ship berths, all dredged to -35 feet MLLW, three of which are for general cargo with Ro/Ro capabilities at the northernmost berth (Terminal 3). The three general cargo berths provide 2,100 feet of dock face; the extended frontage means there is no maximum limit on ship length for berthing.

The southernmost berth of the main dock frontage (identified as POL Terminal 1) doubles as a cargo and petroleum product terminal. That berth and the dedicated petroleum berth (POL Terminal 2) to the south each have approximately 600 feet of berthing/mooring space for ships.

Three 38-foot-gauge, rail-mounted, electric container cranes—two with 30 long ton (LT) of capacity and one with 40 long ton (LT) —are available at the general cargo berths. Only the 40 LT crane was considered for this study as the smaller 30 LT cranes do not have sufficient capacity to lift the container loads in combination with the spreader and revolver attachments required for offload. With existing equipment, therefore, containerized bulk material ship loading for the Ambler project will be a single crane operation until such time that PAMP is completed. There is an opportunity to use the 30 LTs if reinforcements can be done to upgrade their safe working loads (SWLs), or if actual SWL is confirmed to be higher than what the operator claims; however, as these are not readily available, they were not considered.

POA's uplands include 125 acres of cargo handling and storage yard area, 3.4 million barrels of liquid fuel storage, and 59,200 tons of bulk cement storage. These facilities are owned by POA and leased for use to TOTE and Matson.

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Matson (Terminal 1 & 2) and TOTE (Terminal 3) provide twice-weekly scheduled cargo service (approximately four to five ships per week) from the Port of Tacoma. The Port Director for POA has indicated that there is currently ample schedule capacity at the port to accommodate the bulk carrier vessels currently planned for Ambler, but that container cargo and military operations will have precedence. The design Handysize bulk carrier for this study is similar in length to Matson's current Alaska fleet (*Anchorage*, *Kodiak*, and *Tacoma*), but is approximately 30 feet wider. Because of the increased width, additional time may be required to cast off and reposition the vessel to load from both the port and starboard sides. Regarding berthing and moorage, the existing fender system and mooring hardware (bollards and cleats) are adequate for the design bulk carrier vessel since it is similar in size to the vessels currently operating at the port.

1.1.6 Proposed Operations Plan

Concentrate containers arrive and depart from the Port of Alaska at the existing rail sidings located on the eastern edge of the Port boundary. Concentrate containers would be staged and stored at the stabilized North Extension area upon receipt at the port. Offload would be performed using reach stacker container handlers (reach stackers), transferred to the storage area with terminal yard tractors, and then staged in the storage area using reach stackers. With over 7 acres available, the North Extension area has sufficient space for core container storage with overflow capacity for up to two additional vessels. Ship loading of concentrate would occur solely at Terminal 1 using the existing 40-ton gantry crane. Movement of containers from the storage area to the terminal would occur using terminal yard tractors with a cycling loop across the terminal following a similar traffic flow as current Matson operations. Empty containers are returned to the storage yard and onward back onto trains in a reverse manner. An estimated 3,330 containers will be minimum necessary for circulation during peak demand for the Ambler development, not counting additional container quantities that may be desired to hold surplus cargo at port. The proposed site plan for POA is shown in **Figure 1-2** and is also provided in Appendix E (*now Appendix D.5 of the final report Dated January 2026*.)

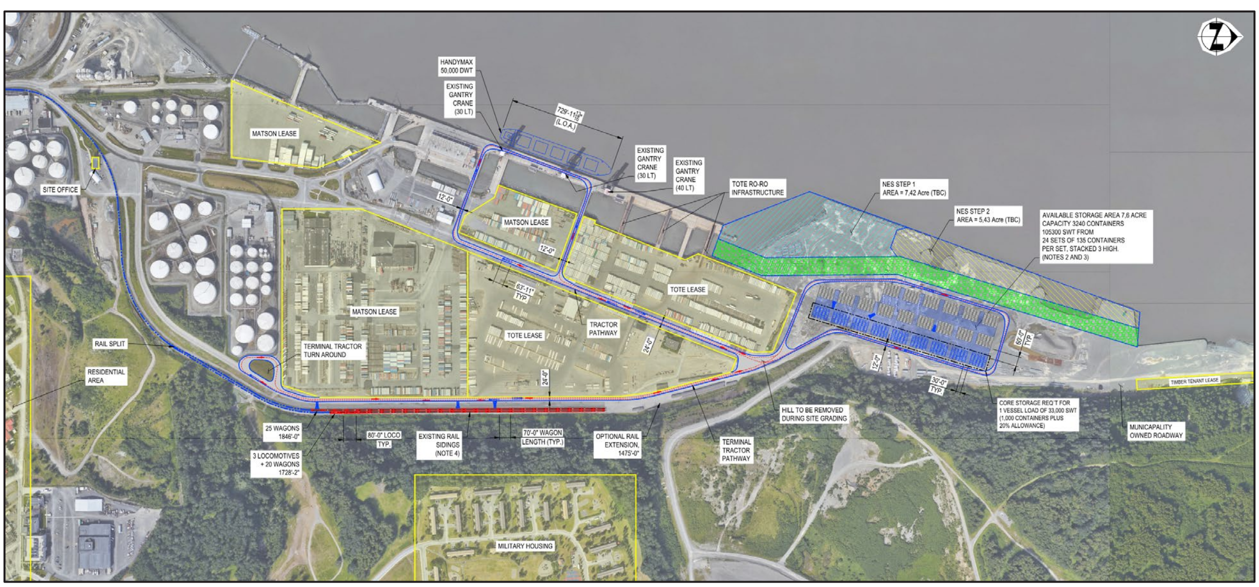

Figure 1-2. POA Proposed Site Plan

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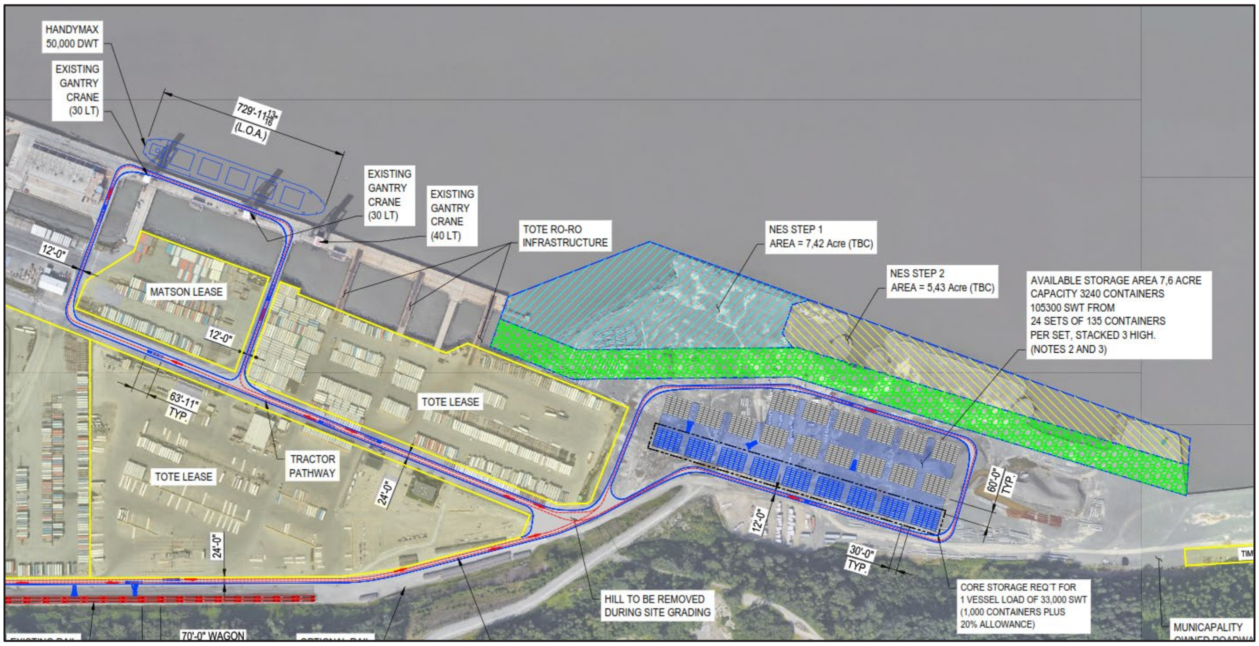

Figure 1-3. POA Proposed Site Plan: Storage Area, Access Roads, and Wharf Detail

1.1.7 CAPITAL IMPROVEMENTS

Of the ports addressed in this study, POA would require the least investment and upgrades to serve the project needs.

Capital improvements to POA are anticipated to include upgrades to the existing gravel surfacing, installation of concrete hardstands to support container stacking, truck scales, paved access roads and truck turnaround areas, load-sensing equipment, RFID inventory controls, a dedicated administration building, area lighting, telecommunication systems, and general electrical and utilities tie-in. Materials handling equipment anticipated for operations, including spares, consists of nine (9) yard haul tractors/trailers, five (5) mobile container reach stackers, and two (2) specialized container revolver attachments.

Assuming that the operation could be contracted to one of the existing tenant operators such as Matson, some supporting facilities such as equipment refueling and maintenance workshops are assumed to be in place and available to this operation, and as such no dedicated facilities need to be installed.

1.1.8 ENVIRONMENTAL AND SOCIAL IMPACTS

Additional environmental impacts at POA are minor since all infrastructure to be used is existing or already planned for construction. Increased rail, truck, and equipment traffic will cause a proportional increase in diesel exhaust at the port, however.

Potential social impacts include the following:

- Residents of the nearby Government Hill (MOA) and Cherry Hill (JBER) neighborhoods may be resistant to an increase in rail traffic at POA because of the increase in noise that will likely be produced by frequent rail car shunting, container handling, and equipment sirens.

- For the direct, single-trailer trucking option to POA, during peak production years there would be approximately 175 trucks in active circulation in the 1,230 mi round trip. They would transit in part along the Glenn Highway which has the busiest section of roadway in all of Alaska between Anchorage and Eagle River. Steady dispatch from DTY, the return of empty trucks to DTY, and legal driving hour limits are all at risk of being impacted by congestion on the highway. Increased interfacing of trucks with civilian traffic poses an increased risk of collision and accidents, worst case scenario involving major concentrate spillage and significant follow-on environmental impacts. It is important to recognize that whilst concentrate containers are sealed from the weather in general, they are not 'armored' and thus not immune to breaking open in a major traffic incident, such as a rollover.

1.2 Port MacKenzie

1.2.1 History

Port MacKenzie has been owned and operated by the Matanuska-Susitna Borough (MSB) since it opened for operations in 1999 with the completion of the Barge Dock bulkhead. The Deep Draft Dock was subsequently completed in 2005. The port was initially intended to more efficiently export Alaska's natural resources but has consistently seen limited vessel traffic.

Port MacKenzie is currently accessible via several roads that connect the Port area to the road system in the Mat-Su Valley. The primary arterial is West Point MacKenzie Road, which enters the Port District from the west and becomes South Don Young Road approximately 1.5 miles from the port. West Point MacKenzie Road is paved and has a maximum grade of 5%. Three minor collector roads—South Lu Young Lane, South Grain Terminal Access Road, and South John Riggs Memorial Way—connect various storage and staging areas within and near the Port District.

The Port District is divided into four districts for development planning: a waterfront-dependent district (WDD) consisting of tidelands and submerged lands, two port industrial districts (PID) distinguished by their proximity to the marine facilities (PID-I being adjacent and PID-II being further inland), and a port commercial district (PCD) to house commercial and lighter industrial infrastructure. PID-I has space and terrain suitable for rail and marine infrastructure associated with cargo transfer operations.

1.2.2 Existing Infrastructure

MSB owns all of the Port District's land—over 9,000 acres—all of which is zoned for development and potential long-term leasing. The Borough generally rents or leases this land in parcels. Two privately owned parcels of land abut the Port District; the owners of both parcels are in favor of port development.

Port MacKenzie's developed waterfront currently features the Deep Draft Dock (pile-supported platform structure) which extends off the Barge Dock (sheet pile bulkhead structure) approximately 470 feet via a pile-supported access trestle. See **Figure 1-4** below for an overview photo of Port MacKenzie.

The Deep Draft Dock has a 1,200-foot face at a minimum mudline elevation of -60 feet MLLW, which is the deepest draft capability in Upper Cook Inlet and does not require maintenance dredging. The dock face is comprised of the platform dock itself and breasting/mooring dolphins that extend off each end of the dock. A fender system is installed along the face of the platform dock and at each of the four (4) breasting dolphins. Other appurtenances on the Deep Draft Dock include mooring bollards, power capstans and quick-release mooring hooks, steel bull rail, safety ladders (integral with fender system), and steel dolphin access catwalks.

The Barge Dock has a total face length of approximately 440 feet at a minimum mudline elevation of -20 feet MLLW, but only about 370 feet is available for barge mooring because of the Deep Draft Dock access trestle located at the north end. The upland storage area (gravel surface) at the Barge Dock is approximately 14.7 acres, and illumination is provided by seven (7) high mast lights (an additional high mast light is also located on the Deep Draft Dock). For vessels with ramp capability, a high tide "bow" ramp is located off the southwest end of the Barge Dock bulkhead for loading/unloading. A 7,000-square-foot terminal building (built in 2006) is located just west of the ramp and includes amenities such as restroom areas (with showers), office space (with conference room and kitchenette), storage space, and modern utilities.

There is a natural elevation change between the upland bulk material handling/stockpile area and the water-dependent dock facilities that are spanned by an elevated conveyor system and access roads. The conveyor system, which includes a ship loader and is now owned by the MSB, connects the material stockpile area to the Deep Draft Dock. The Port has partially removed the conveyor system from the uplands of the Barge Dock and is currently planning to remove the ship loader and support frames from the Deep Draft Dock, in addition to possibly lowering, or partly removing the elevated portion of the conveyor along the trestle.

The port currently receives two large vessels per year (scheduled), one delivering super-sacks of cement for Colaska Inc. and the other delivering road salt for a local contractor with an ADOT&PF contract. Utilization of Port MacKenzie at large is currently generally low, and availability for new cargo is very high.

Figure 1-4. Bulk Carrier Vessel at Port MacKenzie Deep Draft Dock (photo from MSB)

There is a partially constructed rail embankment as part of the Port Mackenzie Rail Extension program, branching from the railroad that currently terminates at Houston and leading south to Port MacKenzie. All of the 32-mile embankment has been constructed except for an 8.3-mile segment (referred to as “Segment 2”) that passes through the Point MacKenzie Agricultural District and starts approximately 5 miles from the port facilities. The embankment terminates at a proposed 1-mile rail loop on the bluff above Port MacKenzie (to the west). Ties, ballast, sub-ballast, rail, and other appurtenances have not been installed on the embankment to date, except for the completed segment (referred to as “Segment 6” or the “Wye”) located in Houston that is actively used by ARRC. The embankment in its partially completed state has been idle since 2016. The embankment’s final intended use is not confirmed, as the Borough is currently investigating the option to convert the existing 18-mile stretch of embankment from Houston to Ayrshire Road into a multi-use public road to provide more direct access to the Parks Highway.

1.2.3 Location and Access

The rail access route to Port MacKenzie is identical to the other three ports until reaching Houston, at which point the cargo will either be redirected down the planned rail extension through to the port or lacking the rail extension, be transferred onto single-trailer trucks to be driven to the port. For this ‘last mile’ trucking leg, the road alignment is envisaged to be able to utilize the partially completed embankments if converted to a private use, but possibly public access road. Otherwise, it would have to detour further east to connect with the South Knik Goose Bay Road to Port MacKenzie.

For the direct, single-trailer trucking option to Port MacKenzie, during peak production years there would be approximately 175 trucks in active circulation in the 1,200 mi round trip.

The terrain between Houston and the port is largely flat with minimal elevation changes. The current truck route has several bridges that can handle the existing semi-truck traffic; the partially complete rail extension requires similar crossings. Because there is minimal civilian infrastructure and no other industrial infrastructure in the area, Port MacKenzie experiences very low traffic, both marine and overland access.

1.2.4 ENVIRONMENTAL CONDITIONS

A naturally steep grade that starts at the uplands area and extends underwater allows deep-draft dock placement with relatively little dredging. The current deep-draft dock has an alongside draft of -60 feet at MLLW.

Because of Port MacKenzie's location near the mouth of the Knik River, it is exposed to the river's harsh environmental conditions such as ice flow and silting, which are currently addressed with consistent inspection and maintenance. The weather in the area can include severe storms and extreme cold, which occasionally delay or shut down present cargo operations. Overall weather patterns are similar to POA, including snowfall and wind. Being on low-lying flat land, there is no avalanche risk to any part of the port property. The port's position in Upper Cook Inlet/Knik Arm makes the threat of tsunamis negligible.

Unlike POA, Port MacKenzie does not have partial shielding from current-driven ice pans originating in the upper Cook Inlet. The site is exposed to unobstructed strong currents that are not parallel to the dock face and, when combined with ice, can force a moored vessel away from the dock putting increased load on mooring lines and associated appurtenances. Based on the exposure and ice conditions at the port, some former vessel pilots have expressed concern with operations at the port during winter ice conditions.

In 2014, the Matanuska-Susitna Borough commissioned a Maritime Navigation Risk Assessment for Port MacKenzie (Safeguard Marine 2014). The study included numerous vessel simulations performed by the Southwest Alaska Pilots Association to assess vessel access to the port and provide guidelines and best practices for vessel and pilot protocols under varied environmental conditions, including ice. The study concluded that regional vessel Pilots are capable of navigating large vessels to Port MacKenzie during extreme conditions, but that further analysis was required for the mooring systems used to hold the vessel at the dock during the winter ice season. The study also provided recommendations (including infrastructure upgrades/improvements), guidelines, and protocols for accessing the port during ice conditions. The study further recommended the incorporation of an ice mitigation or deviation system to reduce ice-induced load to moored vessels. The type of ice mitigation measures or deviation systems were not defined in the study.

Port MacKenzie currently maintains that the dock has all-season access and that vessels can moor at the port during ice conditions. Conversations with vessel brokers indicate that ice-class vessels are available for charter, although at a cost premium and with significant planning for advanced chartering required. For this study, it was assumed that ice conditions would not restrict the usability of the dock. The recommendations, protocols, and guidelines provided in the 2014 risk assessment are assumed to be followed during inclement conditions. However, there is a risk that the vessel access would be impractical or restricted during significant ice conditions.

Refer to **Table 1-2** below for datums at NOAA/NOS Station #9455934, Port MacKenzie, AK (1983-2001 epoch, published on 05/08/2003).

Table 1-2. Port MacKenzie Tide Data

Datum	Elevation (ft MLLW)
Highest Observed Tide	-
Highest Astronomical Tide (HAT)	+35.22
High Tide Line (HTL) *per USACE*	+35.20
Mean Higher High Water (MHHW)	+29.10
Mean High Water (MHW)	+28.38
Mean Sea Level (MSL)	+16.25
Mean Tide Level (MTL)	+15.30
Mean Low Water (MLW)	+2.23
Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-6.47
Lowest Observed Tide	-

1.2.5 Capacity and Handling Capabilities

A -60-foot draft at MLLW and a 1,200-foot trestle pier allow Port MacKenzie to accommodate Panamax-sized vessels. The sheet pile dock has a 500-foot bulkhead with a draft of -20 feet at MLLW fronting 14.7 acres of fill area for cargo transfer. This study assumes the offload of concentrate would occur solely at the pile-supported Deep Draft Dock.

The conveyor system connecting the dock to the uplands is 3,000 feet long and 5 feet wide, designed to transfer dry bulk goods efficiently up the grade adjacent to the dock. The upper end of the conveyor belt allows easy access to the bulk material stockpile, which includes 20,000-square-foot storage warehouses. The Port is currently planning to remove the conveyor and loading arm from the dock. The use of the conveyor system was not incorporated in this study as the concentrate was assumed to be containerized at all stages of transport until ship loading.

The existing Deep Draft Dock was evaluated for supporting the proposed container reach stackers and mobile harbor crane loads and was found to have sufficient capacity. The mobile harbor crane would be installed one time, directly onto the deep draft dock where it would be permanently positioned near the face of the dock. The permanent location of the crane will require the vessel to translate or ‘warp’ at the dock face to provide access to the forward and rear hatches during loading operations.

1.2.6 Proposed Operational Plan

Depending on the mode of transport, concentrate containers would either be received at the rail loop area in the upper bluff or if delivered by truck, directly to the primary storage area located immediately upland of the dock. The primary storage area consists of approximately 6.2 acres and has sufficient area

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for core container storage (one vessel load) with overflow of another vessel's partial load. Additional overflow storage over another full vessel's load is available, if necessary, atop the bluff and up from the primary storage area. On-site inventory movement between rail, primary, and overflow storage areas is to be performed by terminal yard tractors.

During ship loading, delivery of containers from the primary storage area to the dock would occur using container reach stackers that would transit the trestle and position the containers on the dock for picking by the sole mobile harbor crane. The trestle access between the uplands and dock area, whilst having sufficient structural capacity for loaded container reach stackers, is narrow by design. It poses a choking point for the continuous delivery of containers to the dock by reach stackers. Unless the trestle is upgraded (currently assumed out of scope for this study), only one reach stacker may transit the trestle at any time and would be required to reverse off due to lack of space to turn around.

Loading of the vessel would require repositioning or 'warping' of the vessel at least two to three times per vessel, to allow access to the forward and reach hatches. Due to the high currents, tug assist is anticipated to be required during repositioning efforts.

The proposed site plan for Port MacKenzie is shown in **Figure 1-5**, **Figure 1-6**, **Figure 1-7**, and provided in Appendix E (*now Appendix D.5 of the final report Dated January 2026*).

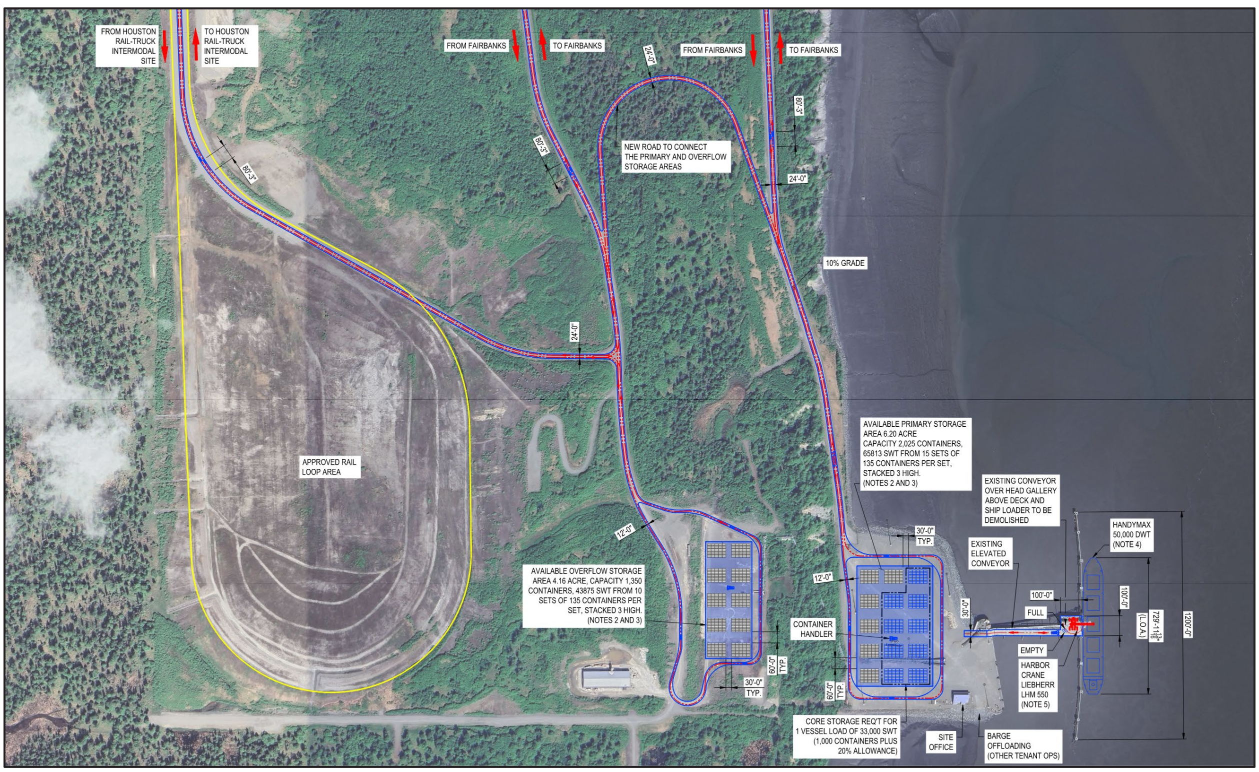

Figure 1-5. Port MacKenzie Proposed Site Plan

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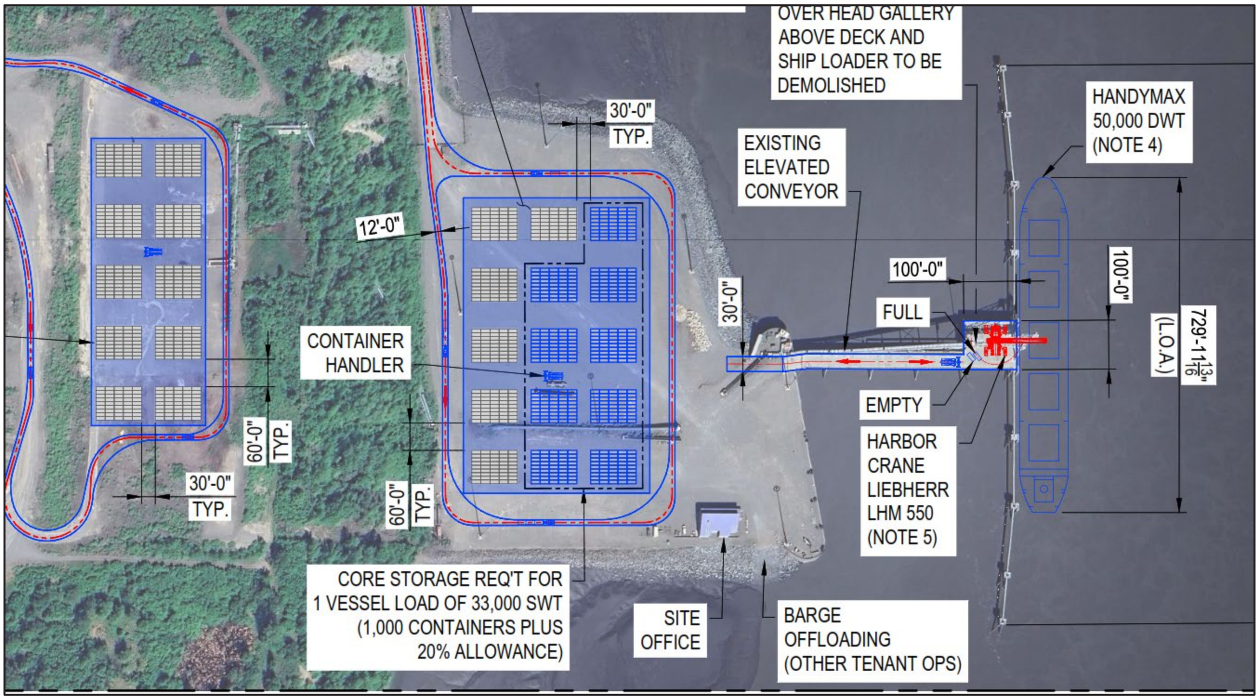

Figure 1-6. Port MacKenzie Proposed Site Plan: Primary Storage Area and Dock Detail

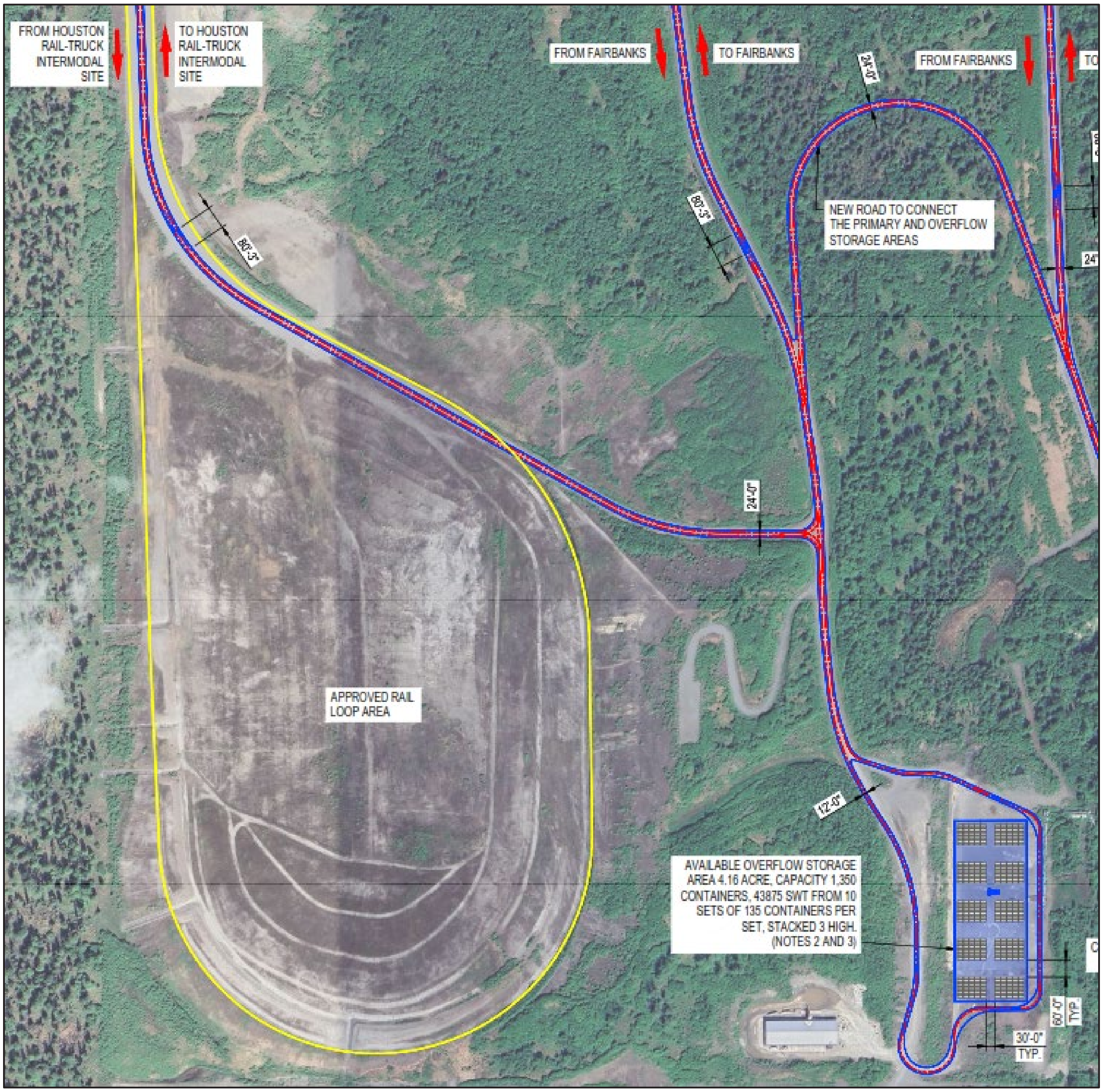

Figure 1-7. Port MacKenzie Proposed Site Plan: Rail Loop, Access Roads, and Overflow Storage Area Detail

1.2.7 Capital Improvements

Capital, additive improvements to Port MacKenzie are anticipated to include:

- Dock modifications to consist of the demolition of four (4) existing mooring dolphins and the installation of six (6) new dolphins (two breasting and four mooring dolphins) with associated catwalks. These improvements are anticipated to allow repositioning of the vessel during loading and to improve moorage at the dock.

- General gravel surfacing of primary storage area and upper overflow storage area, with additional installation of concrete hardstands to support container stacking, altogether sufficient for approximately three (3) vessels' worth of cargo.
- Paved access roads and truck turnaround areas.
- Truck scales, load-sensing equipment, and an RFID container inventory control package.
- Area lighting, electrical distribution, and telecommunication systems.
- Materials handling equipment anticipated for operations, including spares, consists of two (2) yard haul tractors/trailers, five (5) mobile container reach stackers, two (2) rotainer revolver attachments, and administrative vehicles.
- One (1) mobile harbor crane, Liebherr LHM 550 or similar.
- Equipment workshop and refueling station.
- Security fencing and guardhouse.

Capital, non-additive improvements, or alterations to Port MacKenzie include:

- Removal of the existing conveyor's elevated portions on the trestle and existing ship loading arm to allow vehicle access and area for positioning the mobile harbor crane.

Improvements to the Port MacKenzie Rail Extension and terminal facilities that would be required to allow truck or rail operations are covered separately in the Ambler Access Project Technical Assessment Transportation Options Study (*now Appendix D.5 and D.6 of the final report Dated January 2026*).

Of note, Port MacKenzie has an ideally situated, large, two-story administrative building near the waterfront primary storage area, with full office amenities and telecommunication provisions. It is envisaged that this can be utilized by any operator in a near 'move in and use' manner, saving the capital cost of an administration building and its fit-out.

1.2.8 Environmental and Social Impacts

Port MacKenzie's low traffic and remote location minimize social impacts in the port area proper. The naturally steep grade into the inlet reduces the need for dredging, mitigating a major source of environmental disturbance.

The dock modifications are anticipated to require in-water work that can have specific environmental impacts that will need to be addressed to comply with regulatory requirements. Potential impacts to the marine ecosystem due to underwater noise generated during pile driving will need to be addressed, with one of the largest regulatory hurdles being providing endangered species protection during construction.

1.3 Port of Whittier

1.3.1 History

Present-day Whittier was founded During World War II when the United States Army constructed Camp Sullivan (which included Whittier Army Port) in case of disruption at Seward's port in addition to its deep-draft year-round ice-free mooring capabilities. The construction of the port and railroad was finished in 1943 and served as the Army's entrance port for soldiers into Alaska. However, by 1960, the Army began to abandon the Whittier Army Port. On March 27, 1964, the town suffered over $10 million worth of damage from a tsunami following the largest recorded earthquake in US history which destroyed the port

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and railroad infrastructure and accelerated the Army's withdrawal. The infrastructure was rebuilt in a relatively short time frame and rail transport to Anchorage. The town was officially established on July 15, 1969, and was renamed Whittier. Eventually, the town became a port of call for cruise ships, being utilized by local operations and mid-sized cruise ships. When the Anton Anderson Memorial Tunnel opened to the public in 2000, it became the first highway to connect Whittier to Anchorage and inner Alaska. After the tunnel expanded to Whittier, it began to be visited by larger cruise lines. The port functions as the rail link with the lower 48 states and Canada through the barge slip.

1.3.2 EXISTING INFRASTRUCTURE

The Port of Whittier facilities evaluated as part of this study are all owned and operated by ARRC and are located at the ARRC Whittier Port near the head of Passage Canal. The facilities include the Marginal Wharf, upland container storage, and staging area, and barge railcar transfer ramp operated by Alaska Marine Lines (AML). See **Figure 1-8** below for docks located at the ARRC Port in Whittier:

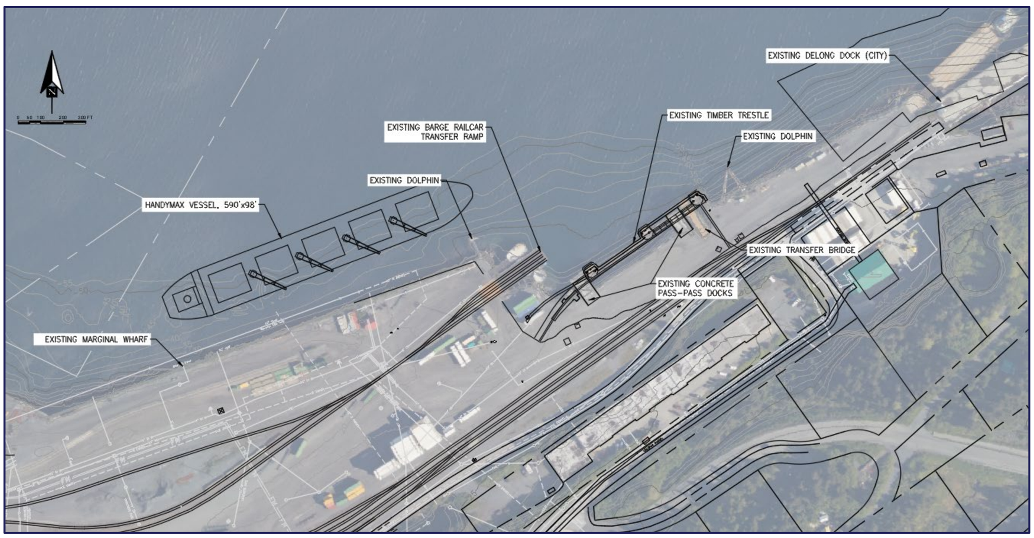

Figure 1-8. ARRC Whittier Port Facilities

Marginal Wharf

In 2005 Whittier's main wharf, referred to as the "Marginal Wharf" surpassed its service life, and was subsequently torn down leaving behind the 1200-foot-long sea wall adjacent to the barge slip. Significant rehabilitation or replacement is required in the next few years if the facility is to resume service. When the marginal wharf was torn down, most of the material was left where the wharf stood. If rehabilitation or replacement of the marginal wharf is to be performed, it would require extraction of that material.

With currently available infrastructure and specifically the as-is condition of the marginal wharf, the Port of Whittier is not capable of handling the design vessel, its ship loading, or container staging requirements for this project.

Figure 1-9 below shows the current state of the sea wall and where the marginal wharf used to stand.

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Figure 1-9. Existing Marginal Wharf (Note Only Seawall Portion Remains)

Upland Container Storage and Staging

Referring to **Figure 1-10** and **Figure 1-11**, space claimed by existing operations in Port of Whittier is the near maximum capacity between rail operations, barge operations, general cargo, and container storage. A core storage area of nominally 4 acres exists, however, it is fully utilized by Alaska Marine Lines for their current storage and offload activities. For the Ambler project's containers, an additional dedicated storage area at the waterfront would need to be constructed through shoreline reclamation and extension into the water. This proposed location is the only viable location that is within reasonable proximity to the trains, the wharf, and ship-loading activities. The proposed storage area is constrained on all sides and is likely able to contain just enough containers (1,200) for 1 vessel's worth of cargo plus a 20% allowance. Overflow container storage will likely be stored much farther to the east of the premises on opportune plots of unused land, intermixed with other storage.

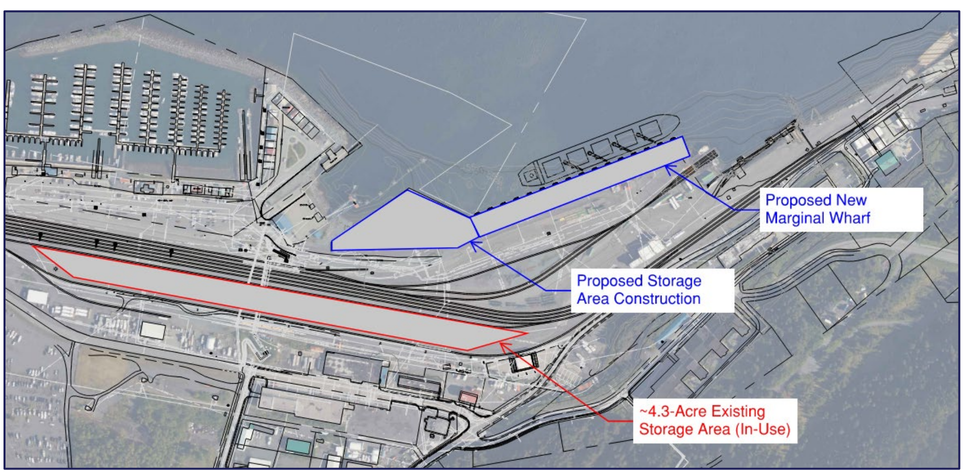

Figure 1-10. Whittier Proposed Site Plan

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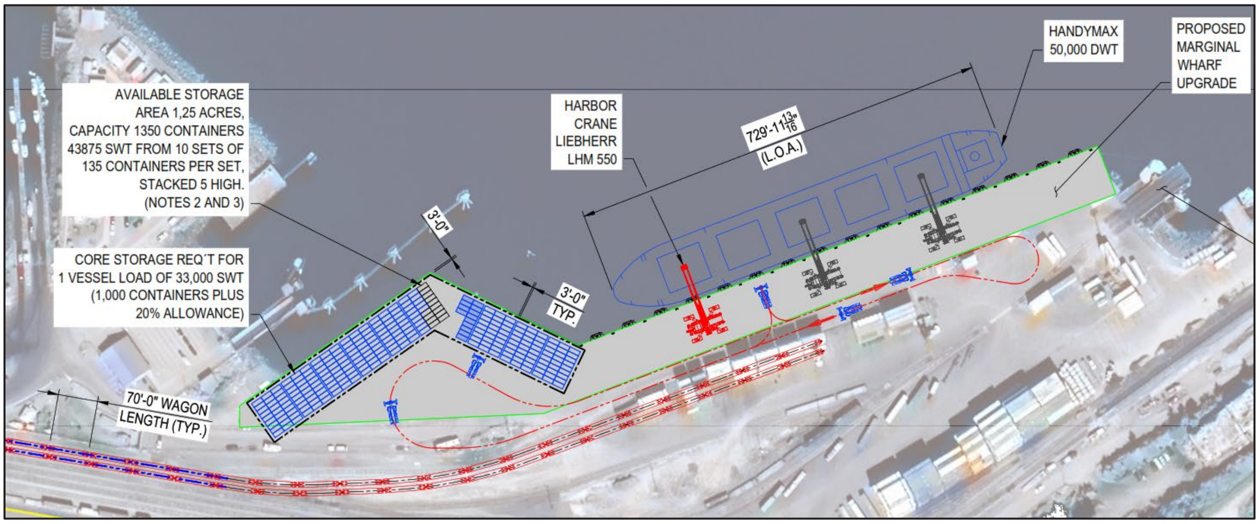

Figure 1-11. Whittier Proposed Site Plan: Storage Area and Marginal Wharf Detail

1.3.3 Location and Access

The Port of Whittier is located 864 miles from the mine site, which includes 449 miles by truck transportation on the proposed Ambler Access Road and existing Dalton Highway and 415 miles by train transportation. Rail transportation to the port shares the same route as the other options from the mine site, up to Anchorage. From Anchorage, the route continues approximately 59 miles on rail and potentially includes operational delays in the winter due to heavy snow and remote access maintenance, as well as from navigating the Anton Anderson Memorial Tunnel, especially in the summer months when there is increased cruise ship tourist traffic. Winter maintenance can be performed on-demand or routinely, both of which carry cost increases. The cost increase of the two options should be further investigated as peak volume years with frequent train arrivals may mean that routine snow clearing versus spot clearing is more economical. An estimated additional 6-12 hours will be incurred from Anchorage to the Port of Whittier and a total rail cycle time of 64-70 hours (or 6 days) is estimated from and returning to the Fairbanks yard. With limited space and trackage at the port, containerized concentrate trains and AML's existing railed cargo all converging on Whittier is expected to cause regular congestion. Train spotting, loading, and unloading delays may be a risk to the cycle times of the trains and, in extreme cases could result in cargo starvation during ship loading and consequently vessel delays.

For the direct, single-trailer trucking option to Port of Whittier originating from the DTY, during peak production years there would be approximately 175 trucks in active circulation in the 1,340-mile round trip. The timed, alternating one-way traffic protocol through the tunnel may incur slight truck delays locally, but overall would likely be inconsequential to trucking cycle times.

1.3.4 Environmental Conditions

The Port of Whittier is a deep-draft, ice-free port that is protected at the head of Passage Canal from open-ocean-produced swells. However, it is especially vulnerable to high winds and heavy snowfalls of 13-15 feet, which cause operational delays. There is also a risk of avalanches falling into the water from slopes to the northeast of Whittier which can carry a tsunami risk. A design snow load of 300 psf is expected per the ASCE 7 standard.

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Refer to **Table 1-3** below for datums at NOAA/NOS Station #9454949, Whittier, AK (1983-2001 epoch, published on 09/08/2008).

Table 1-3. Whittier Tide Data

Datum	Elevation (ft MLLW)
Highest Observed Tide	-
Highest Astronomical Tide (HAT)	+15.83
High Tide Line (HTL) *per USACE*	+15.80
Mean Higher High Water (MHHW)	+12.19
Mean High Water (MHW)	+11.27
Mean Sea Level (MSL)	+6.52
Mean Tide Level (MTL)	+6.38
Mean Low Water (MLW)	+1.49
Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-3.95
Lowest Observed Tide	-

1.3.5 Capacity and Handling Capabilities

With currently available infrastructure and specifically the as-is condition of the marginal wharf, the Port of Whittier is not capable of handling the design vessel, its ship loading, or container staging requirements for this project.

Refer to 1.3.2 for a detailed discussion of the limitations of existing infrastructure.

1.3.6 Proposed Operational Plan

Containers are assumed to be supplied to the port by rail. Trains would be offloaded from the rail line adjacent to the marginal wharf and staged in the new storage area located to the west of the replaced marginal wharf dock. Transfer of containers from the storage area to the terminal would occur using container reach stackers that would transit the dock and position the containers for picking by the mobile harbor crane. The mobile harbor crane would reposition as required on the dock to fill the hatches of the vessel.

For the direct trucking option, containers would be delivered to the Port of Whittier by truck, delivered to a similar location as rail, and similarly received into storage. For transiting through the Anton Anderson Memorial Tunnel, as the tunnel has timed, alternating one-way traffic with a bias for rail traffic, trucks may arrive and depart in small convoys of three (3) to five (5) trucks.

1.3.7 Capital Improvements

The new Marginal Wharf is essential to operations and will need to be constructed for Whittier to be considered a suitable port for this project. The purpose of the redevelopment is to provide a dock that will primarily be used for container freight handling. The proposed new Marginal Wharf will likely include a high-capacity sheet pile bulkhead dock to adequately handle the heavy freight loading requirements. The proposed dock would be sited at approximately elevation -40 MLLW to provide sufficient vessel draft at the face. The structure would include all necessary appurtenances for berthing and mooring of vessels such as dock facing, fenders, and bollards. Upon completion of the proposed replacement design, the new wharf will allow vessels up to 900 feet in length to moor, easily accommodating the 730-foot design vessel. In addition, to handle the desired staging requirements, a new storage area will need to be constructed. The current proposed design for the new storage area is an extension of the sheet pile bulkhead as an addition to the new Marginal Wharf, as shown in Figure 5-10 above. The proposed new storage area would consist of a nominally 1.25-acre footprint, requiring containers to be stacked 5-high to accommodate the requirements of this project. The area will need to be designed to support the stacked containers (roughly 2,300 psf uniform storage load accompanied with container handling live loads) with concrete hardstands provided in the storage area for additional support.

Additional capital improvements required in Whittier are anticipated to include yard access road improvements, approximately 3,600 feet of additional rail track to support train staging, load-sensing equipment, a new project-specific administration building, security fencing, yard and road lighting, and electrical systems. Materials handling equipment anticipated, including spares, consists of five (5) mobile container reach stackers, two (2) rotainer revolver attachments, and a single mobile harbor crane.

1.3.8 Environmental and Social Impacts

Whittier has the unique constraint of the Anton Anderson Memorial Tunnel which is a one-way tunnel underneath the Portage Pass that restricts vehicle movements in both directions. Trains are generally restricted to nighttime movements to allow motor vehicle passage during the day. It is estimated that a train passing through the tunnel results in a 1.5-hour vehicle impact if train travel during daytime hours is needed. However, ARRC does not anticipate hours during the daytime will be needed if Whittier is selected as the port for this project and the addition of train activity should not affect normal pedestrian travel.

Reconstructing the marginal wharf involves underwater activities, leading to potential environmental impacts that must be addressed to meet regulatory standards. Specifically, the noise generated from pile driving poses a concern for the marine ecosystem, necessitating attention to comply with regulations. One major challenge lies in ensuring the protection of endangered species during the construction phase. Additionally, the placement of fill below the ordinary high-water level will disturb the aquatic environment. The disturbance caused by construction could lead to the displacement of sediment and the suspension of particulate matter in the water, potentially affecting filter-feeding organisms and bottom-dwelling species.

1.4 Port of Seward

1.4.1 History

Seward was founded in 1903 when Alaska Central Railway began planning construction of the first railroad in Alaska starting with its first port in Seward. Initially, the railroad extended 50 miles to the north and eventually to Anchorage and Fairbanks. Seward provided port access for the railroad for many years with its main dock near the south end of the town, where the Sealife Center is located today. See **Figure 1-12** below, courtesy of the Seward Community Library, for an aerial view of pre-1964 Seward.

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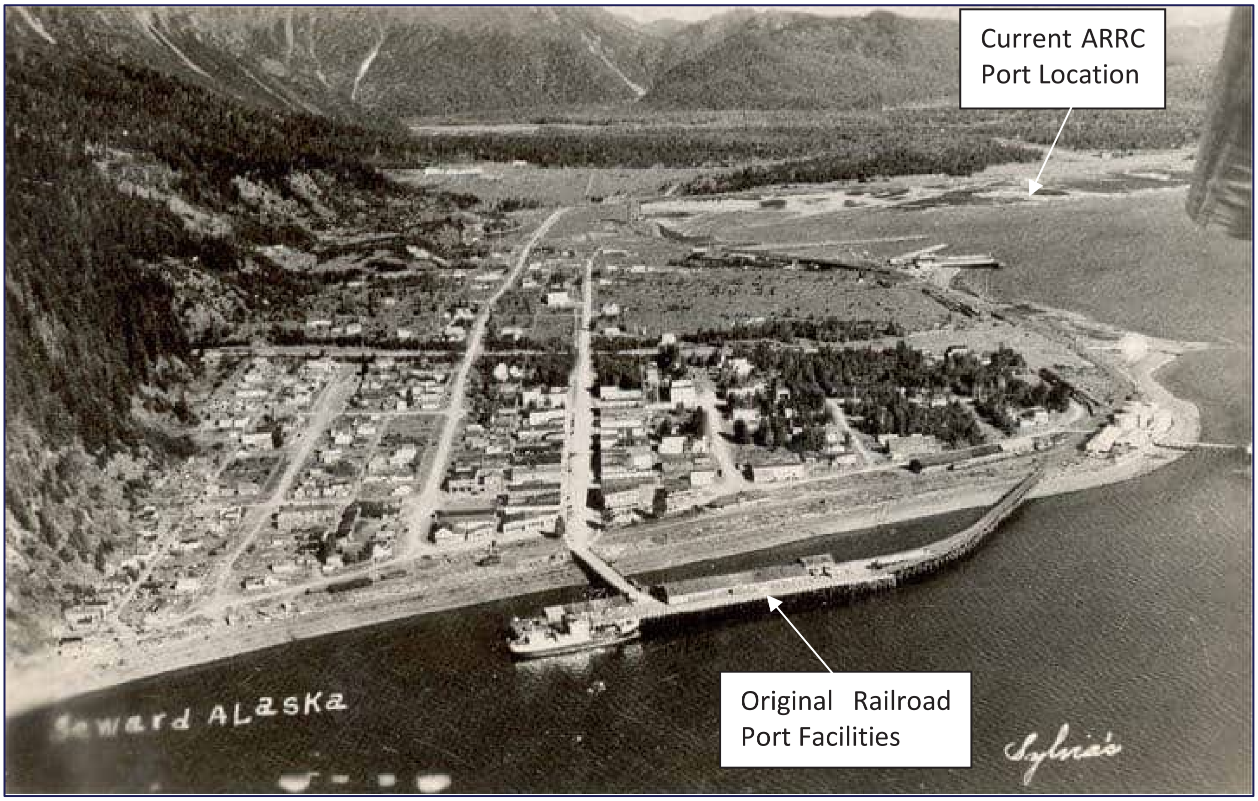

Figure 1-12. Aerial Imagery of Pre-1964 Seward

Following the original Port of Seward facilities' destruction during the 1964 earthquake, a new freight dock with an intermodal terminal building was constructed on the east side of town at the head of Resurrection Bay, known now as ARRC's Seward Passenger Dock (see **Figure 1-12** above). A coal loading facility constructed in 1984 directly west of the Passenger Dock, known as the Coal Dock, was in operation for approximately 30 years; it now sees limited-to-no use. In 2000, the Freight Dock was constructed directly to the east of the Passenger Dock to be used as the primary freight loading and offloading facility to alleviate the stress on the aging Passenger Dock.

1.4.2 EXISTING INFRASTRUCTURE

The Port of Seward facilities that were evaluated for this study are all owned and operated by ARRC and are located at the ARRC Seward Marine Terminal at the head of Resurrection Bay. The facilities include the Coal Dock, the Passenger Dock, the Freight Dock, port staging areas, and upland storage areas. See **Figure 1-13** below for docks located at the ARRC Marine Terminal.

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Figure 1-13. ARRC Seward Port Facilities

Coal Dock

The Coal Dock is a steel pipe pile-supported structure consisting of a 22-span 1732-foot-long trestle with a 41-foot x 40-foot seaward end platform, a mooring dolphin, and five (5) fender dolphins. This dock was constructed in 1984 as a coal offloading facility. A conveyor belt utilizes the west side of the trestle, and a 12-foot (clear) drivable roadway utilizes the east side, the top of dock elevation is at +24 feet (MLLW). The Coal Dock has not been used for bulk materials export since 2016, and the conveyor and ship loading arm were removed from the dock earlier in 2024.

The trestle is constructed of vertical and batter pipe piles, double HP pile caps, wide flange girders, and a timber deck. The seaward end platform was originally designed for coal offloading mechanical equipment and is constructed similarly to the trestle with the addition of wide flange floor framing and concrete bearing pad sections. Additionally, there are six (6) dolphins, five (5) of which are berthing dolphins and one (1) of which is a mooring dolphin. Catwalks connect four (4) dolphins to the dock.

The use of the conveyor system was not incorporated in this study as the concentrate was assumed to be containerized at all stages of transport until ship loading. Substantial expansion and improvements would be required for the Coal Dock to be able to accommodate the proposed offloading of containerized concentrate for the Ambler project. Major upgrades required include but are not limited to substantial widening of the trestle, substantial demolition of the existing shiploader and trestle conveyor, rehabilitation of the train unloading area, and ground preparations of the coal yard for high ground pressure container stacking. Due to the availability of a more readily viable alternative at the nearby Freight Dock, the Coal Dock was excluded from further evaluation as a port site for this study. Despite this, this infrastructure appears to be in good condition and could be repurposed for other bulk export needs in the future, under a future study mandate.

Figure 1-14. Coal Dock Looking North

Passenger Dock

The Passenger Dock is a 63-span, 736-foot x 200-foot steel H-pile-supported structure consisting of reinforced concrete pile caps, reinforced concrete C-channel deck members (including gravel ballast sections to previously support rail operations), and steel pipe batter piles for lateral support. This dock, pictured in **Figure 1-15**, was designed by the U.S. Army Corps of Engineers and constructed in the mid-1960s as an intermodal cargo facility accommodating heavy train and crane operations. The existing transit building was included in the initial construction of the dock. In addition, two (2) steel pipe mooring dolphins were constructed off the south (seaward) end of the dock. The top of the dock elevation is at +24 feet (MLLW).

The Passenger dock primarily serves cruise and passenger service vessels, with occasional use for light freight and logistics. This dock was not offered by ARRC for the concentrate export considerations. The dock is near the end of its operational lifespan and ARRC is actively planning for its replacement. Structural analysis performed for this study has shown that the existing dock cannot support the proposed loads associated with the containerized concentrate offload. Cruise ship seasonal traffic frequently occupies both sides of this dock and would be a major interruption to Ambler's vessels. For all the reasons above the passenger dock was not assessed for suitability for Ambler's cargo export.

Figure 1-15. Passenger Dock Looking South

Freight Dock

The Freight Dock, shown in **Figure 1-16**, is a high-capacity sheet pile bulkhead that was initially constructed in 2000. The dock currently provides approximately 630 linear feet on the west side, with a top-of-dock elevation of +20 feet (MLLW). Sloped armor rock protects the south and east sides of the dock, providing a 200-foot-wide usable dock surface. Additionally, northern portions of the dock were widened to 320 feet in 2007. A pile-supported mooring dolphin and an armor rock protection barrier both project south into Resurrection Bay.

A project to expand the Freight Dock is currently in development with full obligation and planned construction completion in 2028. The expansion project will include lengthening of the dock by approximately 375 linear feet, to provide a total dock length of approximately 1,000 linear feet. The Freight Dock expansion was assumed to be complete for this study. The Freight Dock was identified as the most suitable dock in Seward to accommodate concentrate offload associated with the Ambler project.

Figure 1-16. Freight Dock Looking South

Port and Uplands Storage and Staging

Limited upland storage and staging due to air landing strip and existing tenant mix as shown in Appendix E (*now Appendix D.5 of the final report Dated January 2026*).

1.4.3 LOCATION AND ACCESS TO THE MINE

The Port of Seward is located 919 miles from the mine site, which includes 449 miles by truck transportation on the proposed Ambler Access Road and existing Dalton Highway and 470 miles by train transportation. Rail transportation to the port shares the same route as the other options from the mine site to Anchorage. From Anchorage, the route continues approximately 114 miles on rail with further load restrictions due to steep grades and potentially increased operational delays in the winter due to heavy snow and remote access maintenance. The effect of steep grades limits the train loads to 5,000 tons, historically this has led to train loads only half-full. Winter maintenance can be performed on-demand or routinely, both of which carry cost increases. The cost increase of the two options should be further investigated as peak volume years with frequent train arrivals may mean that routine snow clearing versus spot clearing is more economical. An estimated additional 12 hours (or 1 day) will be incurred from Anchorage to the Port of Seward, and a total rail cycle time of 70 hours (or about 6 days) is estimated to and from the Fairbanks yard.

1.4.4 ENVIRONMENTAL CONDITIONS

The Port of Seward is a deep-draft, ice-free, and environmentally well-protected port, producing a historically favorable port for sea-going vessel freight loading and offloading. The head of Resurrection Bay is approximately 20 miles from the Gulf of Alaska, making it well protected from open-ocean-produced swells and insulated from extreme weather patterns. Consequently, Seward has a relatively mild climate, and the Port of Seward currently incurs little to no operational delays from the weather. A design snow load of 50 psf is expected per the ASCE 7 standard.

Refer to **Table 1-4** below for datums at NOAA/NOS Station #9455090, Seward, AK (1983-2001 epoch, published on 09/29/2011).

Table 5-4. Seward Tide Data

Datum	Elevation (ft MLLW)
Highest Observed Tide (01/01/1987)	+15.70
Highest Astronomical Tide (HAT)	+13.95
High Tide Line (HTL) *per USACE*	+13.80
Mean Higher High Water (MHHW)	+10.63
Mean High Water (MHW)	+9.71
Mean Sea Level (MSL)	+5.56
Mean Tide Level (MTL)	+5.55
Mean Low Water (MLW)	+1.38
Mean Lower Low Water (MLLW)	0.00
Lowest Astronomical Tide (LAT)	-3.53
Lowest Observed Tide (12/14/2008)	-5.01

1.4.5 Capacity and Handling Capabilities

Coal Dock

The Coal Dock was initially designed to convey coal along the trestle and then offload from the seaward end platform with large mechanical equipment onto ships berthing along its mooring and fender dolphins. The dock was designed to withstand the following loads with no reductions implemented from the most recent conditional inspection in 2023:

- Trestle: AASHTO H15 truck, 90-ton crane.
- Platform: AASHTO H15 truck, 40-ton forklift.
- Ship Loader Loads: 815-kip axial, 6,500-kip-feet moment, 163-kip shear.
- Fender Loads: 250 kip-feet, 200-kip line pull.
- Mooring Dolphin: 400-kip line pull.

Passenger Dock

The Passenger Dock was initially designed to accommodate heavy train and crane loading with the following loads:

- Crane Load: 50-kip wheel load.
- Railroad Load: Cooper E-50.
- Forklift Load: 35-kip tire load.
- Truck Load: AASHTO H-20-16.

- Uniform Live Load: 600 psf.

However, due to the condition of the aging dock, load reductions have been implemented throughout recent years. Most significant load reductions followed the 2023 conditional inspection which was accompanied by required repairs before allowing the dock back into service. Once repairs are made (scheduled for winter 2024), the dock may be operated with the following non-concurrent loading:

- Truck Load: AASHTO HS-20.
- Uniform Live Load: 100 psf.

Freight Dock

The Freight Dock was initially designed for heavy freight operations and can accommodate the direct loading of trains from ships berthed to the face of the dock. The dock was designed to withstand the following loads with no reductions implemented from the most recent conditional inspection in 2023:

- Railroad Load: Dual Cooper's E-80.
- Uniform Live Load: 1000 psf.

The planned extension will adhere to the above loading criteria with the addition of the following loads:

- Crane Loads: Grove RT700E, Manitowoc 4000W.
- Forklift Loads: 970 Hyster, 620 Taylor.

Port and Uplands Storage and Staging

The Seward Loading Facility, adjacent to the Freight Dock, was built in 1984 for transferring bulk materials from railcars into a stockpile.

- Area: 33.91 acres
- Bulk Stockpile Capacity: 130,000 tons

1.4.6 Proposed Operational Plan

Containers are assumed to be supplied to the port by rail. Trains would be limited to a 5,000-ton capacity with a maximum car capacity of 110-ton due to steep grades on the rail alignment to Seward. The identified storage area is located north of the Freight Dock, consisting of approximately 2.2 acres. This area would accommodate the core storage requirements with an additional area for overflow of approximately 1,600 containers total. The storage area could be further expanded if necessary, as upland space is plentiful. Containers would be offloaded from the rail cars using container reach stackers and staged within the storage area. Movement of containers from the storage area to the dock for ship loading would occur using terminal yard tractor trailers that are loaded using container reach stackers. The terminal yard tractor trailers would transit from the storage area to the dock where they would be positioned for picking and subsequent ship loading by the mobile harbor crane. Empty containers are returned to the storage yard and onward back onto trains in a reverse manner. The mobile harbor crane would reposition as required on the dock to fill the hatches of the vessel. A summary of this plan is shown in **Figure 5-17** below.

It should be noted that due to Seward's distance, it is the only port that will definitively require an additional unit train, or a partial train with mixed cargo, to satisfy the project's volumes during peak years.

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The cost of this extra train (or parts thereof) would typically be borne by ARRC and be factored into the cost charged to the owner.

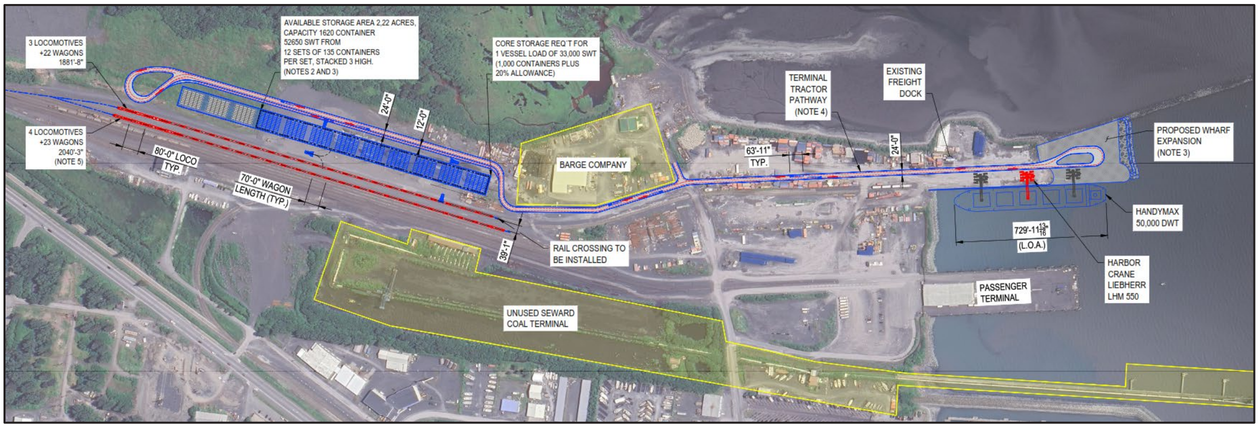

Figure 5-17. Seward Proposed Site Plan

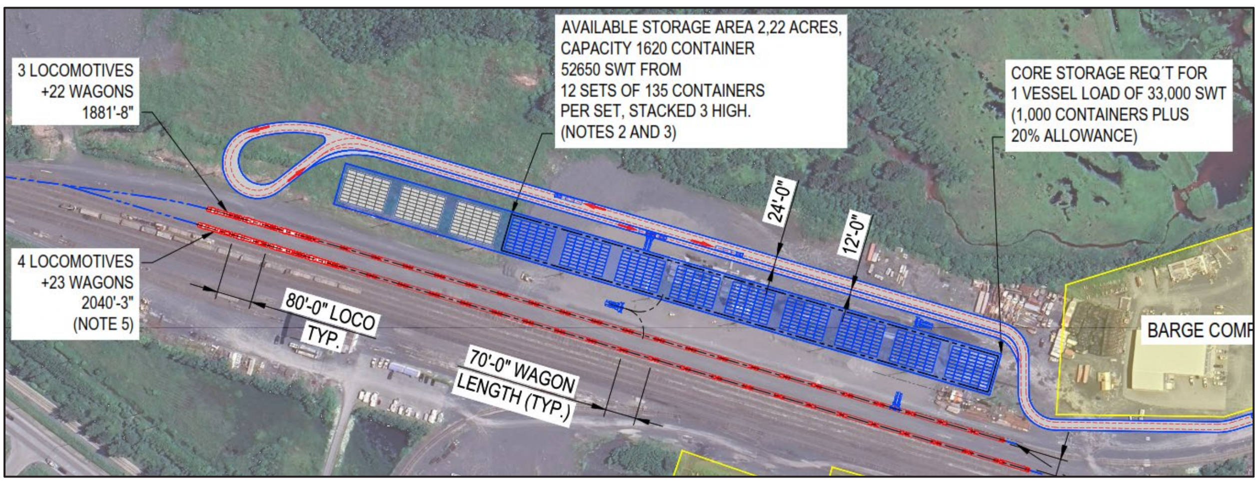

Figure 5-18. Seward Proposed Site Plan: Storage Area Detail

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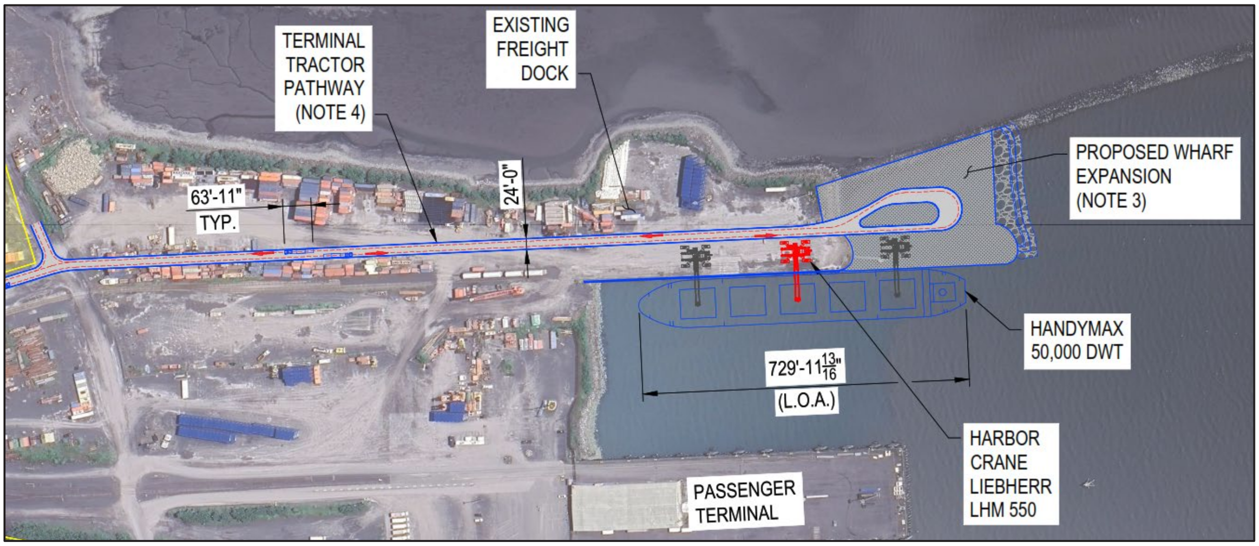

Figure 5-19. Seward Proposed Site Plan: Dock Area Detail

1.4.7 Capital Improvements

Seward is anticipated to require minimal capital improvements to accommodate the export of concentrates for the Ambler project. The improvements required include:

- Expansion of the proposed storage area.
- Upgrades to the existing gravel surfacing.
- Installation of concrete hardstands to support container stacking, truck scales, paved access roads, diversion roads, and truck turnaround areas.
- Load-sensing equipment and RFID inventory controls.
- Administration building, workshop, and refueling station.
- Lighting, electrical distribution, and telecommunication systems.
- Materials handling equipment anticipated for operations, including spares, consists of eight (8) yard haul tractor/trailers, five (5) mobile container reach stackers, and two (2) rotainer revolver attachments.
- One (1) mobile harbor crane, Liebherr LHM 550 or similar.

1.4.8 Environmental and Social Impacts

The Port of Seward experiences heavy cruise ships and other tourism-based traffic, placing mooring and upland space in high demand. The current Master Plan for the port prioritizes passenger operations and expands certain facilities to better accommodate cruise ship landings; increased commodities export would likely be at odds with this goal.

Capital improvements for the Port of Seward would have a low direct environmental impact as it would not require significant additional work and specifically improvements that require in-water construction.

APPENDIX D.5 – AAP PORT ASSESSMENT SITE PLANS

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PND Engineers, Inc. is not responsible for safety programs, methods or procedures of operation, or the construction of the design shown on these drawings. Where specifications are general or not called out, the specifications shall conform to standards of industry. Drawings are for use on this project only and are not intended for reuse without written approval from PND. Drawings are also not to be used in any manner that would constitute a detriment directly or indirectly to PND.

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AK. LIC# AECC250

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PROJECT:
AIDEA
AMBLER PORT STUDIES

TITLE:
SEWARD
EXISTING SITE CONDITIONS

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO: 1 OF XX
CHECKED BY: CDC	PROJECT NO: 231099	

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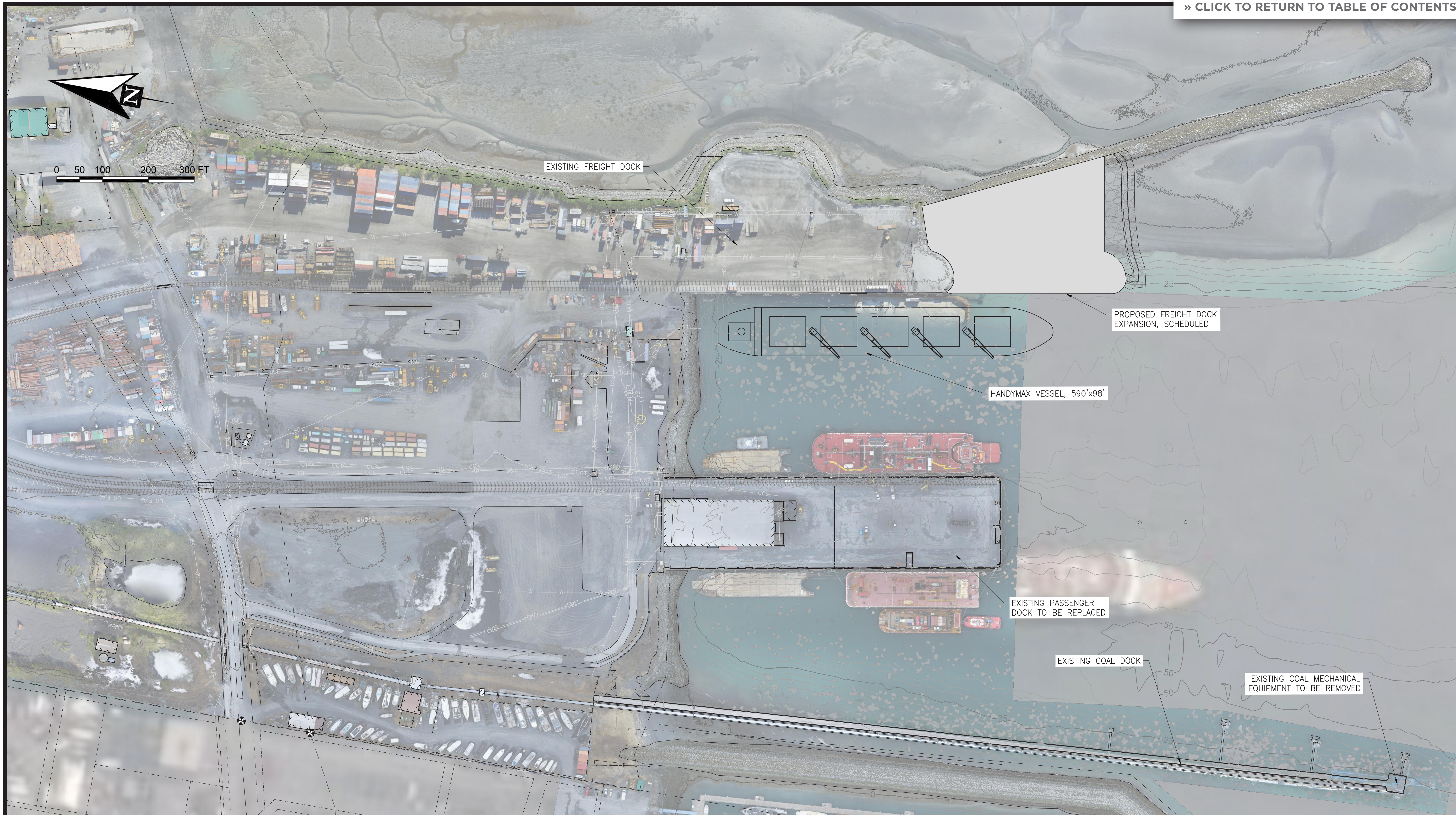

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TITLE:
SEWARD
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CHECKED BY: CDC	PROJECT NO: 231099	

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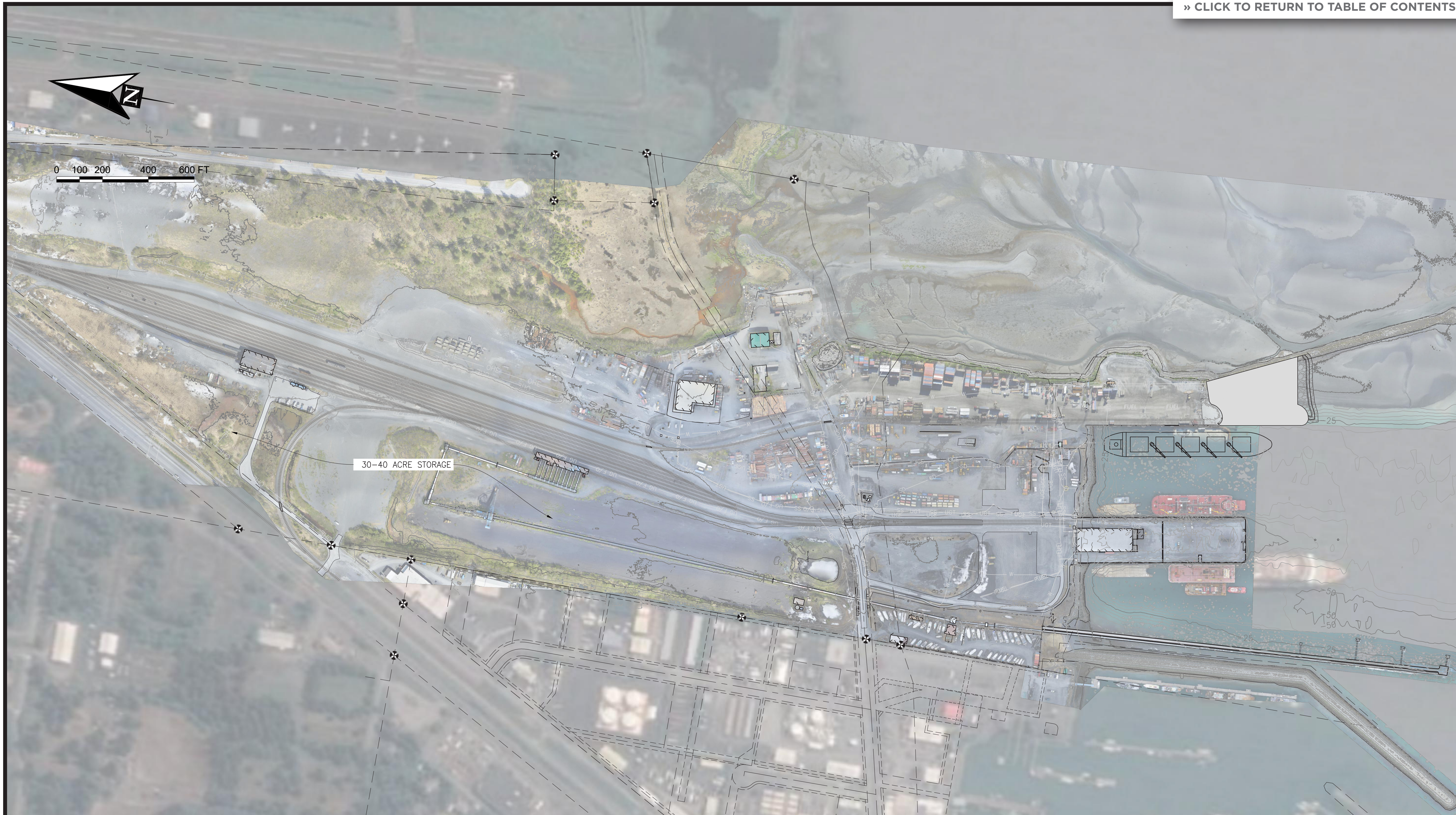

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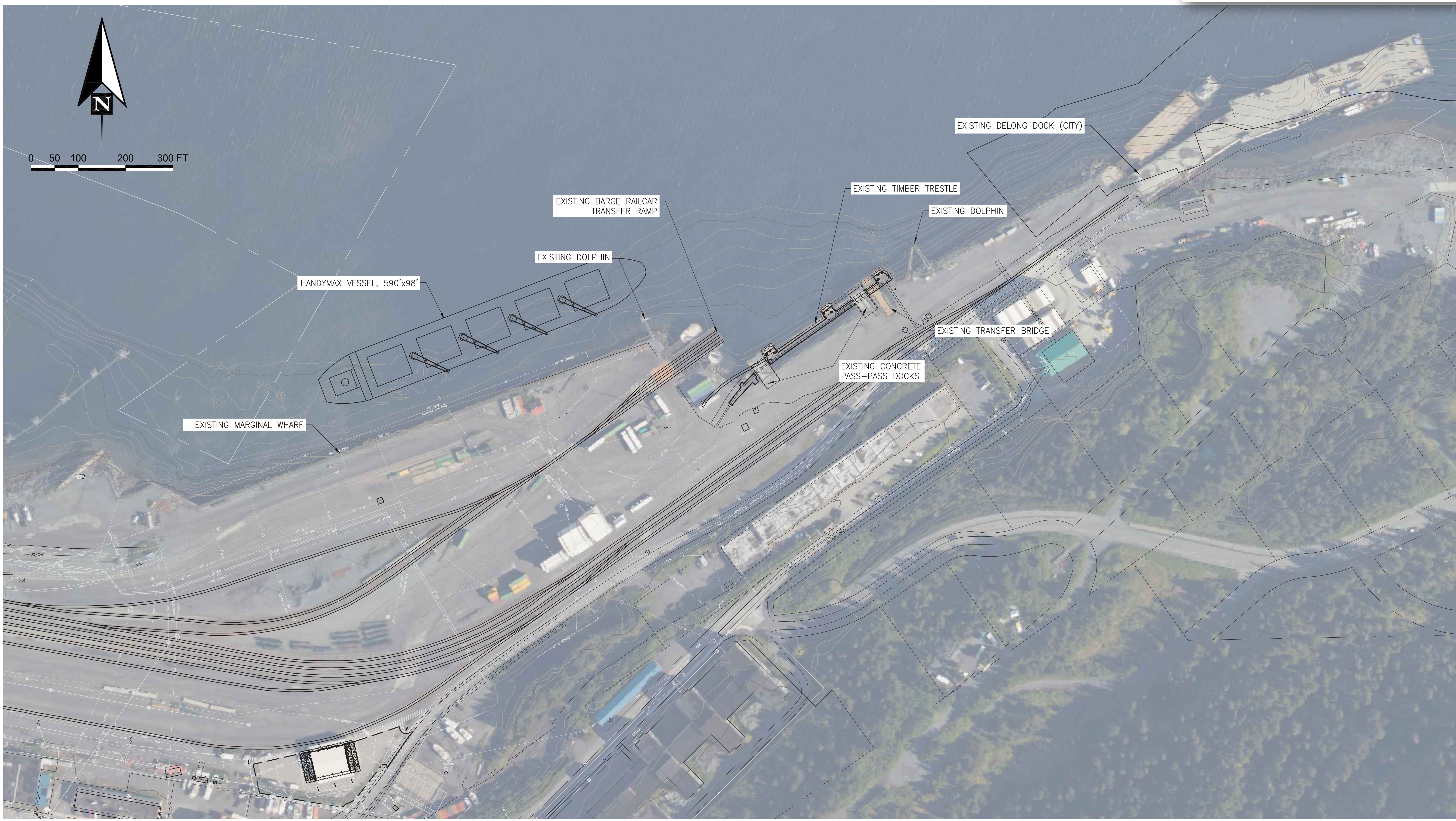

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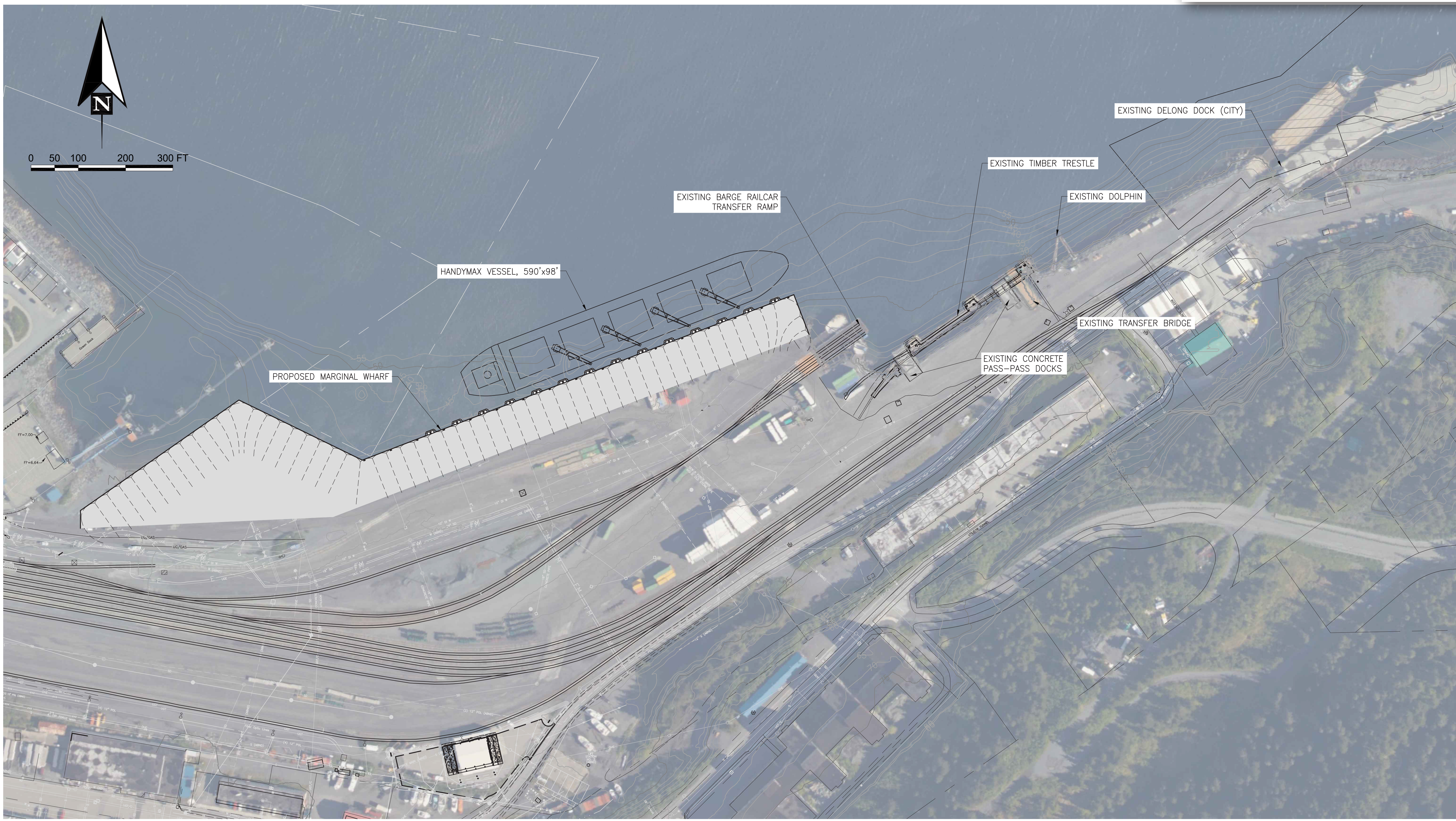

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1506 West 36th Avenue
Anchorage, Alaska 99503
Phone: 907.561.1011
www.pndengineers.com
AK. LIC# AECC250

PND ENGINEERS, INC.

PROJECT:
AIDEA AMBLER PORT STUDIES

TITLE:
WHITTIER FUTURE DEVELOPMENT

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO:	5 OF XX
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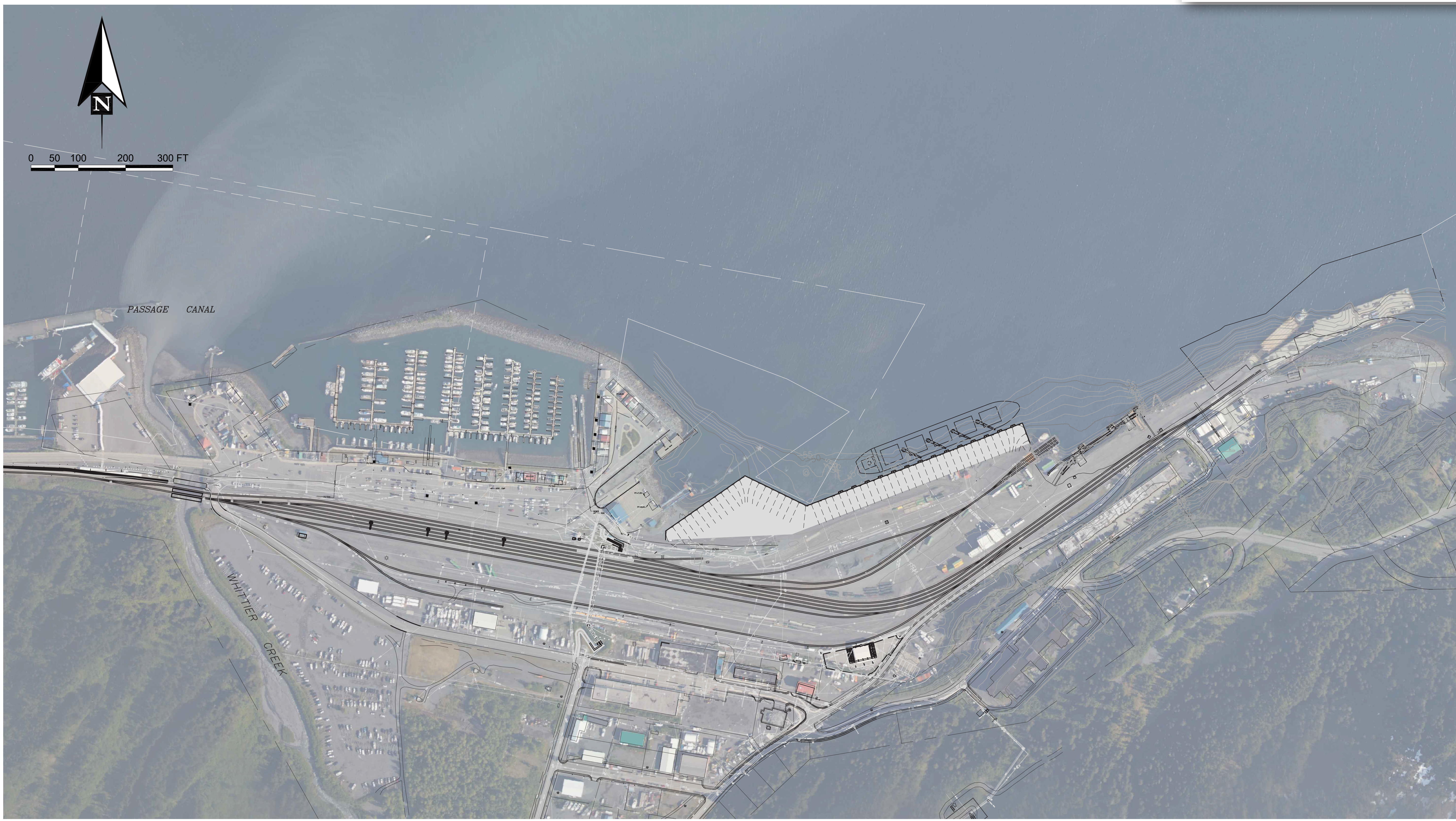

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PND ENGINEERS, INC.

PROJECT:
AIDEA AMBLER PORT STUDIES

TITLE:
WHITTIER OVERALL SITE PLAN

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO: 6 OF XX
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PND ENGINEERS, INC.

PROJECT:
AIDEA
AMBLER PORT STUDIES

TITLE:
PORT MACKENZIE
EXISTING SITE CONDITIONS

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO: 7 of XX
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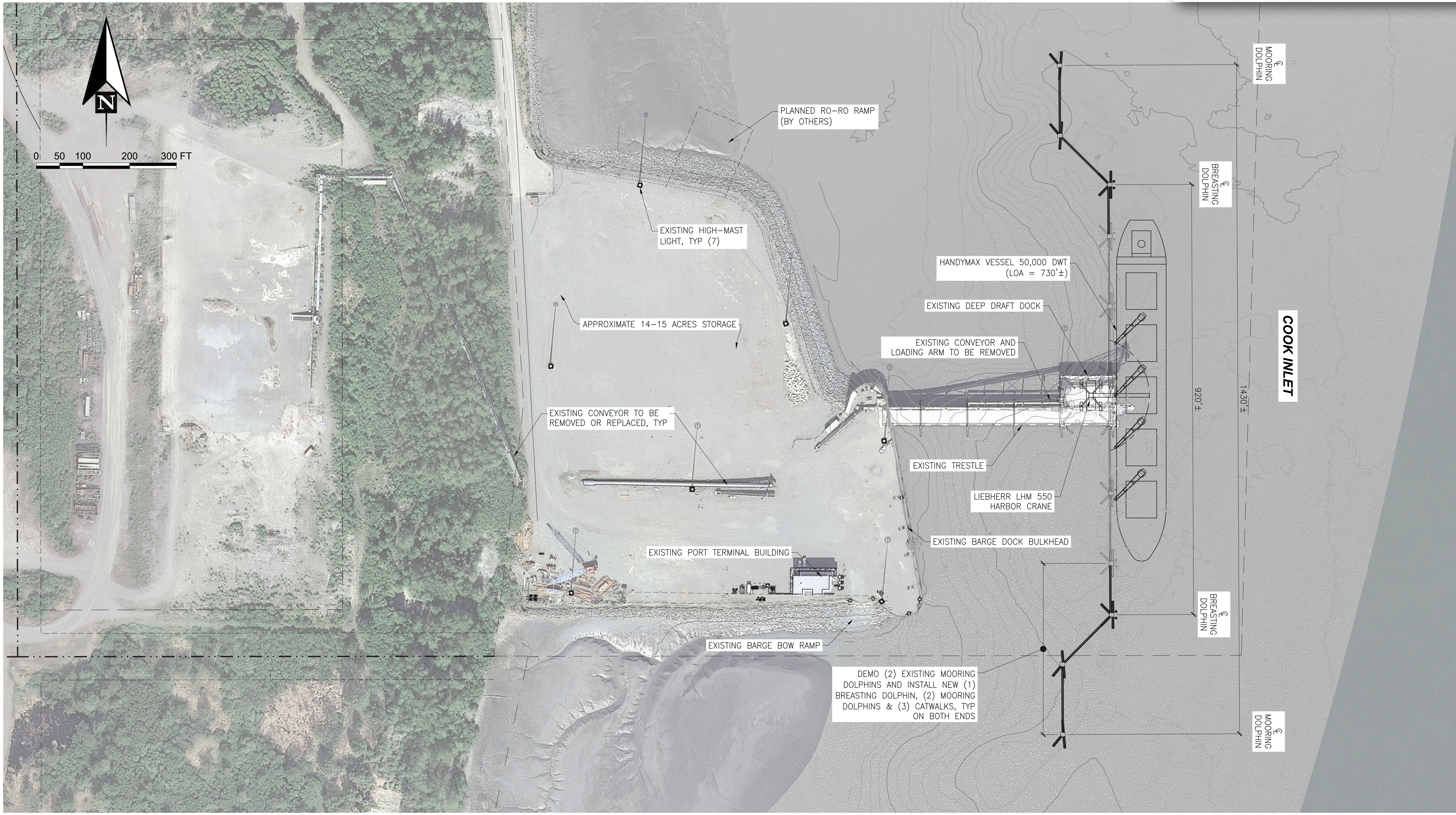

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PND ENGINEERS, INC.

PROJECT:
AIDEA
AMBLER PORT STUDIES

TITLE:
PORT MACKENZIE
INFRASTRUCTURE UPGRADES

DESIGNED BY:	JAC	DATE:	3/26/2024
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PND ENGINEERS, INC.

PROJECT:
AIDEA
AMBLER PORT STUDIES

TITLE:
PORT MACKENZIE
INFRASTRUCTURE UPGRADES

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO: 9 OF XX
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PND ENGINEERS, INC.

PROJECT:
AIDEA AMBLER PORT STUDIES

TITLE:
PORT OF ALASKA EXISTING SITE CONDITIONS

DESIGNED BY:	JAC	DATE:	3/26/2024	SHEET NO: 10 OF XX
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PND Engineers, Inc.

PROJECT:
AIDEA AMBLER PORT STUDIES

TITLE:
PORT OF ALASKA FUTURE DEVELOPMENT

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO: 11	OF XX
CHECKED BY: CDC	PROJECT NO: 231099		

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PND ENGINEERS, INC.

PROJECT:
AIDEA
AMBLER PORT STUDIES

TITLE:
PORT OF ANCHORAGE
FUTURE DEVELOPMENT

DESIGNED BY: JAC	DATE: 3/26/2024	SHEET NO:
CHECKED BY: CDC	PROJECT NO: 231099	12 OF XX

APPENDIX D.6 – AAP LOGISTICS AND OPERATIONS

1. LOGISTICS AND OPERATIONS

Logistics and operations occurring at the port sites are provided in the Ambler Access Project Technical Assessment – Individual Port Assessments study (*now Appendix D.4 of the final report Dated January 2026*) for the respective ports. Operational requirements at the ports are not anticipated to vary significantly based on the transportation alternative used to deliver the concentrate containers. The following section further details the logistical and operational requirements for each of the transportation options evaluated in this study. Under all options considered containers are tracked from the start of the journey at the mine using RFID technology that would correlate container identification with payload tonnage, type, and consignee. RFID tracking is maintained throughout the logistics chain at every transfer location such as the DTY, FTY, LTY, and HTY as applicable. Ultimately the container moved to the dock for ship loading would tracked as "ship loaded."

1.1 Option 1 – Single Trailer to Fairbanks and Rail to Ports

Concentrate containers would be transported from the mine sites on double-trailer haul trucks and staged at the Dalton Transfer Yard (DTY) located at the intersection of the AAP road and Dalton highway. This transportation option utilizes existing transportation infrastructure without major upgrades. Containers would be staged and transferred to single trailer haul trucks for transportation down the Dalton Highway to Fairbanks. The trucking distance from DTY to the Fairbanks intermodal yard is nominally 250-miles one way, with an estimated round trip truck cycle time, including loading and unloading sequences, estimated between 15 to 17 hours depending on road conditions. For this study, a 16-hour cycle time was assumed. The trucking route would consist of the Dalton Highway, Elliot Highway, Steese Highway, Johansen Expressway, Pegger Road, Phillips Field Road to the ARRC Fairbanks Intermodal Facility. Trucking would occur continuously, requiring an estimated 77 to 80 trucks completing cycles between the Dalton Transfer Yard and the Fairbanks Intermodal Facility during peak production. Full containers would be offloaded from trucks using reach stackers and exchanged for empty containers for return to the Dalton Transfer Yard.

The concentrate containers would be offloaded and staged at the ARRC intermodal facility in Fairbanks. An area capable of storing 7 sets of 135 containers, assumed to be stacked 5-high, was identified at the intermodal yard. (Note: 135 containers represents a single train load with 45 rail cars each holding 3 containers). This would allow for staging of received full containers for export and empty containers for return to the mine sites. The transfer of containers to and from rail would occur using container reach stackers. A total of 5 reach stackers (4 in operation with 1 spare) are anticipated at the transfer yard to allow efficient transfer of containers.

Rail transportation would occur at a frequency of every 45 hours per full cycle during peak production years to keep up with a vessel every 2 weeks. Railway cycle times to the respective ports are provided in **Table 1-1** based on ARRC's general experience and their order of magnitude estimate. Ausenco in this study also conducted a first principles analysis of train cycle times, with aim to reduce cycle times by optimizing in-yard container handling equipment. Ausenco's estimated cycle times are presented also in **Table 1-1** in "( )" parenthesis. Loading and unloading of containers onto the train occurs simultaneously, hence (*). Since the train's utilization is so high, all effort is assumed to be focused on its quick turnaround. The times estimated below also assume the operation is efficient and at steady state operationally at all

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points in the chain under the Owners control. Equipment requirements based on Ausenco's cycle times have been used as basis for capital equipment needs and cost estimates presented throughout this study.

Table 1-1. Railway Cycle Times to Various Ports

Action	Port of Alaska (hrs)	Port MacKenzie (hrs)	Whittier (hrs)	Seward (hrs)
Load Full Containers @ Fairbanks	6 (2*)	6 (2*)	6 (2*)	6 (2*)
Travel to Port	12 (12)	11 (11)	16 (16)	23 (23)
Delays/Waiting	1 (1)	1 (1)	1 (1)	1 (1)
Unload Full Containers @ Port	6 (4*)	6 (3*)	6 (2*)	6 (2*)
Delays/Waiting	2 (2)	2 (2)	2 (4)	2 (2)
Load Empty Containers @ Port	6 (*)	6 (*)	6 (*)	6 (*)
Travel to Fairbanks	12 (12)	12 (12)	16 (16)	18 (18)
Delays/Waiting	2 (2)	2 (2)	2 (2)	2 (2)
Unload Empty Containers @ Fairbanks	6 (*)	6 (*)	6 (*)	6 (*)
TOTAL CYCLE TIME	**53 (35)**	**52 (33)**	**61 (43)**	**70 (50)**

1.2 Option 2 – Double Trailer to Livengood, Single Trailer to Fairbanks, Rail to Ports

Under this transportation alternative, double-trailer trucks would haul concentrate containers direct from the Ambler district without requiring transfer at the DTY. However, the intersection between the AAP access road and Dalton highway was considered the boundary for the purpose of this study. Double-trailer trucks would transport two containers of concentrate from the DTY along the upgraded Dalton highway to a newly constructed Livengood Transfer Yard (LTY). The truck cycle time between DTY and LTY was estimated at 10-hrs including loading and unloading sequences, requiring an estimated 18 trucks during peak production. (Note: if double-trailer trucks were hauled directly from the Ambler district, the cycle time is estimated to exceed the 15-hour maximum allowable driver time).

Containers would be transferred from double-trailer trucks and staged for transfer to single-trailer trucks at the LTY. Transfer of containers would occur using container reach stackers. The LTY would be sized at approximately 1.4-acres to provide adequate storage of nominally 1,000 staged containers and additional facilities required to support transportation operations. Highway-legal single trailer haul units would be used for transport of containers between Livengood and the Fairbanks ARRC Intermodal Yard. Storage, staging, transfer of containers and rail transport to the ports would be as outlined for Option 1.

1.3 Option 3 – Single Trailer to Livengood, Rail to Ports

This alternative would utilize unmodified existing road infrastructure on the Dalton Highway and the proposed Dunbar-Livengood Rail Extension to transport concentrate containers to the receiving port.

Single trailer trucks would transport containers between the DTY and the new LTY. The truck cycle time between DTY and LTY was estimated at 10-hrs including loading and unloading sequences, requiring an estimated 35 trucks during peak production. Full containers would be offloaded from trucks using reach stackers and exchanged for empty containers for return to the DTY.

At the LTY, an area capable of storing 7 sets of 135 containers (7 train's worth), assumed to be stacked 5-high, would be provided to allow adequate buffer quantities. This would allow for staging of received full containers bound for port and empty containers for return to the mine sites. Transfer of containers to and from rail would occur using container reach stackers. Based on conversations with ARRC, the rail cycle times between the Livengood Intermodal Yard and the ports are estimated to be comparable to those originating from Fairbanks (shown in Table 1-1, above). Rail transportation would occur at a frequency of every 45 hours per full cycle during peak production years to keep up with a vessel every 2 weeks. The new LTY would be a new northern rail limit for ARRC, and so would require relatively extensive facilities to support terminal rail operations including crew, administrative, security, light maintenance, refueling and servicing.

1.4 Option 4 – Double Trailer to Livengood, Rail to Ports

Under this transportation alternative, double-trailer trucks would haul concentrate containers down the upgraded Dalton Highway corridor to the LTY and then transfer to rail for transport to the receiving port using the Dunbar-Livengood Rail Extension. Truck transport on the Dalton would occur as outlined under Option 2 and rail transport from Livengood to the receiving ports would occur as outlined under Option 3.

1.5 Option 5 – Single Trailer to Direct to Ports

This transportation alternative would entail direct transportation of concentrate containers using single-trailer trucks from the DTY directly to the receiving port. Trucking would occur using highway legal single-trailer trucks, allowing for unrestricted transportation on the public road system. Truck transport would be continuous and require an estimated 175-200 trucks in active circulation (excluding spares), depending on the receiving port location. The round trip duration of haul would be 26 to 34 hours, where a driver can only make the trip one way. A separate return driver cohort is required. Altogether this option is very labor intensive and is said by the trucking industry to be very difficult to fulfill given the Alaskan labor market.

1.6 Port MacKenzie Rail Spur

Transportation of containers to Port MacKenzie was evaluated under two sub-alternatives:

- Fully completing the Port MacKenzie Rail Extension from Houston, and using rail to transport containers all the way to Port Mackenzie from Fairbanks, or
- Completing the Port MacKenzie Rail Extension from Houston, rail embankment (civil works) only, and converting the top cap to a road to use trucks to transport containers for the final segment between Houston and Port Mackenzie.

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1.6.1 RAIL

Transport of concentrate to Port MacKenzie would occur using the completed Port MacKenzie Rail Extension. Transfer of containers at the port would occur as outlined in the Port MacKenzie assessment (*now Appendix D.4 of the final report Dated January 2026*).

1.6.2 ROAD

Rail transported concentrate containers would be offloaded and staged at a new transfer yard located at the termination of the spur road in Houston (Houston Transfer Yard, or HTY) and then transported by truck to Port MacKenzie. The transfer yard would provide an area capable of storing 2 sets of 135 containers (or two trains' worth), assumed to be stacked 3-high. This would allow for the staging of received full containers and empty containers for return to the mine sites. Transfer of containers would be performed using reach stackers.

An estimated 25 single-trailered, or 13 double-trailered trucks (assuming road legal or exempted) would be required for delivering containers from HTY to Port MacKenzie, a round-trip time of approximately 3.5 hours.

APPENDIX E – BASIS OF ESTIMATE

REVISION HISTORY AND APPROVAL

REV	DESCRIPTION	BY	CHECKED	APPROVED	DATE
A	PRELIMINARY REVIEW	CC (PND) LC (Aus)	JC (PND) BM (Aus)		March 2024

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1. INTRODUCTION

1.1. Purpose

PND Engineers, Inc. (PND) has prepared this cost basis of estimate (BOE) for the Alaska Industrial Development and Export Authority (AIDEA) to define the procedures, assumptions, and methodology that underlie the development of the estimates prepared for the Ambler Port Technical Feasibility Study.

1.2. Accuracy

This cost estimate is based on a preliminary project screening designs, resulting in a Class 5 construction cost estimate according to the Association for the Advancement of Cost Engineering (AACE). The accuracy of the estimate is approximately -50%, +100%. This accuracy range is determined by the quality and completeness of the supporting documentation and by the estimating methodology. Fabrication, transportation, construction and material costs, as well as schedule, may vary depending on means of procurement and project implementation.

2. CAPITAL EXPENDITURES (CAPEX)

2.1. Estimate Methodology

Estimates are built up using anticipated and historical production rates for each type of work to be completed. Project costs are developed from the "bottom up" using the estimating program Ineight® Estimate V20.2.0. The estimating program utilizes a crew and work item analysis estimate method. In-house pricing data and historical costs were utilized to populate the estimating program database. Productivity rates for individual project components are developed based upon in-house historical data and information received from relevant contractors where historical data is unavailable.

2.2. Estimate Scope

The estimates encompass the construction costs for civil and structural capital expenditure (CAPEX) scope identified in the technical feasibility study for the various transportation and port alternatives including: new infrastructure (roads, bridges, etc), infrastructure upgrades and improvements, necessary/identified equipment, etc.

Estimates include all necessary direct costs during construction, indirect costs incurred by the contractor during the period of construction (i.e. support personnel and equipment) and contractor profit and risk. The estimated costs are for construction only and do not include estimating uncertainties or unexpected construction costs (i.e. variations in final quantities). Estimated costs for mobilization/demobilization, design, permitting and construction administration, management and inspection are included as a percentage of direct construction costs. Costs are based on conceptual level design. The inclusions, exclusions, and assumptions are discussed further in the Estimate Basis and work breakdown structure (WBS) sections below.

2.3. Work Breakdown Structure (WBS)

The CAPEX estimates are limited in scope to the direct capital expenses anticipated for each of the various components and/or alternatives evaluated as part of this project. Costs include anticipated infrastructure upgrades/improvements, equipment (including handling, process and ancillary equipment) anticipated under each of the alternatives. The estimates have been separated into primary WBS components, corresponding to the potential transportation and port alternatives developed as part of this study. The WBS items, with a description of the associated scope and assumptions, are as follows:

1. Dalton Highway Road Upgrades – Cost estimate includes infrastructure upgrades anticipated to allow use of double-trailer truck configurations from the Ambler Access Road intersection along the Dalton Highway from MP 160 to MP 0 in Livengood.
    - Road Upgrades – Includes anticipated costs to upgrade the Dalton Highway to achieve maximum grades of approximately 6-percent to allow use of double-trailer truck configurations. Cut and fill volumes were based on AutoCAD Civil3D modeling of the roadway using publicly available LiDAR topographical data.
    - Bridges – Includes anticipated costs required for replacement of 13 bridges located along the Dalton corridor. Costs include complete replacement of the bridges including foundations, abutments and superstructures. Conceptual foundations consist of driven steel pile foundations with cast-in-place concrete infill and precast concrete caps. Bridge superstructures are assumed to be fabricated steel with an assumed maximum span lengths of 80-feet with precast concrete deck panels.
2. Livengood Yard – Cost estimate includes new infrastructure anticipated for an intermodal transfer yard located in Livengood. Civil quantities were based on AutoCAD Civil3D modeling of the yard area using publicly available LiDAR topographical data.
    - Livengood Yard – Includes anticipated cost for construction of a nominally 13-acre intermodal yard including site civil work.
    - Materials Handling Equipment – Includes container reach stackers required for transloading of containers.
    - Process Equipment – Includes truck scales and load sensing equipment at the intermodal yard.
    - Ancillary Equipment – Includes anticipated ancillary equipment.
    - Administration – Includes concentrate transportation specific administration building, workshop, security, and onsite equipment refueling station.
    - Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard.

3. Livengood Rail Spur – Cost estimate includes new infrastructure anticipated for installation of the Dunbar to Livengood rail extension including an intermodal transfer yard located in Livengood. Alignment was based on conceptual linework provided by ARRC. Civil quantities were based on AutoCAD Civil3D modeling of the rail section using publicly available LiDAR topographical data.
    - Rail Embankment – Includes civil works anticipated for construction of the railbed embankment.

- Mainline Rail – Includes cost for construction of the mainline rail including ballast, ties and rail.
- Bridges – Includes anticipated costs required for installation of 22 bridges located along the proposed rail corridor. Costs include of the bridges including foundations, abutments and superstructures. Estimates are based on driven steel pile foundations with cast-in-place concrete infill and precast concrete caps. Bridge superstructures are assumed to be fabricated steel with an assumed maximum span lengths of 30-feet.
- Livengood Intermodal Yard – Includes anticipated cost for construction of a nominally 13-acre intermodal yard including site civil work, yard rail, and rail terminal facilities.
- Materials Handling Equipment – Includes container reach stackers required for transloading of containers.
- Process Equipment – Includes truck scales and load sensing equipment at the intermodal yard.
- Ancillary Equipment – Includes anticipated ancillary equipment.
- Administration – Includes concentrate transportation specific administration building, workshop, security, and onsite equipment refueling station.
- Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard.

4. Fairbanks Intermodal Yard
    - Civil Works – Includes site preparation, gravel yard upgrades, access road upgrades, truck turnaround areas and concrete stands at the exiting intermodal yard.
    - On-Site Rail – Includes main loop track extension and anticipated switches
    - Materials Handling Equipment – Includes mobile container reach stackers.
    - Process Equipment – Includes truck scales
    - Ancillary Equipment – Includes general purpose utility trucks.
    - Administration – Includes concentrate transportation specific administration building.
    - Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard.
5. Port MacKenzie – Rail Extension
    - Cost estimate for completion of the rail extension provided by ARRC based on 90% design documents
        - Segment 2 Civil Construction
        - Grade Preparation and Sub-Ballast
        - Fiber Optics and Telecommunications
        - Track Construction
        - Terminal Facilities
        - Environmental Mitigation
        - Engineering/Survey/Construction Management/Legal
6. Port MacKenzie – Houston Rail Spur Road
    - Segment 2 Embankment - Includes cost for civil work for completion of segment 2 embankment and construction of elevated crossing over Reddane Drive.

- Grade Preparation/Road Surfacing – Segments 1,3,4,5,6 - Includes preparation of existing embankment and installation of gravel road surfacing material.
- Houston Intermodal Yard – Includes anticipated cost for construction of a nominally 3-acre intermodal yard including site civil work, concrete hardstands for container storage, and security fencing.
- On-site Rail in Houston - Includes Y-junction and track extending into the proposed intermodal yard.
- Materials Handling Equipment – Includes mobile container reach stackers.
- Ancillary Equipment – Includes general purpose utility trucks.
- Administration – Includes concentrate transportation specific administration building, workshop, security, and onsite equipment refueling station.
- Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard.
- Contingency - Included as a below the line item, assumed at 30-percent of total estimated cost.

7. Port of Alaska (Anchorage)
    - Civil Works – Includes site preparation, clearing, additional gravel surfacing, concrete hardstands for container storage, paved truck turnarounds and access roads.
    - Materials Handling Equipment – Includes anticipated yard haul tractors and trailers, container reach stackers, revolver attachments and bulk materials containers (rotainers)
    - Process Equipment – Includes load sensing equipment
    - Ancillary Equipment – Includes general purpose utility trucks and forklifts
    - Administration – Includes concentrate transportation specific administration building
    - Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard.
8. Port MacKenzie
    - Dock Upgrades – Includes demolition and removal of the existing ship loader and dolphins identified for replacement, installation of 2 new breasting dolphins and 4 new mooring dolphins with associated catwalks.
    - Civil Works – Includes site preparation, clearing, additional gravel surfacing, concrete hardstands for container storage, paved truck turnarounds, access roads and security fencing
    - Materials Handling Equipment – Includes anticipated mobile harbor crane, yard haul tractors and trailers, container reach stackers, revolver attachments and bulk materials containers (rotainers)
    - Process Equipment – Includes load sensing equipment
    - Ancillary Equipment – Includes general purpose utility trucks and forklifts
    - Administration – Includes concentrate transportation specific administration building, workshop, security buildings, and onsite equipment refueling station.
    - Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard and access roads.

9. Port of Seward
    - Civil Works – Includes storage yard site preparation, clearing, additional gravel surfacing, concrete hardstands for container storage, paved truck turnarounds and access roads.
    - Materials Handling Equipment – Includes anticipated mobile harbor crane, yard haul tractors and trailers, container reach stackers, revolver attachments and bulk materials containers (rotainers)
    - Process Equipment –
    - Ancillary Equipment – Includes general purpose utility trucks and forklifts
    - Administration – Includes concentrate transportation specific administration building, workshop, and onsite equipment refueling station.
    - Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard and access roads.
10. Port of Whittier
    - Marginal Wharf Reconstruction - Includes reconstruction of the marginal wharf with a high-capacity steel sheet pile bulkhead, ground modifications, dock appurtenances including fenders, facebeam, bullrail and bollards and asphalt concrete surfacing.
    - Civil Works – Includes storage yard site preparation, clearing, additional gravel surfacing, concrete hardstands for container storage, paved truck turnarounds, access roads and security fencing.
    - On-site Rail - Includes new rail located behind the wharf and additional track for train staging.
    - Materials Handling Equipment – Includes anticipated mobile harbor crane, yard haul tractors and trailers, container reach stackers, revolver attachments and bulk materials containers (rotainers)
    - Process Equipment – Includes load sensing equipment
    - Ancillary Equipment – Includes general purpose utility trucks and forklifts
    - Administration – Includes concentrate transportation specific administration building.
    - Electrical, Instrumentation and Controls – Includes anticipated electrical equipment, lighting and RFID controls for the proposed intermodal yard and access roads.

2.4. ASSUMPTIONS

- Man-hours, Labor Costs, and Equipment Costs are based on 12-hours shifts. Production rates based on 12-hour shifts. The contractor will work 1 shift in a 24-hour period during construction unless specifically noted otherwise. Man-hours, Labor Costs, and Equipment
- All structural steel, pile, rebar, and prefabricated elements will be procured in the Contiguous United States and shipped to the project site. All other materials will be procured within Alaska.
- Haul distance for aggregate materials assumed at a fixed 10 miles from the placement site.
- Cut volumes assumed to be usable as fill (where applicable) at 90% recovery.
- Costs are presented in current day (Q1 2024) dollars.
- Mobilization/demobilization included at an assumed 10% of direct construction cost.
- Design and permitting included at an assumed 6% of direct construction cost.

- Construction administration, management and inspection included at an assumed 10% of direct construction cost.

2.5. Inclusions

- Construction subcontractor profit and risk for equipment is included in the equipment rates and is assumed at 15%.
- Construction subcontractor profit and risk for materials is included in the material cost and is assumed at 10%.

2.6. Exclusions

- Contingency
- Escalation
- Owner Project Management/Administration
- Owner Construction Administration
- Prime Contractor markup for subcontractor
- Weather days
- Equipment standby

2.7. Direct Costs

Direct costs include all costs associated with the supply and installation of the identified facility components according to the SOW discussed above. The components of the direct costs are discussed below:

2.7.1. Equipment and Materials Pricing

Equipment rates are based on historical rates and information obtained from heavy civil and marine contractors. Equipment costs include fuel consumption at $6.00 per gallon. Materials pricing is based on recent quotes from material suppliers and fabricators and includes contractor risk and profit at 10% of the material cost. Costs for materials provided from the Contiguous United States include shipping FOB Seattle, Washington. Shipping from Seattle to the project site is included in the Mobilization and Demobilization costs. Cost for materials sourced from Alaska include shipping FOB project site.

2.7.2. Labor Rates and Factors

Labor rates are based on current prevailing wage determinations for Alaska heavy civil and marine construction projects as determined by Alaska Department of Labor per *Title 36 Laborers' and Mechanics' Minimum Rates of Pay* (referred to as "Mini Davis Bacon"). Labor rates are considered full burden which includes markup for pension, federal and state taxes, medical, workman's compensation, vacation, overtime premiums, and profit. Where the Department of Labor has not specified minimum rates of pay, rates from relevant contractors were utilized.

2.8. INDIRECT COSTS

Not explicitly included.

2.9. ESCALATION

Not included.

3. OPERATIONAL EXPENDITURES (OPEX)

3.1. BACKGROUND

Ausenco led the development of a comparative Operational Expenditures (OPEX) estimate for the various mine-to-port transportation options, to arrive at an ultimate dollar-per-ton concentrate shipped for comparison.

3.2. ESTIMATE METHODOLOGY

3.2.1. General Basis

The following are the general basis employed in this estimate:

- OPEX estimates assume that capital site upgrades and equipment capital, altogether considered as the CAPEX, are accounted for separately as CAPEX costs. The OPEX excludes these costs or they are amortized as an annual expenditure.

- The estimate was conducted with the peak tonnage rate of 836,000 tons per year, roughly representing the volumes of the first one-third (1/3) of the 36-year life of mine. This represents the costliest period of annual absolute OPEX. Tonnages for lower production years are assumed to be linearly scalable from the peak cost, despite very slight non-linearity due to fixed premise and staffing overheads that are fixed regardless of production volumes.

- Estimates used 2023 and 2024 US dollars; no escalation has been assumed.

- All $/ton rates are additionally shown with a +/- 30% accuracy, commensurate with the level of accuracy at this stage of study.

- Estimate relied on the input of relevant and credible industry partners such as trucking companies, port owners, rail operators and stevedoring operators that are already incumbents at the various locations, are the premier service provider in the region or have expressed interest in offering their service during eventual project execution. Ausenco provided pricing using scaling, benchmarks, and experience for areas that no industry partners could support. The details of each party’s cost provisions to this estimate are discussed in the respective sections below.

- Estimates provided in other denominations ($ per container, $ per railcar etc.) were translated to $/ton basis for commonality.

- All tonnages in US short tons.

3.2.2. Nodal Estimation Approach Overview

Due to the various options and permutations considered, and the number of modes of transport and providers involved, the OPEX estimate adopted a nodal approach where each option is broken down into transportation nodes (or legs) for separate costing. The costs of each node are then summed to provide an all-in $/t cost for the option. Figure 1 provides a visual overview of a typical transportation option, and its nodal costs. All nodes and costs of the node consider the bidirectional movement of containers, i.e. full containers to port and empty containers to mine.

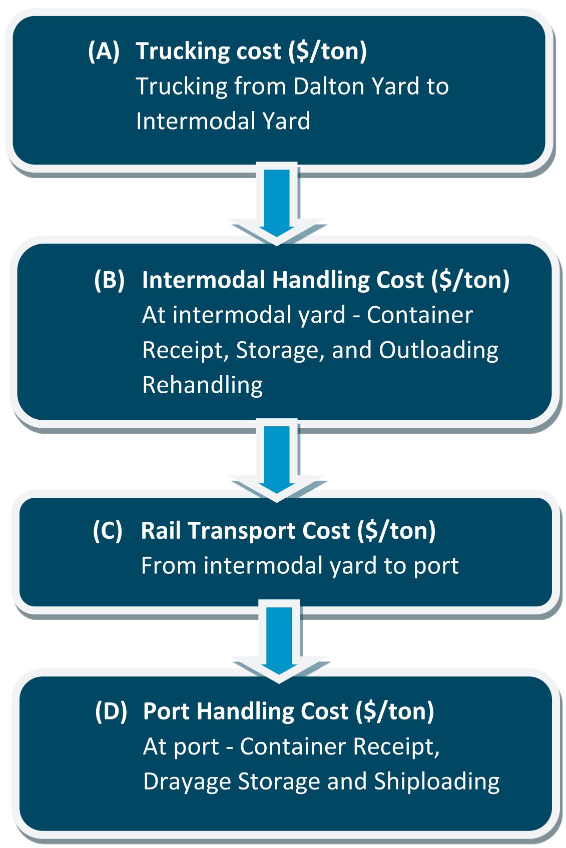

Figure 1. Typical Transportation Option - Nodal Breakdown

3.2.3. Battery Limits

The scope of the OPEX estimate is from the departure from the Dalton Intermodal Yard (Dalton Yard) to concentrate placement onboard a ship. The OPEX of the Dalton Yard, and the ocean freight of the cargo to overseas destination were excluded.

3.2.4. General Exclusions

The following are considerations excluded from this OPEX estimate:

- OPEX of the Dalton Intermodal Yard (Dalton Yard).
- Cost of ocean freight including any ship-associated costs such as vessel dockage, demurrage etc. For a comparative estimate of this nature, the cost of this final leg of transport all originating within south-central Alaska can be considered to be generally the same across all options.
- Cost of backhaul of mine supplies, consumables and spare parts towards the mine, or cost savings thereof using containerized haulage in reverse.

3.3. OPEX ESTIMATE -TRUCKING

A trucking company within the region provided indicative costs for three major option groups of this study:

- Long haul trucking from Dalton Yard to:
  - Fairbanks intermodal yard (508 mi round trip) or,
  - Livengood intermodal yard (350 mi round trip).
- Ultra long-haul trucking from Dalton Yard directly to each of the four ports considered (1,180-1,470 mi round trip).
- “Last mile” short haul trucking from Houston to Port Mackenzie (60 mi round trip) for those options where rail service to Port MacKenzie terminates at Houston.

Costings provided by AWL are presented in Table 1. These costs include truck purchase cost amortization on AWL’s part, fuel, labour, overhead, repair, maintenance and truck replacement capital for an overall turn-key cost charged to the cargo owner. Costs also include empty container return haul, estimated by AWL at 50% of the cost of loaded outbound.

Costs were quoted for single container haul only. AWL declined to quote double container haul with B-trains on the principal concern that the Dalton Hwy is currently not able to legally haul B-trains and would require significant upgrades to bring the gradient, bridging and turning radii into compliance for B-trains. Table 1 includes Ausenco’s assumption (*) of what B-train haulage would cost based on an assumed 0.75 factor (25% savings) from single container haulage. A 25% saving is typical based on Ausenco’s other Northern Canadian mine cargo haulage benchmarks, where B-trains are permitted.

Table 1. Trucking Costs Estimates.

Truck Transport Route	Concentrate Payload	Distance Round Trip (Mi)	Estimated Hours Round Trip	$ / ton Round Trip	Estimate Active Fleet In Circuit
DALTON HWY COLDFOOT <-> FAIRBANKS INTERMODAL YARD	**1 x 36.2 ton Container Gross**	**508**	14	$ 216.09	**77-80**
	2 x 36.2 ton Container Gross; B-train			**$ 162.07***	**Not Quoted**
DALTON HWY COLDFOOT <-> LIVENGOOD INTERMODAL YARD	**1 x 36.2 ton Container Gross**	**350**	10	$ 154.35	**35**
	2 x 36.2 ton Container Gross; B-train			**$ 115.76 ***	**Not Quoted**
DALTON HWY COLDFOOT <-> PORT MACKENZIE	**1 x 36.2 ton Container Gross**	**1180**	26	$ 474.65	**175**
DALTON HWY COLDFOOT <-> PORT OF ANCHORAGE	**1 x 36.2 ton Container Gross**	**1230**	26	$ 474.65	**175**
DALTON HWY COLDFOOT <-> PORT OF WHITTIER	**1 x 36.2 ton Container Gross**	**1340**	32	$ 534.32	**175**
DALTON HWY COLDFOOT <-> PORT OF SEWARD	**1 x 36.2 ton Container Gross**	**1470**	34	$ 554.21	**175**
HOUSTON <-> PORT MACKENZIE SHORT HAUL	**1 x 36.2 ton Container Gross**	**60**	3.5	$ 34.81	**25**
	2 x 36.2 ton Container Gross; B-train			**$ 26.10***	**Not Quoted**

3.4. OPEX ESTIMATE – INTERMODAL YARDS

3.4.1. Upstream No.1 Intermodal Yard – Fairbanks vs Livengood

The Upstream No. 1 Intermodal Yard **if located in Fairbanks** is located on ARRC's Fairbanks operations yard. ARRC quoted the costs of this intermodal operation as integral to the rail haulage cost. No additional yard operating costs were quoted separately.

For the nodal approach, the OPEX of the Upstream No. 1 Intermodal Yard Fairbanks in itself is deemed to be $0/ton.

The Upstream No. 1 Intermodal Yard **if located in Livengood** is also located on ARRC premises along the railway but is currently barren and undeveloped. ARRC has stated interest in only leasing the land to a 3rd party operator to run the facility. A stevedoring company in the region provided operating costs for running this intermodal operation

The costs include container handling on and off rail and truck, moving to and from storage, fuels, lifting equipment maintenance, spares, staff labour, utilities, power, and snow clearance. This cost also includes a presumed \$0.36 / ft^{2}-y of space lease from ARRC, assumed at 50% of the rate of their relatively more costly water-front lease costs at their ports.

For the nodal approach, the OPEX of the Upstream No. 1 Intermodal Yard in Livengood is estimated at \$20.8/ton (peak 836 kt/y), or \$22.3/ton (avg 513 kt/y).

Details of the estimate can be found in Appendix B.

3.4.2. Downstream No.2 Intermodal Yard – Houston

The Downstream No.2 Intermodal Yard is required in some options where the rail service towards Port MacKenzie terminates at Houston and another intermodal rehandling is required to truck the containers to port. Ausenco derived operating costs for this site by scaling estimates for Livengood, based on their similarities, with adjustments:

- Reductions to maintenance support and staffing overhead, assuming that Houston will function as a satellite of Port Mackenzie's operations and would be supported by them.
- Reductions to power and utilities being a more compact site than Livengood.
- Maintained an assumed land lease rate (from Indigenous landowner) at \$0.35/ft^2-y.

The OPEX of the Downstream Intermodal Yard in Houston with is estimated to be **\$19.93/ton (peak 836 kt/y), or \$20.90/ton (avg 513 kt/y).**

Details of the estimate can be found in Appendix B.

3.5. OPEX ESTIMATE – RAIL TRANSPORT

Alaska Rail Road Corporation (ARRC) provided cost estimates for rail haul from either Fairbanks or Livengood intermodal yards, to each of the four port options and the sub-option of rail terminating at Houston, 30 mi before MacKenzie. For intermodal operating out of Fairbanks (FBX) but not Livengood, ARRC has deemed intermodal handling to be included in the rail transport costs. ARRC made no differentiation at this stage of study in the cost of rail transport out of Fairbanks or Livengood, despite a 150 mi distance differential. It is assumed that ARRC considers the additional mileage to/from Livengood to be equivalent to the cost of intermodal operations at Fairbanks.

Costing provided by ARCC are presented in Table 2. ARRC's costs include rolling stock purchase cost amortization on ARRC's part (if required), fuel, labour, overhead, repair, maintenance, track snow clearance, and rolling stock replacement capital for an overall turn-key cost charged to the cargo owner.

Costs are inclusive of empty container return haul.

Table 2. Rail Transport OPEX Estimates.

Rail Transport Route	\$/car	\$/container	\$/ton
FBX-WHITTIER HAUL	\$ 8,800	\$ 4,400	**\$ 135.4**
FBX-SEWARD HAUL	\$ 3,200	\$ 1,600	**\$ 49.2**
FBX-ANCHORAGE HAUL	\$ 2,100	\$ 1,050	**\$ 32.3**
FBX-MACKENZIE HAUL	\$ 2,100	\$ 1,050	**\$ 32.3**

FBX-HOUSTON HAUL	$ 2,600	$ 1,300	**$ 40.0**
LIVENGOOD-WHITTIER HAUL	$ 8,800	$ 4,400	**$ 135.4**
LIVENGOOD-SEWARD HAUL	$ 3,200	$ 1,600	**$ 49.2**
LIVENGOOD-ANCHORAGE HAUL	$ 2,100	$ 1,050	**$ 32.3**
LIVENGOOD-MACKENZIE HAUL	$ 2,100	$ 1,050	**$ 32.3**
LIVENGOOD--HOUSTON HAUL	$ 2,600	$ 1,300	**$ 40.0**

3.6. OPEX ESTIMATE - PORTS

3.6.1. Port of Alaska in Anchorage

The current container handling tenant operator in the region assisted with development of cost estimates for containerized concentrate operations at PoA. These costs include:

- container handling on and off rail cars.
- drayage movement of containers to and from storage by yard haul tractor trailers.
- stevedoring movement of containers to and from berth during ship loading by yard haul tractor trailers.
- tipping of cargo into ships.
- operation of an RFID-based cargo inventory tracking system.
- fuels, equipment maintenance, spares, staffing and labour, utilities, power and snow clearance.
- site and operations management.

Additionally, a wharfage of $1.43/ton and a $1.50 / sq ft per year lease cost of the storage yard was added to their operating cost build up, based on the officially posted PoA land lease tariff rates.

The annual OPEX of port operations at Port of Alaska in Anchorage is estimated to be **$39.1/ton (peak 836 kt/y), or $41.3/ton (avg 513 kt/y).**

Details of the estimate can be found in Appendix B.

3.6.2. Port of Seward

A stevedoring company within the region provided cost estimates for containerized concentrate operations at Port of Seward (Seward), assuming they would be the tenant operator leasing space from ARRC.

Costs for operating in Port of Seward for this study include:

- container handling on and off rail cars.
- drayage movement of containers to and from storage by reach stackers.
- stevedoring movement of containers to and from berth during ship loading by yard haul tractor trailers.
- tipping of cargo into ships.
- operation of an RFID-based cargo inventory tracking system.
- fuels, equipment maintenance, spares, staffing and labour, utilities, power and snow clearance.
- site and operations management.

Additionally, a wharfage of $2.00/ton shipped and a $0.69 / sq ft per year lease cost of the storage yard was added to their operating cost build-up, payable to ARRC, based on Seward's port manager's estimate of a probable negotiated price position.

The annual OPEX of port operations at Port of Seward is estimated to be **$26.1/ton (peak 836 kt/y), or $28.5/ton (avg 513 kt/y).**

Details of the estimate can be found in Appendix B.

3.6.3. Port MacKenzie

Port MacKenzie is currently largely unused and does not have an existing tenant operator to advise on site-specific operating costs. Ausenco developed an operating cost estimate for Port MacKenzie based the cost estimate for the Seward operation.

Estimated costs for operating in Port MacKenzie include similar elements as Port of Seward, except:

- no yard tractors are envisaged to be used between the storage yard and berth, due to space limitations on trestle and berth.
- fuels not required by drayage to and from berth are offset by drayage necessary to shuttle containers to and from the primary lower yard and overflow upper yard. These are assumed to be budgetarily equal at this stage of study.
- vessel line operations allowances are increased from $12,000 to $20,000 per vessel, due to the need to warp ships multiple times during a mooring.
- Power and utilities allowances are increased from $100,000 to $150,000 per year, due to a larger site footprint.

Additionally, based on Port MacKenzie's manager's quotation, a wharfage of $1.31/ton shipped and an order of magnitude $200,000 / sq ft per year lease cost for the all-in use of Port MacKenzie was added to their operating cost build-up, payable to the Port / Matanuska-Susitna Borough.

The annual OPEX of port operations at Port MacKenzie is estimated to be **$26.4/ton (peak 836 kt/y), or $28.8/ton (avg 513 kt/y).**

Details of the estimate can be found in Appendix B.

3.6.4. Port of Whittier

Port of Whittier's current tenant operator for barging operations, Alaska Marine Lines, declined to quote for this study. ARRC's port manager for Whittier was unavailable for this study. Ausenco developed a first principles-based operating cost estimate for Port of Whittier based on Ausenco's benchmarks and experience with similar operations.

Costs for operating in Port of Whittier for this study include the same elements as other ports discussed above, with the following as basis:

- Energy costs such as electricity, diesel, and heating natural gas based on publicly available rates for Alaska;
- Heating and lighting energy consumption rates referenced from Energy Information Administration (EIA) and are commensurate with those for polar regions or otherwise US cold-weather regions.
- Fixed annual maintenance costs estimated at 1% of CAPEX for civil-structural works and 2% of CAPEX for electrical and mechanical equipment.
- Dynamic annual maintenance costs for mechanical equipment estimated at 1% of CAPEX for every 1,000 hours of operation.
- Container annual damage replacement and attrition estimated at 2% of the approximately 3,300 container holdings at port.
- Onsite rail annual maintenance at $12,000 per kilometer.
- Burdened labour hourly costs supplied by PND Engineers, representative of typical wages in the Alaskan market, with overtime multiplier of 1.35 for hourly workers.
- Wharfage of $2.00/ton shipped assumed based on ARRC's Seward pricing.
- $0.69 / sq ft per year lease cost based on ARRC's Seward pricing.

With the above, the annual OPEX of port operations at Port of Whittier by a generic operator, as incurred by the operator is estimated to be **$11.2/ton (peak 836 kt/y), or $12.7/ton (avg 513 kt/y).**

Assuming a 100% profit margin assessed by the operator, the cost of goods shipped to the cargo owner could be **$22.5/ton (peak 836 kt/y), or $25.5/ton (avg 513 kt/y).**

Details of the estimate can be found in Appendix B.

3.7. ANNUAL AND TOTAL OPEX CONSOLIDATED BY TRANSPORT OPTION

Summarizing all cost elements above, the peak annual OPEX for each transportation option is presented below in Table 3. Table 4 presents the same results arranged by increasing cost in terms of $/ton. All costs shown are in 2023/2024 dollars, representing the peak production case of 836,000 ton/y.

Table 5. presents the overall OPEX for the complete Life of Mine (LOM) across the 37 years of production with an average of 513,800 tons each year. All costs shown are in 2023/2024 dollars, with no consumer price index (i.e. inflaton) or net present value (NPV) translations have been applied.

Details of the summary, along with the cost buildup of each node, can be found in Appendix A.

Table 3. Summary of Peak Annual OPEX by Transportation Option.

OPEX SUMMARY - PEAK PRODUCTION 836,000 TON/Y - 2023/2024 DOLLARS		
Option	Description	Cargo Handling - Peak Production ($/ton)
OPTION 1 - ANC	Single Truck to FBX, Rail to ANC	$ 288.92
OPTION 1 - MAC	Single Truck to FBX, Rail to MAC	$ 276.07
OPTION 1 - MAC via HOU	Single Truck to FBX, Rail to HOU, Truck to MAC	$ 329.80
OPTION 1- SWD	Single Truck to FBX, Rail to SWD	$ 293.97
OPTION 1 - WHT	Single Truck to FBX, Rail to WHT	$ 376.59
OPTION 2 - ANC	Double Truck to FBX, Rail to ANC	$ 234.90
OPTION 2 - MAC	Double Truck to FBX, Rail to MAC	$ 222.05
OPTION 2 - MAC via HOU	Double Truck to FBX, Rail to HOU, Truck to MAC	$ 275.78
OPTION 2- SWD	Double Truck to FBX, Rail to SWD	$ 239.95
OPTION 2 - WHT	Double Truck to FBX, Rail to WHT	$ 322.57
OPTION 3 - ANC	Single Truck to LVG, Rail to ANC	$ 247.98
OPTION 3 - MAC	Single Truck to LVG, Rail to MAC	$ 235.13
OPTION 3 - MAC via HOU	Single Truck to LVG, Rail to HOU, Truck to MAC	$ 288.86
OPTION 3- SWD	Single Truck to LVG, Rail to SWD	$ 253.03
OPTION 3 - WHT	Single Truck to LVG, Rail to WHT	$ 335.65
OPTION 4 - ANC	Double Truck to LVG, Rail to ANC	$ 209.39
OPTION 4 - MAC	Double Truck to LVG, Rail to MAC	$ 196.54
OPTION 4 - MAC via HOU	Double Truck to LVG, Rail to HOU, Truck to MAC	$ 250.27
OPTION 4- SWD	Double Truck to LVG, Rail to SWD	$ 214.44
OPTION 4 - WHT	Double Truck to LVG, Rail to WHT	$ 297.06
OPTION 5 - ANC	Single Truck Direct ANC	$ 515.18
OPTION 5 - MAC	Single Truck Direct MAC	$ 502.33
OPTION 5 - SWD	Single Truck Direct SWD	$ 582.89
OPTION 5 - WHT	Single Truck Direct WHT	$ 557.42

Table 4. Summary of Peak Annual OPEX by Transportation Option - Arranged by Cost.

OPEX SUMMARY - PEAK PRODUCTION 836,000 TON/Y - 2023/2024 DOLLARS		
Option	Description	Cargo Handling - Peak Production ($/ton)
OPTION 4 - MAC	Double Truck to LVG, Rail to MAC	$ 196.54
OPTION 4 - ANC	Double Truck to LVG, Rail to ANC	$ 209.39
OPTION 4- SWD	Double Truck to LVG, Rail to SWD	$ 214.44
OPTION 2 - MAC	Double Truck to FBX, Rail to MAC	$ 222.05
OPTION 2 - ANC	Double Truck to FBX, Rail to ANC	$ 234.90
OPTION 3 - MAC	Single Truck to LVG, Rail to MAC	$ 235.13
OPTION 2- SWD	Double Truck to FBX, Rail to SWD	$ 239.95
OPTION 3 - ANC	Single Truck to LVG, Rail to ANC	$ 247.98
OPTION 4 - MAC via HOU	Double Truck to LVG, Rail to HOU, Truck to MAC	$ 250.27
OPTION 3- SWD	Single Truck to LVG, Rail to SWD	$ 253.03
OPTION 2 - MAC via HOU	Double Truck to FBX, Rail to HOU, Truck to MAC	$ 275.78
OPTION 1 - MAC	Single Truck to FBX, Rail to MAC	$ 276.07
OPTION 3 - MAC via HOU	Single Truck to LVG, Rail to HOU, Truck to MAC	$ 288.86
OPTION 1 - ANC	Single Truck to FBX, Rail to ANC	$ 288.92
OPTION 1- SWD	Single Truck to FBX, Rail to SWD	$ 293.97
OPTION 4 - WHT	Double Truck to LVG, Rail to WHT	$ 297.06
OPTION 2 - WHT	Double Truck to FBX, Rail to WHT	$ 322.57
OPTION 1 - MAC via HOU	Single Truck to FBX, Rail to HOU, Truck to MAC	$ 329.80
OPTION 3 - WHT	Single Truck to LVG, Rail to WHT	$ 335.65
OPTION 1 - WHT	Single Truck to FBX, Rail to WHT	$ 376.59
OPTION 5 - MAC	Single Truck Direct MAC	$ 502.33
OPTION 5 - ANC	Single Truck Direct ANC	$ 515.18
OPTION 5 - WHT	Single Truck Direct WHT	$ 557.42
OPTION 5 - SWD	Single Truck Direct SWD	$ 582.89

Table 5. Summary of Life of Mine OPEX by Transportation Option - Arranged by Cost.

OPEX SUMMARY - LIFE OF MINE- 2023/2024 DOLLARS		
Option	Description	LOM Cargo Handling ($ millon)
OPTION 4 - MAC	Double Truck to LVG, Rail to MAC	$ 3,736
OPTION 4 - ANC	Double Truck to LVG, Rail to ANC	$ 3,980
OPTION 4- SWD	Double Truck to LVG, Rail to SWD	$ 4,076
OPTION 2 - MAC	Double Truck to FBX, Rail to MAC	$ 4,221
OPTION 2 - ANC	Double Truck to FBX, Rail to ANC	$ 4,465
OPTION 3 - MAC	Single Truck to LVG, Rail to MAC	$ 4,470
OPTION 2- SWD	Double Truck to FBX, Rail to SWD	$ 4,561
OPTION 3 - ANC	Single Truck to LVG, Rail to ANC	$ 4,714
OPTION 4 - MAC via HOU	Double Truck to LVG, Rail to HOU, Truck to MAC	$ 4,758
OPTION 3- SWD	Single Truck to LVG, Rail to SWD	$ 4,810
OPTION 2 - MAC via HOU	Double Truck to FBX, Rail to HOU, Truck to MAC	$ 5,243
OPTION 1 - MAC	Single Truck to FBX, Rail to MAC	$ 5,248
OPTION 3 - MAC via HOU	Single Truck to LVG, Rail to HOU, Truck to MAC	$ 5,491
OPTION 1 - ANC	Single Truck to FBX, Rail to ANC	$ 5,492
OPTION 1- SWD	Single Truck to FBX, Rail to SWD	$ 5,588
OPTION 4 - WHT	Double Truck to LVG, Rail to WHT	$ 5,647
OPTION 2 - WHT	Double Truck to FBX, Rail to WHT	$ 6,132
OPTION 1 - MAC via HOU	Single Truck to FBX, Rail to HOU, Truck to MAC	$ 6,269
OPTION 3 - WHT	Single Truck to LVG, Rail to WHT	$ 6,381
OPTION 1 - WHT	Single Truck to FBX, Rail to WHT	$ 7,159
OPTION 5 - MAC	Single Truck Direct MAC	$ 9,549
OPTION 5 - ANC	Single Truck Direct ANC	$ 9,793
OPTION 5 - WHT	Single Truck Direct WHT	$ 10,596
OPTION 5 - SWD	Single Truck Direct SWD	$ 11,081

4. BENCHMARKS

4.1. GENERAL DISCUSSION

Final costs are vetted against both in-house and outside relevant estimates and recent comparable project costs. Total man-hours and total fuel consumption are reviewed to verify general agreement with historical expectations.

APPENDIX A: OPEX COST ESTIMATE SUMMARY

OPEX SUMMARY - 2023/2024 DOLLARS

Option	Description	Cargo Handling - Peak Production ($/ton)	LOM Cargo Handling ($ millon)	Dalton Yard to Truck	Truck Haul	Truck - Rail Intermodal No.1 Handling	Rail Haul	Rail-Truck Intermodal No.2 Handling	Truck Haul - Intermodal No. 2 to Port	Port (Rail-Yard-Ship Handling)	Land Lease	Wharfage	Dockage and Ocean Freight	Additional Allowances	Additional Allowance Notes
					$/ton	$/ton	$/ton	$/ton	$/ton	$/ton	-	$/ton	$/ton	$/ton	-
OPTION 1 - ANC	Single Truck to FBX, Rail to ANC	$ 288.92	$ 5,492	Excluded	$ 216.09	Included by ARRC	$ 32.3	N/A	N/A	$ 39.10	Included	$ 1.43	Excluded	N/A	
OPTION 1 - MAC	Single Truck to FBX, Rail to MAC	$ 276.07	$ 5,248	Excluded	$ 216.09	Included by ARRC	$ 32.3	N/A	N/A	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 1 - MAC via HOU	Single Truck to FBX, Rail to HOU, Truck to MAC	$ 329.80	$ 6,269	Excluded	$ 216.09	Included by ARRC	$ 40.0	$ 19.93	$ 26.10	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 1- SWD	Single Truck to FBX, Rail to SWD	$ 293.97	$ 5,588	Excluded	$ 216.09	Included by ARRC	$ 49.2	N/A	N/A	$ 26.08	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 1 - WHT	Single Truck to FBX, Rail to WHT	$ 376.59	$ 7,159	Excluded	$ 216.09	Included by ARRC	$ 135.4	N/A	N/A	$ 22.50	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 2 - ANC	Double Truck to FBX, Rail to ANC	$ 234.90	$ 4,465	Excluded	$ 162.07	Included by ARRC	$ 32.3	N/A	N/A	$ 39.10	Included	$ 1.43	Excluded	N/A	
OPTION 2 - MAC	Double Truck to FBX, Rail to MAC	$ 222.05	$ 4,221	Excluded	$ 162.07	Included by ARRC	$ 32.3	N/A	N/A	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 2 - MAC via HOU	Double Truck to FBX, Rail to HOU, Truck to MAC	$ 275.78	$ 5,243	Excluded	$ 162.07	Included by ARRC	$ 40.0	$ 19.93	$ 26.10	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 2- SWD	Double Truck to FBX, Rail to SWD	$ 239.95	$ 4,561	Excluded	$ 162.07	Included by ARRC	$ 49.2	N/A	N/A	$ 26.08	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 2 - WHT	Double Truck to FBX, Rail to WHT	$ 322.57	$ 6,132	Excluded	$ 162.07	Included by ARRC	$ 135.4	N/A	N/A	$ 22.50	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 3 - ANC	Single Truck to LVG, Rail to ANC	$ 247.98	$ 4,714	Excluded	$ 154.35	$ 20.8	$ 32.3	N/A	N/A	$ 39.10	Included	$ 1.43	Excluded	N/A	
OPTION 3 - MAC	Single Truck to LVG, Rail to MAC	$ 235.13	$ 4,470	Excluded	$ 154.35	$ 20.8	$ 32.3	N/A	N/A	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 3 - MAC via HOU	Single Truck to LVG, Rail to HOU, Truck to MAC	$ 288.86	$ 5,491	Excluded	$ 154.35	$ 20.8	$ 40.0	$ 19.93	$ 26.10	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 3- SWD	Single Truck to LVG, Rail to SWD	$ 253.03	$ 4,810	Excluded	$ 154.35	$ 20.8	$ 49.2	N/A	N/A	$ 26.08	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 3 - WHT	Single Truck to LVG, Rail to WHT	$ 335.65	$ 6,381	Excluded	$ 154.35	$ 20.8	$ 135.4	N/A	N/A	$ 22.50	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 4 - ANC	Double Truck to LVG, Rail to ANC	$ 209.39	$ 3,980	Excluded	$ 115.76	$ 20.8	$ 32.3	N/A	N/A	$ 39.10	Included	$ 1.43	Excluded	N/A	
OPTION 4 - MAC	Double Truck to LVG, Rail to MAC	$ 196.54	$ 3,736	Excluded	$ 115.76	$ 20.8	$ 32.3	N/A	N/A	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 4 - MAC via HOU	Double Truck to LVG, Rail to HOU, Truck to MAC	$ 250.27	$ 4,758	Excluded	$ 115.76	$ 20.8	$ 40.0	$ 19.93	$ 26.10	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 4- SWD	Double Truck to LVG, Rail to SWD	$ 214.44	$ 4,076	Excluded	$ 115.76	$ 20.8	$ 49.2	N/A	N/A	$ 26.08	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 4 - WHT	Double Truck to LVG, Rail to WHT	$ 297.06	$ 5,647	Excluded	$ 115.76	$ 20.8	$ 135.4	N/A	N/A	$ 22.50	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 5 - ANC	Single Truck Direct ANC	$ 515.18	$ 9,793	Excluded	$ 474.65	N/A	N/A	N/A	N/A	$ 39.10	Included	$ 1.43	Excluded	N/A	
OPTION 5 - MAC	Single Truck Direct MAC	$ 502.33	$ 9,549	Excluded	$ 474.65	N/A	N/A	N/A	N/A	$ 26.37	Included	$ 1.31	Excluded	N/A	
OPTION 5 - SWD	Single Truck Direct SWD	$ 582.89	$ 11,081	Excluded	$ 554.21	N/A	N/A	N/A	N/A	$ 26.08	Included	$ 2.00	Excluded	$ 0.60	1
OPTION 5 - WHT	Single Truck Direct WHT	$ 557.42	$ 10,596	Excluded	$ 532.32	N/A	N/A	N/A	N/A	$ 22.50	Included	$ 2.00	Excluded	$ 0.60	1

1 - Site Security $0.60

PORT OF ALASKA - ANCHORAGE

CARGO VOLUME INPUTS

Annual Tonnages (ton)	836000	513000
Container per year	25700	15800
Ship calls per year	25	16
Land Lease (SQ FT)	519000	519000

PoA Cost Matrix	Unit Cost	Basis	Per Annum Peak	Per Annum Average
Drayage	$ 7,908,446	per year	$ 7,908,446	$ 4,909,669
Vessel Stevedoring	$ 11,212,768	per year	$ 11,212,768	$ 6,961,037
Berthing / lines	$ 615,236	per year	$ 615,236	$ 381,947
Yard Operations	$ 7,692,510	per year	$ 7,692,510	$ 4,775,613
Maintenance	$ 2,291,200	per year	$ 2,291,200	$ 1,422,407
Fuels and Lubricants	$ 714,739	per year	$ 714,739	$ 443,719
Site Management	$ 1,500,000	per year	$ 1,500,000	$ 1,500,000
Land lease from PoA (per PoA Tariff 2024)	$ 1.50	per sqft per year	$ 778,500	$ 778,500
		Total Annual OPEX	**$ 32,713,399**	**$ 21,172,893**
		Total $/t	**$ 39.1**	**$ 41.3**

	LOM	Avg Per Year	Peak Year
Drayage	$ 176,748,090	$ 4,909,669	$ 7,908,446
Vessel Stevedoring	$ 250,597,325	$ 6,961,037	$ 11,212,768
Berthing / lines	$ 13,750,078	$ 381,947	$ 615,236
Yard Operations	$ 171,922,083	$ 4,775,613	$ 7,692,510
Maintenance	$ 51,206,669	$ 1,422,407	$ 2,291,200
Fuels and Lubricants	$ 15,973,895	$ 443,719	$ 714,739
Site Management	$ 54,000,000	$ 1,500,000	$ 2,416,185
Land lease from PoA (per PoA Tariff 2024)	Excl	Excl	Excl
	Peak vs Avg Factor	1.61	

PORT OF SEWARD

CARGO VOLUME INPUTS

Annual Tonnages (ton)	836000	513000
Container per year	25700	15800
Ship calls per year	25	16
Land Lease (SQ FT)	300000	300000

Seward Handling Cost Matrix	Unit Cost	Basis	Per Annum Peak	Per Annum Average
Offload and reload train	$ 225	per container	$ 5,782,500	$ 3,555,000
Receive, moor, de-moor, and cast-off ship	$ 12,000	per ship	$ 300,000	$ 192,000
Move containers to and from dockside for container cargo dump into ship,	$ 475	per container	$ 12,207,500	$ 7,505,000
Land Lease (from ARRC), 300,000 sqft	$ 0.69	per sq ft/year	$ 207,000	$ 207,000
Shop space annual lease	$ 48,000	per year	$ 48,000	$ 48,000
Utilities / Power / Lighting / Heat	$ 100,000	Annual allowance, factored from Whittier first principles calc.	$ 100,000	$ 100,000
Maintenance Labour - of on-site equipment including cranage, trucks, forklifts, civil/structural upkeep 2 full time positions	$ 600,000	per year	$ 600,000	$ 600,000
Maintenance Parts - of on-site equipment	$ 250,000	per year	$ 250,000	$ 250,000
Shop annual operating cost	$ 25,000	per year	$ 25,000	$ 25,000
Fuels (200000 gal)	$ 907,200	per year	$ 907,200	$ 907,200
Lubricants	$ 75,000	per year	$ 75,000	$ 75,000
Filters and Consumables	$ 50,000	per year	$ 50,000	$ 50,000
Site Manager (1 FTE)	$ 300,000	per year	$ 300,000	$ 300,000
Cargo Inventory Tracking (1 FTE)	$ 300,000	per year	$ 300,000	$ 300,000
Grader Rental, snow and site maintenance, 6 months / year	$ 12,000	per month	$ 72,000	$ 72,000
Loader Rental, , snow and site maintenance,6 months / year	$ 12,000	per month	$ 72,000	$ 72,000
Truck x 2; Lease Basis	$ 40,000	per year both	$ 40,000	$ 40,000
Mechanic Truck	$ 20,000	per year	$ 20,000	$ 20,000
Container Maintenance / Attrition (2% CAPEX / year, Ausenco's estimation)	See Right	per year	$ 450,000	$ 276,100
		Total Annual OPEX	**$ 21,806,200**	**$ 14,594,300**
		Total $/t	**$ 26.08**	**$ 28.45**

PORT OF MACKENZIE

SCALED FROM SEWARD ESTIMATE - PORT MAC CANNOT PROVIDE ALL IN OPERATING COST.

CARGO VOLUME INPUTS

Annual Tonnages (ton)	836000	513000
Container per year	25700	15800
Ship calls per year	25	16
Land Lease (SQ FT)	300000	300000

Seward Handling Cost Matrix	Unit Cost	Basis	Per Annum Peak	Per Annum Average	Basis Remarks
Offload and reload train	$ 225	per container	$ 5,782,500	$ 3,555,000	Carryover from Seward estimate
Receive, moor, de-moor, and cast-off ship	$ 20,000	See "Basis Remarks"	$ 500,000	$ 320,000	Per ship up from Seward's $12K due to need to warp ship, assume $20K.
Move containers to and from dockside for container cargo dump into ship,	$ 475	per container	$ 12,207,500	$ 7,505,000	Carryover from Seward estimate
Land Lease (from Borough / Port Mac), upper and lower areas.	$ 200,000.00	lumpsum per year	$ 200,000	$ 200,000	As per Port Mac's estimate, $200k Lumpsum / year
Shop space annual lease	$ 48,000	per year	$ 48,000	$ 48,000	Carryover from Seward estimate
Utilities / Power / Lighting / Heat	$ 150,000	See "Basis Remarks"	$ 150,000	$ 150,000	Up from Seward's $100K due to larger dual site, assume $150K.
Maintenance Labour - of on-site equipment including cranage, trucks, forklifts, civil/structural upkeep 2 full time positions	$ 600,000	per year	$ 600,000	$ 600,000	Carryover from Seward estimate
Maintenance Parts - of on-site equipment	$ 250,000	per year	$ 250,000	$ 250,000	Carryover from Seward estimate
Shop annual operating cost	$ 25,000	per year	$ 25,000	$ 25,000	Carryover from Seward estimate
Fuels (200000 gal)	$ 907,200	per year	$ 907,200	$ 907,200	Carryover from Seward estimate
Lubricants	$ 75,000	per year	$ 75,000	$ 75,000	Carryover from Seward estimate
Filters and Consumables	$ 50,000	per year	$ 50,000	$ 50,000	Carryover from Seward estimate
Site Manager (1 FTE)	$ 300,000	per year	$ 300,000	$ 300,000	Carryover from Seward estimate
Cargo Inventory Tracking (1 FTE)	$ 300,000	per year	$ 300,000	$ 300,000	Carryover from Seward estimate
Grader Rental, snow and site maintenance, 6 months / year	$ 12,000	per month	$ 72,000	$ 72,000	Carryover from Seward estimate
Loader Rental, , snow and site maintenance,6 months / year	$ 12,000	per month	$ 72,000	$ 72,000	Carryover from Seward estimate
Truck x 2; Lease Basis	$ 40,000	per year both	$ 40,000	$ 40,000	Carryover from Seward estimate
Mechanic Truck	$ 20,000	per year	$ 20,000	$ 20,000	Carryover from Seward estimate
Container Maintenance / Attrition (2% CAPEX / year, Ausenco's estimation)	See Right	per year	$ 450,000	$ 276,100	Carryover from Seward estimate
		Total Annual OPEX	**$ 22,049,200**	**$ 14,765,300**	
		Total $/t	**$ 26.37**	**$ 28.78**	

PORT OF WHITTIER
(GENERIC OPERATOR)

OPEX - PORT OF WHITTIER - CONTAINERIZED BULK MATERIAL HANDLING

COST INPUTS

Electricity	$ 0.147	$US per kWh, business rate https://www.globalpetrolprices.com
Natural Gas	$ 6.5	$US per 1000 cu.ft, industrial rate https://www.eia.gov/dnav/ng/NG_PRI_SUM_DCU_SAK_M.htm
Diesel	$ 1.20	$US per Litre, anticipatory for 2025 (Jan 2024 Cost $1.03) https://www.globalpetrolprices.com
Inflation	5.0%	Assumed

MAINTENANCE COSTS

Item	Cost		Cost Basis	Cost Basis Qty	PEAK Annual OPEX ($US)	AVG Annual OPEX ($US)
Land Lease		$ 0.69	per sqft per year	105,000	$ 72,450	$ 72,450
Civil-Structural Installations	1.0%		of Installed CAPEX, includes marine structures	$ 50,931,467	$ 510,000	$ 510,000
Mechanical Equipment and Installations - fixed	2.0%		of Installed CAPEX	$ 13,131,000	$ 263,000	$ 263,000
Mechanical Equipment and Installations - dynamic	1.0%		of Installed CAPEX per 1000 hours operation	N/A	$ 183,981	$ 112,968
Electrical Equipment Installations	2.0%		of Installed CAPEX	$ 2,842,000	$ 57,000	$ 57,000
Container repair and attrition	2.0%		of Installed CAPEX as annual attrition, 2% damage replacements per year, of total 3,300 peak holdings.	$ 22,477,500	$ 450,000	$ 276,100
Onsite Rail	$ 12,000		per Installed km yard rail (3600 ft installed approx.)	1.10	$ 14,000	$ 14,000
					$ 1,550,431	$ 1,305,518

ELECTRICAL AND GAS COSTS (Ref: https://www.eia.gov/consumption/commercial/data/2018/index.php?view=consumption)

Facility	EIA 2018 Category	kWh/sqft (EIA 2018)	cuft/sqft (EIA 2018)	Area (m2)	Area(sqft)	Annual OPEX ($US)
Cargo storage building	Warehouse and Storage	5.9	0.3	0	---	$ 0
Administration Building, Main	Office	3.9	0.37	297	1,500	$ 4,600
Workshop	Warehouse and Storage	5.9	0.3	222	---	$ 0
Guardhouse	Office	3.9	0.37	24	---	$ 0
Lighting		**Installed kWh**				
Yard Lighting	LED. 150W - 480W Flood and Street Light, Various	487,000			292,000	$ 71,600
						$ 76,200

Lincoln Chan: https://www.forkliftcenter.com/forklifts/files/1080-smvreachstackers-

MECHANICAL OPERATING COSTS (0 indicates qty not applicable for this intermodal yard option)

Primary Description	Secondary Description	Qty on hand	PEAK Operating Hours / Period / equipment	AVG Operating Hours / Period / equipment	Period	Period / Year	Diesel Fuel L / hr / eqmpt	PEAK diesel Fuel L / year	AVG Diesel Fuel L / year	PEAK Annual OPEX ($US)	AVG Annual OPEX ($US)
Mobile Harbour Crane (MHC)	Liebherr LHM 550 or equiv.	1	1,090	670	Year	1	30	32,700	20,100	$ 39,300	$ 24,200
Yard Haul Tractor	Kalmar Ottawa T2 or equiv.	0	---	---	Day	350	6.8	---	---	$ 0	$ 0
Yard Haul Trailer	Cheetah 52' 72,000 lb payload, single container, quad axle.	0	---	---	Week	50	---	---	---	$ 0	$ 0
Container Reach stacker (mobile), 5 high	Generic reach stacker, 20 ft ISO, stack 5 high capable, Kalmar DRG450-82S5X	5	1,780	1,090	Year	1	16	142,400	87,200	$ 170,900	$ 104,700
Revolver attachment, Specialized Container Revolving	RAM 4151LW Lightweight Series; 33 tonnes (36 US ton) SWL; 11.7 tonnes ta	1	---	---	Day	350	---	---	---	$ 0	$ 0
Utility Truck, General Purpose	4x4 (double cabin)	2	4	4	Day	350	7	18,760	18,760	$ 22,600	$ 22,600
Forklift	General Purpose 10,000 lbs capacity	0	---	---	Week	50	8	---	---	$ 0	$ 0
Fire Protection Trailer		1	12	12	Year	1	8	96	96	$ 200	
									126156	$ 233,000	$ 151,500

STAFFING COSTS

Roles - Management	Role Category Equivalent	Role Count	Shifts	Total Staff Count	Base rate ($US salary	OT Multiplier	PEAK Annual Total Cost of Employment ($US)	AVG Annual Total Cost of Employment ($US)
Site Manager	Logistics Manager	1	1	1	$ 239,200	1	$ 240,000	$ 240,000
Shift Supervisor	Concentrate Loadout Superi	1	2	2	$ 228,800	1.35	$ 618,000	$ 618,000
Roles - Fixed	**Role Category Equivalent (12h)**	**Staff Count Per shift**	**Shifts / year**	**Total Staff Annual Hours**	**Base rate ($US hourly)**	**OT Multiplier**		
Operator, Reach Stacker - Trains	Loader Operator	4	189	9,072	$ 105	1.35	$ 1,286,000	$ 789,136
Operator, Reach Stacker - Ships	Loader Operator	4	125	6,000	$ 105	1.35	$ 851,000	$ 522,205
Operator, Shiploading	Loader Operator	1	125	1,500	$ 105	1.35	$ 213,000	$ 130,705
Labourer, Trains	Labourer	8	189	18,144	$ 95	1.35	$ 2,327,000	$ 1,427,932
Labourer, Shiploading	Labourer	2	125	3,000	$ 95	1.35	$ 385,000	$ 236,250
Vehicle Mechanic	Heavy Vehicle Maintenance	1	350	4,200	$ 105	1.35	$ 596,000	$ 596,000
Clerk, Logistics	Logistics Clerk	1	700	8,400	$ 90	1.35	$ 1,021,000	$ 510,500
Clerk, Scale Operator	Trades Assistant	0	0	---	$ 187,200	1.35	$ 0	$ 0
Security Guard	Security Staff	0	0	---	$ 197,600	1.35	$ 0	$ 0
						Subtotal	$ 7,537,000	$ 5,070,727

2024 US Dollars	Total Annual PEAK OPEX , without contingency 836,000 tons / a	Total Annual AVG OPEX, without contingency 513,000 tons / a
Total Annual OPEX	$ 9,397,000	$ 6,528,000
$/t OPEX	$ 11.2	$ 12.7
Operator's Margin	100%	100%
$/t Fee Charged By Operator	$ 22.5	$ 25.5

LIVENGOOD INTERMODAL YARD

CARGO VOLUME INPUTS

Annual Tonnages (ton)	836000	513000
Container per year	25700	15800
Ship calls per year	25	16
Land Lease (SQ FT)	300000	300000

Livengood Intermodal Handling Cost Matrix	Unit Cost	Basis	Per Annum Peak	Per Annum Average
Offload and reload Truck	$ 400	per container	$ 10,280,000	$ 6,320,000
Offload and reload Train	$ 200	per container	$ 5,140,000	$ 3,160,000
Land Lease (from ARRC)	$ 0.35	per sq ft/year	$ 105,000	$ 105,000
Maintenance Parts - of on-site equipment	$ 100,000	per year	$ 100,000	$ 100,000
Fuels (100000 gal)	$ 453,600	per year	$ 453,600	$ 453,600
Lubricants, Arctic Grade	$ 50,000	per year	$ 50,000	$ 50,000
Filters and Consumables	$ 25,000	per year	$ 25,000	$ 25,000
Shop annual operating cost	$ 20,000	per year	$ 20,000	$ 20,000
Shop space annual lease	$ 48,000	per year	$ 48,000	$ 48,000
Utilities / Power / Lighting / Heat	$ 75,000	Annual allowance, factored from Whittier first principles calc.	$ 75,000	$ 75,000
Site Manager (1 FTE)	$ 300,000	per year	$ 300,000	$ 300,000
Logistics Clerk / Office Manager (1 FTE)	$ 300,000	per year	$ 300,000	$ 300,000
Mechanic (1FTE) Maintenance Labour - of on-site equipment including cranage, trucks, forklifts, civil/structural upkeep	$ 300,000	per year	$ 300,000	$ 300,000
Grader Rental, snow and site maintenance, 6 months / year	$ 12,000	per month	$ 72,000	$ 72,000
Loader Rental, , snow and site maintenance,6 months / year	$ 12,000	per month	$ 72,000	$ 72,000
Truck x 2; Lease Basis	$ 40,000	per year both	$ 40,000	$ 40,000
Mechanic Truck; Lease Basis	$ 0	per year	$ 0	$ 0
Container Maintenance / Attrition (2% CAPEX / year, Ausenco's estimation)	Excluded	per year	Excluded	Excluded
		Total Annual OPEX	**$ 17,380,600**	**$ 11,440,600**
		Total $/t	**$ 20.8**	**$ 22.3**

HOUSTON INTERMODAL YARD

SCALED FROM LIVENGOOD ESTIMATE - PORT MAC CANNOT PROVIDE ALL IN OPERATING COST.

CARGO VOLUME INPUTS

Annual Tonnages (ton)	836000	513000
Container per year	25700	15800
Ship calls per year	25	16
Land Lease (SQ FT)	226000	226000

Livengood Intermodal Handling Cost Matrix	Unit Cost	Basis	Per Annum Peak	Per Annum Average	Basis Remarks
Crossload Truck and Train	$ 400	per container	$ 10,280,000	$ 6,320,000	Carryover from Livengood estimate
Offload and reload Train	$ 200	per container	$ 5,140,000	$ 3,160,000	Carryover from Livengood estimate
Land Lease (from borough / first nations)	$ 0.35	per sq ft/year	$ 79,100	$ 79,100	Lease of pad area and loading strip along train
Maintenance Parts - of on-site equipment	$ 100,000	per year	$ 100,000	$ 100,000	Carryover from Livengood estimate, exclude shuttle truck haul HOUS-MAC
Fuels (100000 gal)	$ 453,600	per year	$ 453,600	$ 453,600	Carryover from Livengood estimate, exclude shuttle truck haul HOUS-MAC
Lubricants, Arctic Grade	$ 50,000	per year	$ 50,000	$ 50,000	Carryover from Livengood estimate
Filters and Consumables	$ 25,000	per year	$ 25,000	$ 25,000	Carryover from Livengood estimate
Shop annual operating cost	$ 10,000	per year	$ 10,000	$ 10,000	Reduced from Livengood. Temporary tented shop only, supported by Port Mac as required.
Shop space annual lease	$ 0	per year	$ 0	$ 0	Not required
Utilities / Power / Lighting / Heat	$ 38,000	Annual allowance, factored from Livengood	$ 38,000	$ 38,000	Reduced 50% from Livengood. Very compact site.
Site Manager (1 FTE)	$ 0	per year	$ 0	$ 0	Not required; deemed satellite location to Port Mac
Logistics Clerk / Office Manager (0.5 FTE)	$ 150,000	per year	$ 150,000	$ 150,000	Deemed satellite location to Port Mac, sent up half time to Houston as req
Site security (0.5 FTE)	$ 150,000	per year	$ 150,000	$ 150,000	Half time
Mechanic (1FTE) Maintenance Labour - of on-site equipment including cranage, trucks, forklifts, civil/structural upkeep	$ 0	per year	$ 0	$ 0	Not required. Send up from Port Mac as required.
Grader Rental, snow and site maintenance, 6 months / year	$ 12,000	per month	$ 72,000	$ 72,000	Carryover from Livengood estimate
Loader Rental, , snow and site maintenance,6 months / year	$ 12,000	per month	$ 72,000	$ 72,000	Carryover from Livengood estimate
Truck x 2; Lease Basis	$ 40,000	per year both	$ 40,000	$ 40,000	Carryover from Livengood estimate
Mechanic Truck; Lease Basis	$ 0	per year	$ 0	$ 0	Not required. Send up from Port Mac as required.
Container Maintenance / Attrition (2% CAPEX / year, Ausenco's estimation)	Excluded	per year	Excluded	Excluded	Covered under Port Mac OPEX.
		Total Annual OPEX	**$ 16,659,700**	**$ 10,719,700**	
		Total $/t	**$ 19.93**	**$ 20.90**	

ALASKA RAILROAD CORP. RAIL HAUL OPEX - ALL ROUTES

Annual Tonnages (ton)	836000
Container per year	25700
Cargo per Container (ton)	32.5

Rail Transport	$/car	$/container	$/t
FBX-WHITTIER HAUL	$ 8,800	$ 4,400	$ 135.4
FBX-SEWARD HAUL	$ 3,200	$ 1,600	$ 49.2
FBX-ANCHORAGE HAUL	$ 2,100	$ 1,050	$ 32.3
FBX-MACKENZIE HAUL	$ 2,100	$ 1,050	$ 32.3
FBX-HOUSTON HAUL	$ 2,600	$ 1,300	$ 40.0
LIVENGOOD-WHITTIER HAUL	$ 8,800	$ 4,400	$ 135.4
LIVENGOOD-SEWARD HAUL	$ 3,200	$ 1,600	$ 49.2
LIVENGOOD-ANCHORAGE HAUL	$ 2,100	$ 1,050	$ 32.3
LIVENGOOD-MACKENZIE HAUL	$ 2,100	$ 1,050	$ 32.3
LIVENGOOD--HOUSTON HAUL	$ 2,600	$ 1,300	$ 40.0

ALASKA WEST EXPRESS / LYNDEN
TRUCKING OPEX - ALL ROUTES

Route	Concentrate Payload	Distance Round Trip (Mi)	ESTIMATED NET CARGO/ YEAR	Estimated Hours Round Trip	$ / 100 ton outbound	$ / 100 ton empty return	$ / ton Round Trip	$ / ton- mi outbound (return miles excl)	Estimate Active Fleet In Circuit
DALTON HWY COLDFOOT <-> FAIRBANKS INTERMODAL YARD	1 x 36.2 ton Container Gross	508	36 YEAR OPPORTUNITY first 3rd - 25,700 containers / year second 3rd - 14,900 final 3rd - 8,800	14	$ 14,406.08	$ 7,203.04	$ 216.09	$ 0.851	77-80
	2 x 36.2 ton Container Gross; B-train				$ 10,804.56	$ 5,402.28	$ 162.07	$ 0.638	Not Quoted
DALTON HWY COLDFOOT <-> LIVENGOOD INTERMODAL YARD	1 x 36.2 ton Container Gross	350		10	$ 10,290.06	$ 5,145.03	$ 154.35	$ 0.882	35
	2 x 36.2 ton Container Gross; B-train				$ 7,717.54	$ 3,858.77	$ 115.76	$ 0.662	Not Quoted
DALTON HWY COLDFOOT <-> PORT MACKENZIE	1 x 36.2 ton Container Gross	1180		26	$ 31,643.65	$ 15,821.82	$ 474.65	$ 0.804	175
DALTON HWY COLDFOOT <-> PORT OF ANCHORAGE	1 x 36.2 ton Container Gross	1230		26	$ 31,643.65	$ 15,821.82	$ 474.65	$ 0.772	175
DALTON HWY COLDFOOT <-> PORT OF WHITTIER	1 x 36.2 ton Container Gross	1340		32	$ 35,621.55	$ 17,810.77	$ 534.32	$ 0.797	175
DALTON HWY COLDFOOT <-> PORT OF SEWARD	1 x 36.2 ton Container Gross	1470		34	$ 36,947.51	$ 18,473.76	$ 554.21	$ 0.754	175
HOUSTON <-> PORT MACKENZIE SHORT HAUL	1 x 36.2 ton Container Gross	60		3.5	$ 2,320.44	$ 1,160.22	$ 34.81	$ 1.160	25
	2 x 36.2 ton Container Gross; B-train				$ 1,740	$ 870.17	$ 26.10	$ 0.870	Not Quoted

36 Year Mine Life	Containers / Year	Containers/Day 365 year
First third - 836,000 tons / year	25,700	70
Second third - 486,000 ton / year	14,900	41
Final third - 236,000 tons/year	8,800	24

Costs of B-train not originally provided by AWL due to inability to haul in these routes; Ausenco assumed that B-train costs will be 75% of single truck cost for comparative purposes

AWL Basis

APPENDIX F.1 – CAPEX COST ESTIMATES

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Option	Port Site	Dalton Highway	Fairbanks Yard	Livengood Rail	Port MacKenzie Rail	Transportation CAPEX	Port CAPEX	Total CAPEX
Option 1	Anchorage		$17,015,001			$17,015,001	$45,437,072	$62,452,072
	Port Mac - Rail		$17,015,001		$194,328,896	$211,343,897	$73,633,831	$284,977,728
	Port Mac - Road		$17,015,001		$98,751,275	$115,766,276	$73,633,831	$189,400,107
	Whittier		$17,015,001			$17,015,001	$124,793,663	$141,808,664
	Seward		$17,015,001			$17,015,001	$51,993,163	$69,008,164
Option 2	Anchorage	$1,433,608,147	$17,015,001			$17,015,001	$45,437,072	$62,452,072
	Port Mac - Rail	$1,433,608,147	$17,015,001		$194,328,896	$211,343,897	$73,633,831	$284,977,728
	Port Mac - Road	$1,433,608,147	$17,015,001		$98,751,275	$115,766,276	$73,633,831	$189,400,107
	Whittier	$1,433,608,147	$17,015,001			$17,015,001	$124,793,663	$141,808,664
	Seward	$1,433,608,147	$17,015,001			$17,015,001	$51,993,163	$69,008,164
Option 3	Anchorage			$1,294,137,794		$1,294,137,794	$45,437,072	$1,339,574,865
	Port Mac - Rail			$1,294,137,794	$194,328,896	$1,488,466,690	$73,633,831	$1,562,100,521
	Port Mac - Road			$1,294,137,794	$98,751,275	$1,392,889,068	$73,633,831	$1,466,522,900
	Whittier			$1,294,137,794		$1,294,137,794	$124,793,663	$1,418,931,457
	Seward			$1,294,137,794		$1,294,137,794	$51,993,163	$1,346,130,956
Option 4	Anchorage	$1,433,608,147		$1,294,137,794		$2,727,745,941	$45,437,072	$2,773,183,012
	Port Mac - Rail	$1,433,608,147		$1,294,137,794	$194,328,896	$2,922,074,837	$73,633,831	$2,995,708,668
	Port Mac - Road	$1,433,608,147		$1,294,137,794	$98,751,275	$2,826,497,216	$73,633,831	$2,900,131,047
	Whittier	$1,433,608,147		$1,294,137,794		$2,727,745,941	$124,793,663	$2,852,539,604
	Seward	$1,433,608,147		$1,294,137,794		$2,727,745,941	$51,993,163	$2,779,739,104

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231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
1	**Dalton Highway Upgrades**	1.00	LS	$1,433,608,147.39	$1,433,608,147.39
1.1	Road Upgrades (MP 37-160)	1.00	LS	$1,201,488,683.07	$1,201,488,683.07
1.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$94,000,000.00	$94,000,000.00
1.1.2	Clearing and Grubbing	900.00	Acre	$11,971.11	$10,774,002.86
1.1.3	Cut/Excavation	18,300,000.00	CY	$14.74	$269,731,333.71
1.1.4	Selected Material - Assumes 90% Usable from Cut	22,130,000.00	CY	$29.18	$645,729,094.15
1.1.5	Subbase Fill	208,000.00	CY	$39.04	$8,120,502.29
1.1.6	Surface Course	137,000.00	CY	$54.99	$7,533,750.06
1.1.7	Design and Permitting (Assumes 6%)	1.00	LS	$62,100,000.00	$62,100,000.00
1.1.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$103,500,000.00	$103,500,000.00
1.2	Bridges	1.00	LS	$232,119,464.32	$232,119,464.32
1.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$17,170,000.00	$17,170,000.00
1.2.2	Hess Creek	140.00	LF	$41,934.22	$5,870,791.19
1.2.2.1	Demolition	140.00	LF	$3,217.47	$450,445.83
1.2.2.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.2.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.2.4	Superstructure	140.00	LF	$14,947.85	$2,092,699.55
1.2.2.5	Temporary Work/Access Trestle	140.00	LF	$8,309.22	$1,163,290.26
1.2.3	Yukon River	2,300.00	LF	$45,754.48	$105,235,296.88
1.2.3.1	Demolition	2,300.00	LF	$3,217.47	$7,400,181.47
1.2.3.2	Sheetpile Abutments	2.00	EA	$761,880.52	$1,523,761.05
1.2.3.3	Pile Supported Piers (Assumes 80' max spans)	30.00	EA	$827,530.80	$24,825,923.94
1.2.3.4	Ice Breaking Piers	28.00	EA	$684,520.39	$19,166,570.96
1.2.3.5	Superstructure	2,300.00	LF	$14,945.62	$34,374,926.84
1.2.3.6	Temporary Work/Access Trestle	2,300.00	LF	$7,801.71	$17,943,932.62
1.2.4	Ft Hamlin Hills Creek	50.00	LF	$59,270.98	$2,963,548.84
1.2.4.1	Demolition	50.00	LF	$3,217.47	$160,873.51
1.2.4.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.4.3	Pile Supported Piers (Assumes 80' max spans)	2.00	EA	$523,185.90	$1,046,371.80
1.2.4.4	Superstructure	50.00	LF	$14,940.77	$747,038.41
1.2.4.5	Temporary Work/Access Trestle	50.00	LF	$8,289.35	$414,467.26
1.2.5	Kanuti River	160.00	LF	$40,777.47	$6,524,395.33
1.2.5.1	Demolition	160.00	LF	$3,217.47	$514,795.23
1.2.5.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.5.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.5.4	Superstructure	160.00	LF	$14,942.32	$2,390,770.91
1.2.5.5	Temporary Work/Access Trestle	160.00	LF	$9,090.46	$1,454,473.63
1.2.6	Fish Creek	120.00	LF	$45,289.13	$5,434,695.39
1.2.6.1	Demolition	120.00	LF	$3,217.47	$386,096.42
1.2.6.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.6.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.6.4	Superstructure	120.00	LF	$14,944.90	$1,793,388.18
1.2.6.5	Temporary Work/Access Trestle	120.00	LF	$9,090.46	$1,090,855.22
1.2.7	South Fork Bonanza Creek	100.00	LF	$48,091.14	$4,809,113.91
1.2.7.1	Demolition	100.00	LF	$3,217.47	$321,747.02
1.2.7.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.7.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.7.4	Superstructure	100.00	LF	$14,940.77	$1,494,076.82
1.2.7.5	Temporary Work/Access Trestle	100.00	LF	$8,289.35	$828,934.51
1.2.8	North Fork Bonanza Creek	120.00	LF	$45,289.13	$5,434,695.39
1.2.8.1	Demolition	120.00	LF	$3,217.47	$386,096.42
1.2.8.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.8.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.8.4	Superstructure	120.00	LF	$14,944.90	$1,793,388.18
1.2.8.5	Temporary Work/Access Trestle	120.00	LF	$9,090.46	$1,090,855.22
1.2.9	Prospect Creek	130.00	LF	$43,595.19	$5,667,374.62

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231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
1.2.9.1	Demolition	130.00	LF	$3,217.47	$418,271.13
1.2.9.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.9.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.9.4	Superstructure	130.00	LF	$14,946.49	$1,943,043.86
1.2.9.5	Temporary Work/Access Trestle	130.00	LF	$8,782.34	$1,141,704.07
1.2.10	Jim River No.1	130.00	LF	$43,595.19	$5,667,374.62
1.2.10.1	Demolition	130.00	LF	$3,217.47	$418,271.13
1.2.10.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.10.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.10.4	Superstructure	130.00	LF	$14,946.49	$1,943,043.86
1.2.10.5	Temporary Work/Access Trestle	130.00	LF	$8,782.34	$1,141,704.07
1.2.11	Jim River No.2	130.00	LF	$43,595.19	$5,667,374.62
1.2.11.1	Demolition	130.00	LF	$3,217.47	$418,271.13
1.2.11.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.11.3	Pile Supported Piers (Assumes 80' max spans)	3.00	EA	$523,185.90	$1,569,557.70
1.2.11.4	Superstructure	130.00	LF	$14,946.49	$1,943,043.86
1.2.11.5	Temporary Work/Access Trestle	130.00	LF	$8,782.34	$1,141,704.07
1.2.12	Douglas Creek	50.00	LF	$59,270.98	$2,963,548.84
1.2.12.1	Demolition	50.00	LF	$3,217.47	$160,873.51
1.2.12.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.12.3	Pile Supported Piers (Assumes 80' max spans)	2.00	EA	$523,185.90	$1,046,371.80
1.2.12.4	Superstructure	50.00	LF	$14,940.77	$747,038.41
1.2.12.5	Temporary Work/Access Trestle	50.00	LF	$8,289.35	$414,467.26
1.2.13	Jim River No.3	180.00	LF	$41,293.49	$7,432,828.19
1.2.13.1	Demolition	180.00	LF	$3,217.47	$579,144.64
1.2.13.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.13.3	Pile Supported Piers (Assumes 80' max spans)	4.00	EA	$523,185.90	$2,092,743.60
1.2.13.4	Superstructure	180.00	LF	$14,944.90	$2,690,082.27
1.2.13.5	Temporary Work/Access Trestle	180.00	LF	$8,200.33	$1,476,059.82
1.2.14	South Fork Koyukuk River	430.00	LF	$49,042.85	$21,088,426.50
1.2.14.1	Demolition	430.00	LF	$3,217.47	$1,383,512.19
1.2.14.2	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
1.2.14.3	Pile Supported Piers (Assumes 80' max spans)	7.00	EA	$827,530.80	$5,792,715.59
1.2.14.4	Ice Breaking Piers	5.00	EA	$684,520.39	$3,422,601.96
1.2.14.5	Superstructure	430.00	LF	$14,945.38	$6,426,514.32
1.2.14.6	Temporary Work/Access Trestle	430.00	LF	$8,065.78	$3,468,284.58
1.2.15	Design and Permitting (Assumes 6%)	1.00	LS	$11,300,000.00	$11,300,000.00
1.2.16	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$18,890,000.00	$18,890,000.00
94					$1,433,608,147.39

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231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
2	**Livengood Yard**	1.00	LS	$18,439,192.26	$18,439,192.26
2.1	Livengood Intermodal Yard	1.00	LS	$5,383,892.26	$5,383,892.26
2.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$430,000.00	$430,000.00
2.1.2	Clearing and Grubbing	20.00	Acre	$11,971.11	$239,422.29
2.1.3	Cut/Excavation	133,000.00	CY	$14.74	$1,960,342.48
2.1.4	Subgrade Fill	5,000.00	CY	$23.94	$119,680.08
2.1.5	Structural Fill, Type A	33,150.00	CY	$28.89	$957,571.45
2.1.6	Aggregate Base Course	22,100.00	CY	$44.84	$990,875.96
2.1.7	Design and Permitting (Assumes 6%)	1.00	LS	$256,000.00	$256,000.00
2.1.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$430,000.00	$430,000.00
2.2	Materials Handling Equipment	1.00	LS	$5,920,000.00	$5,920,000.00
2.2.1	Container Reach Stacker	4.00	EA	$1,480,000.00	$5,920,000.00
2.3	Process Equipment	1.00	LS	$92,800.00	$92,800.00
2.3.1	Truck Scales	1.00	EA	$71,800.00	$71,800.00
2.3.2	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
2.4	Ancillary Equipment	1.00	LS	$215,000.00	$215,000.00
2.4.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
2.4.2	Forklift	1.00	EA	$65,000.00	$65,000.00
2.5	Administration	1.00	LS	$3,347,500.00	$3,347,500.00
2.5.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$112,500.00	$112,500.00
2.5.2	Admin Building	2,500.00	SF	$550.00	$1,375,000.00
2.5.3	Workshop	2,500.00	SF	$550.00	$1,375,000.00
2.5.4	Guard House	1.00	EA	$250,000.00	$250,000.00
2.5.5	Refuling Station	1.00	EA	$12,000.00	$12,000.00
2.5.6	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
2.5.7	Design and Permitting (Assumes 6%)	1.00	LS	$74,000.00	$74,000.00
2.5.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$124,000.00	$124,000.00
2.6	Electrical, Instrumentation and Controls	1.00	LS	$3,480,000.00	$3,480,000.00
2.6.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$262,000.00	$262,000.00
2.6.2	Transformers, Small	2.00	EA	$6,000.00	$12,000.00
2.6.3	Transformers, Medium	1.00	EA	$70,000.00	$70,000.00
2.6.4	Distribution Panel, Small	2.00	EA	$10,000.00	$20,000.00
2.6.5	Distribution Panel, Medium	1.00	EA	$30,000.00	$30,000.00
2.6.6	Lighting Control Panel	2.00	EA	$5,000.00	$10,000.00
2.6.7	Lighting (Road) - Poles, Foundations and Fittings - Assume 1 per 100 LF	5.00	EA	$25,000.00	$125,000.00
2.6.8	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	48.00	EA	$25,000.00	$1,200,000.00
2.6.9	RFID Inventory Control Package	0.85	LS	$1,400,000.00	$1,190,000.00
2.6.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
2.6.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
2.6.12	Design and Permitting (Assumes 6%)	1.00	LS	$173,000.00	$173,000.00
2.6.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$288,000.00	$288,000.00
41					$18,439,192.26

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
3	**Livengood Rail Spur**	1.00	LS	$1,297,047,793.56	$1,297,047,793.56
3.1	Railbed Embankment	1.00	LS	$884,742,186.78	$884,742,186.78
3.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$69,100,000.00	$69,100,000.00
3.1.2	Aggregate Minsite Development	4.00	EA	$1,056,368.74	$4,225,474.97
3.1.3	Clearing and Grubbing	950.00	Acre	$11,971.11	$11,372,558.57
3.1.4	Cut/Excavation	5,360,000.00	CY	$14.74	$79,003,275.89
3.1.5	Subgrade Fill - Assumes 90% Usable from Cut	24,530,000.00	CY	$22.40	$549,509,199.34
3.1.6	Structural Fill, Type A	554,000.00	CY	$28.89	$16,002,853.13
3.1.7	Aggregate Base Course	310,000.00	CY	$44.84	$13,899,165.11
3.1.8	Cross Drainage Culverts - Assumed @ 500' max spacing	635.00	EA	$31,590.02	$20,059,659.77
3.1.9	Design and Permitting (Assumes 6%)	1.00	LS	$45,600,000.00	$45,600,000.00
3.1.10	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$75,970,000.00	$75,970,000.00
3.2	Mainline Rail	59.80	Mile	$2,559,273.75	$153,044,570.03
3.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$11,800,000.00	$11,800,000.00
3.2.2	Provide and Install Rail Ties	59.80	Mile	$887,710.66	$53,085,097.30
3.2.3	Mainline Ballast	149,000.00	CY	$121.84	$18,153,566.46
3.2.4	Provide and Install Rail	59.80	Mile	$823,342.91	$49,235,906.27
3.2.5	Design and Permitting (Assumes 6%)	1.00	LS	$7,790,000.00	$7,790,000.00
3.2.6	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$12,980,000.00	$12,980,000.00
3.3	Bridges	1.00	LS	$232,110,359.53	$232,110,359.53
3.3.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$18,200,000.00	$18,200,000.00
3.3.2	Goldstream Creek	720.00	LF	$25,147.74	$18,106,371.55
3.3.2.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.2.2	Pile Supported Piers (Assumes 30' max spans)	23.00	EA	$296,601.96	$6,821,845.15
3.3.2.3	Superstructure	720.00	LF	$7,202.84	$5,186,046.81
3.3.2.4	Temporary Work/Access Trestle	720.00	LF	$7,644.00	$5,503,681.73
3.3.3	Pond/Lake	650.00	LF	$25,377.28	$16,495,234.23
3.3.3.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.3.2	Pile Supported Piers (Assumes 30' max spans)	21.00	EA	$296,601.96	$6,228,641.22
3.3.3.3	Superstructure	650.00	LF	$7,206.58	$4,684,278.37
3.3.3.4	Temporary Work/Access Trestle	650.00	LF	$7,673.10	$4,987,516.78
3.3.4	Pond/Lake	700.00	LF	$24,291.34	$17,003,939.10
3.3.4.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.4.2	Pile Supported Piers (Assumes 30' max spans)	23.00	EA	$296,601.96	$6,821,845.15
3.3.4.3	Superstructure	700.00	LF	$7,208.12	$5,045,684.40
3.3.4.4	Temporary Work/Access Trestle	700.00	LF	$6,488.02	$4,541,611.69
3.3.5	Unnamed Stream	40.00	LF	$31,171.03	$1,246,841.09
3.3.5.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.5.2	Superstructure	40.00	LF	$7,210.62	$288,424.82
3.3.5.3	Temporary Work/Access Trestle	40.00	LF	$9,090.46	$363,618.41
3.3.6	Chatanika River	130.00	LF	$28,454.28	$3,699,056.33
3.3.6.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.6.2	Pile Supported Piers (Assumes 30' max spans)	4.00	EA	$296,601.96	$1,186,407.85
3.3.6.3	Superstructure	130.00	LF	$7,202.84	$936,369.56
3.3.6.4	Temporary Work/Access Trestle	130.00	LF	$7,549.85	$981,481.05
3.3.7	Pond/Lake	270.00	LF	$25,652.56	$6,926,192.08
3.3.7.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.7.2	Pile Supported Piers (Assumes 30' max spans)	8.00	EA	$296,601.96	$2,372,815.70
3.3.7.3	Superstructure	270.00	LF	$7,202.84	$1,944,767.55
3.3.7.4	Temporary Work/Access Trestle	270.00	LF	$7,458.56	$2,013,810.95
3.3.8	Pond/Lake	175.00	LF	$26,449.81	$4,628,717.54
3.3.8.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.8.2	Pile Supported Piers (Assumes 30' max spans)	5.00	EA	$296,601.96	$1,483,009.82
3.3.8.3	Superstructure	175.00	LF	$7,202.84	$1,260,497.49
3.3.8.4	Temporary Work/Access Trestle	175.00	LF	$7,373.79	$1,290,412.38
3.3.9	Pond/Lake	130.00	LF	$28,458.02	$3,699,542.44

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
3.3.9.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.9.2	Pile Supported Piers (Assumes 30' max spans)	4.00	EA	$296,601.96	$1,186,407.85
3.3.9.3	Superstructure	130.00	LF	$7,206.58	$936,855.67
3.3.9.4	Temporary Work/Access Trestle	130.00	LF	$7,549.85	$981,481.05
3.3.10	Washington Creek	500.00	LF	$25,532.23	$12,766,116.08
3.3.10.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.10.2	Pile Supported Piers (Assumes 30' max spans)	16.00	EA	$296,601.96	$4,745,631.41
3.3.10.3	Superstructure	500.00	LF	$7,202.92	$3,601,460.29
3.3.10.4	Temporary Work/Access Trestle	500.00	LF	$7,648.45	$3,824,226.52
3.3.11	Tatalina River 1	1,000.00	LF	$25,314.07	$25,314,069.98
3.3.11.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.11.2	Pile Supported Piers (Assumes 30' max spans)	33.00	EA	$296,601.96	$9,787,864.78
3.3.11.3	Superstructure	1,000.00	LF	$7,202.84	$7,202,842.79
3.3.11.4	Temporary Work/Access Trestle	1,000.00	LF	$7,728.56	$7,728,564.54
3.3.12	Tatalina River 2	300.00	LF	$25,571.79	$7,671,537.37
3.3.12.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.12.2	Pile Supported Piers (Assumes 30' max spans)	9.00	EA	$296,601.96	$2,669,417.67
3.3.12.3	Superstructure	300.00	LF	$7,202.84	$2,160,852.84
3.3.12.4	Temporary Work/Access Trestle	300.00	LF	$7,488.23	$2,246,469.01
3.3.13	Tatalina River 3	200.00	LF	$26,563.90	$5,312,779.76
3.3.13.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.13.2	Pile Supported Piers (Assumes 30' max spans)	6.00	EA	$296,601.96	$1,779,611.78
3.3.13.3	Superstructure	200.00	LF	$7,203.62	$1,440,724.11
3.3.13.4	Temporary Work/Access Trestle	200.00	LF	$7,488.23	$1,497,646.00
3.3.14	Tatalina River 4	700.00	LF	$25,515.17	$17,860,617.00
3.3.14.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.14.2	Pile Supported Piers (Assumes 30' max spans)	23.00	EA	$296,601.96	$6,821,845.15
3.3.14.3	Superstructure	700.00	LF	$7,202.84	$5,041,989.96
3.3.14.4	Temporary Work/Access Trestle	700.00	LF	$7,717.12	$5,401,984.03
3.3.15	Eagle Creek	60.00	LF	$29,814.77	$1,788,886.50
3.3.15.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.15.2	Pile Supported Piers (Assumes 30' max spans)	1.00	EA	$296,601.96	$296,601.96
3.3.15.3	Superstructure	60.00	LF	$7,202.84	$432,170.57
3.3.15.4	Temporary Work/Access Trestle	60.00	LF	$7,755.27	$465,316.10
3.3.16	Shorty Creek	30.00	LF	$40,957.03	$1,228,711.04
3.3.16.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.16.2	Superstructure	30.00	LF	$7,204.79	$216,143.62
3.3.16.3	Temporary Work/Access Trestle	30.00	LF	$13,925.65	$417,769.56
3.3.17	Tolovana River 1	100.00	LF	$29,541.39	$2,954,138.81
3.3.17.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.17.2	Pile Supported Piers (Assumes 30' max spans)	3.00	EA	$296,601.96	$889,805.89
3.3.17.3	Superstructure	100.00	LF	$7,207.12	$720,712.06
3.3.17.4	Temporary Work/Access Trestle	100.00	LF	$7,488.23	$748,823.00
3.3.18	Tolovana River 2	100.00	LF	$29,541.39	$2,954,138.81
3.3.18.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.18.2	Pile Supported Piers (Assumes 30' max spans)	3.00	EA	$296,601.96	$889,805.89
3.3.18.3	Superstructure	100.00	LF	$7,207.12	$720,712.06
3.3.18.4	Temporary Work/Access Trestle	100.00	LF	$7,488.23	$748,823.00
3.3.19	Tolovana River 3	100.00	LF	$29,541.39	$2,954,138.81
3.3.19.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.19.2	Pile Supported Piers (Assumes 30' max spans)	3.00	EA	$296,601.96	$889,805.89
3.3.19.3	Superstructure	100.00	LF	$7,207.12	$720,712.06
3.3.19.4	Temporary Work/Access Trestle	100.00	LF	$7,488.23	$748,823.00
3.3.20	Pond/Lake	180.00	LF	$26,058.37	$4,690,506.18
3.3.20.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.20.2	Pile Supported Piers (Assumes 30' max spans)	5.00	EA	$296,601.96	$1,483,009.82

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CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
3.3.20.3	Superstructure	180.00	LF	$7,204.79	$1,296,861.70
3.3.20.4	Temporary Work/Access Trestle	180.00	LF	$7,310.20	$1,315,836.80
3.3.21	Pond/Lake	120.00	LF	$29,803.44	$3,576,412.39
3.3.21.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.21.2	Pile Supported Piers (Assumes 30' max spans)	4.00	EA	$296,601.96	$1,186,407.85
3.3.21.3	Superstructure	120.00	LF	$7,204.79	$864,574.47
3.3.21.4	Temporary Work/Access Trestle	120.00	LF	$7,755.27	$930,632.21
3.3.22	Pond/Lake	100.00	LF	$29,537.11	$2,953,711.03
3.3.22.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.22.2	Pile Supported Piers (Assumes 30' max spans)	3.00	EA	$296,601.96	$889,805.89
3.3.22.3	Superstructure	100.00	LF	$7,202.84	$720,284.28
3.3.22.4	Temporary Work/Access Trestle	100.00	LF	$7,488.23	$748,823.00
3.3.23	Tolovana River 4	600.00	LF	$25,208.32	$15,124,990.36
3.3.23.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.23.2	Pile Supported Piers (Assumes 30' max spans)	19.00	EA	$296,601.96	$5,635,437.30
3.3.23.3	Superstructure	600.00	LF	$7,202.84	$4,321,705.68
3.3.23.4	Temporary Work/Access Trestle	600.00	LF	$7,621.75	$4,573,049.52
3.3.24	Ready Boullion Creek	100.00	LF	$29,537.11	$2,953,711.03
3.3.24.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
3.3.24.2	Pile Supported Piers (Assumes 30' max spans)	3.00	EA	$296,601.96	$889,805.89
3.3.24.3	Superstructure	100.00	LF	$7,202.84	$720,284.28
3.3.24.4	Temporary Work/Access Trestle	100.00	LF	$7,488.23	$748,823.00
3.3.25	Design and Permitting (Assumes 6%)	1.00	LS	$12,000,000.00	$12,000,000.00
3.3.26	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$20,000,000.00	$20,000,000.00
3.4	Livengood Intermodal Yard	1.00	LS	$14,095,377.23	$14,095,377.23
3.4.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$1,120,000.00	$1,120,000.00
3.4.2	Clearing and Grubbing	20.00	Acre	$11,971.11	$239,422.29
3.4.3	Cut/Excavation	133,000.00	CY	$14.74	$1,960,342.48
3.4.4	Subgrade Fill	5,000.00	CY	$23.94	$119,680.08
3.4.5	Structural Fill, Type A	33,150.00	CY	$28.89	$957,571.45
3.4.6	Aggregate Base Course	22,100.00	CY	$44.84	$990,875.96
3.4.7	Rail	1.30	Mile	$1,801,911.51	$2,342,484.97
3.4.7.1	Provide and Install Rail Ties	1.30	Mile	$887,710.66	$1,154,023.85
3.4.7.2	Mainline Ballast	2,100.00	CY	$123.21	$258,745.50
3.4.7.3	Provide and Install Rail	1.30	Mile	$715,165.86	$929,715.61
3.4.8	Terminal Facilities	1.00	LS	$4,575,000.00	$4,575,000.00
3.4.8.1	Train Maintenance Building	3,000.00	SF	$700.00	$2,100,000.00
3.4.8.2	Operations Building	2,000.00	SF	$550.00	$1,100,000.00
3.4.8.3	Maintenance/Equipment Building	2,500.00	SF	$550.00	$1,375,000.00
3.4.9	Design and Permitting (Assumes 6%)	1.00	LS	$670,000.00	$670,000.00
3.4.10	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$1,120,000.00	$1,120,000.00
3.5	Materials Handling Equipment	1.00	LS	$5,920,000.00	$5,920,000.00
3.5.1	Container Reach Stacker	4.00	EA	$1,480,000.00	$5,920,000.00
3.6	Process Equipment	1.00	LS	$92,800.00	$92,800.00
3.6.1	Truck Scales	1.00	EA	$71,800.00	$71,800.00
3.6.2	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
3.7	Ancillary Equipment	1.00	LS	$215,000.00	$215,000.00
3.7.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
3.7.2	Forklift	1.00	EA	$65,000.00	$65,000.00
3.8	Administration	1.00	LS	$3,347,500.00	$3,347,500.00
3.8.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$112,500.00	$112,500.00
3.8.2	Admin Building	2,500.00	SF	$550.00	$1,375,000.00
3.8.3	Workshop	2,500.00	SF	$550.00	$1,375,000.00
3.8.4	Guard House	1.00	EA	$250,000.00	$250,000.00
3.8.5	Refuling Station	1.00	EA	$12,000.00	$12,000.00
3.8.6	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00

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CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
3.8.7	Design and Permitting (Assumes 6%)	1.00	LS	$74,000.00	$74,000.00
3.8.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$124,000.00	$124,000.00
3.9	Electrical, Instrumentation and Controls	1.00	LS	$3,480,000.00	$3,480,000.00
3.9.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$262,000.00	$262,000.00
3.9.2	Transformers, Small	2.00	EA	$6,000.00	$12,000.00
3.9.3	Transformers, Medium	1.00	EA	$70,000.00	$70,000.00
3.9.4	Distribution Panel, Small	2.00	EA	$10,000.00	$20,000.00
3.9.5	Distribution Panel, Medium	1.00	EA	$30,000.00	$30,000.00
3.9.6	Lighting Control Panel	2.00	EA	$5,000.00	$10,000.00
3.9.7	Lighting (Road) - Poles, Foundations and Fittings - Assume 1 per 100 LF	5.00	EA	$25,000.00	$125,000.00
3.9.8	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	48.00	EA	$25,000.00	$1,200,000.00
3.9.9	RFID Inventory Control Package	0.85	LS	$1,400,000.00	$1,190,000.00
3.9.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
3.9.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
3.9.12	Design and Permitting (Assumes 6%)	1.00	LS	$173,000.00	$173,000.00
3.9.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$288,000.00	$288,000.00
184					$1,297,047,793.56

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CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
4	**Fairbanks Intermodal Yard**	1.00	LS	$17,015,000.98	$17,015,000.98
4.1	Civil Works	1.00	LS	$2,822,430.33	$2,822,430.33
4.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$220,000.00	$220,000.00
4.1.2	Site Preparation - Survey, Clearing and Grubbing	8.70	Acre	$15,961.49	$138,864.93
4.1.3	Gravel Yard	2.50	Acre	$0.00	$0.00
4.1.4	Concrete Hardstands	1,250.00	CY	$1,096.06	$1,370,075.14
4.1.5	Yard Access Road (2-way)	2,600.00	LF	$213.02	$553,864.97
4.1.5.1	Subbase	3,080.00	CY	$39.04	$120,245.90
4.1.5.2	Aggregate Base Course	1,027.00	CY	$54.99	$56,475.63
4.1.5.3	Asphalt Concrete Surfacing	1,027.00	CY	$367.23	$377,143.44
4.1.6	Truck Turnaround	1.00	LS	$150,625.29	$150,625.29
4.1.6.1	Subbase	830.00	CY	$39.04	$32,403.93
4.1.6.2	Aggregate Base Course	280.00	CY	$54.99	$15,397.45
4.1.6.3	Asphalt Concrete Surfacing	280.00	CY	$367.23	$102,823.92
4.1.7	Design and Permitting (Assumes 6%)	1.00	LS	$146,000.00	$146,000.00
4.1.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$243,000.00	$243,000.00
4.2	On-Site Rail	1.00	LS	$1,869,270.65	$1,869,270.65
4.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$146,000.00	$146,000.00
4.2.2	Rail Track	2,200.00	LF	$376.83	$829,028.38
4.2.2.1	Provide and Install Rail Ties	0.42	Mile	$887,710.66	$372,838.48
4.2.2.2	Mainline Ballast	906.02	CY	$121.84	$110,385.88
4.2.2.3	Provide and Install Rail	0.42	Mile	$823,342.91	$345,804.02
4.2.3	Turnouts and Switches	3.00	EA	$212,414.09	$637,242.27
4.2.3.1	Rail Track - Turnouts	1,500.00	LF	$374.83	$562,242.27
4.2.3.2	Switches	3.00	EA	$25,000.00	$75,000.00
4.2.4	Design and Permitting (Assumes 6%)	1.00	LS	$97,000.00	$97,000.00
4.2.5	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$160,000.00	$160,000.00
4.3	Materials Handling Equipment	1.00	LS	$7,400,000.00	$7,400,000.00
4.3.1	Container Reach Stacker	5.00	EA	$1,480,000.00	$7,400,000.00
4.4	Process Equipment	1.00	LS	$71,800.00	$71,800.00
4.4.1	Truck Scales	1.00	EA	$71,800.00	$71,800.00
4.5	Ancillary Equipment	1.00	LS	$75,000.00	$75,000.00
4.5.1	Utility Truck	1.00	EA	$75,000.00	$75,000.00
4.6	Administration	1.00	LS	$1,435,500.00	$1,435,500.00
4.6.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$112,500.00	$112,500.00
4.6.2	Admin Building	2,000.00	SF	$550.00	$1,100,000.00
4.6.3	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
4.6.4	Design and Permitting (Assumes 6%)	1.00	LS	$74,000.00	$74,000.00
4.6.5	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$124,000.00	$124,000.00
4.7	Electrical, Instrumentation and Controls	1.00	LS	$3,341,000.00	$3,341,000.00
4.7.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$262,000.00	$262,000.00
4.7.2	Transformers, Small	3.00	EA	$6,000.00	$18,000.00
4.7.3	Transformers, Medium	1.00	EA	$70,000.00	$70,000.00
4.7.4	Distribution Panel, Small	3.00	EA	$10,000.00	$30,000.00
4.7.5	Distribution Panel, Medium	1.00	EA	$30,000.00	$30,000.00
4.7.6	Lighting Control Panel	1.00	EA	$5,000.00	$5,000.00
4.7.7	Lighting (Road) - Poles, Foundations and Fittings	27.00	EA	$25,000.00	$675,000.00
4.7.8	Ligting (Yard) - Poles, Foundations and Fittings	20.00	EA	$25,000.00	$500,000.00
4.7.9	RFID Inventory Control Package	0.85	LS	$1,400,000.00	$1,190,000.00
4.7.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
4.7.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
4.7.12	Design and Permitting (Assumes 6%)	1.00	LS	$173,000.00	$173,000.00
4.7.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$288,000.00	$288,000.00
53					$17,015,000.98

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CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
5	**Port MacKenzie - Rail Extension - ARRC Estimate**	1.00	LS	$194,328,896.00	$194,328,896.00
5.1	Segment 2 Civil Construction	1.00	LS	$42,142,851.00	$42,142,851.00
5.2	Grade Preparation adn Sub-Ballast	1.00	LS	$24,546,250.00	$24,546,250.00
5.3	Fiber Optics and Telecommunication	1.00	LS	$6,225,895.00	$6,225,895.00
5.4	Track Construction	1.00	LS	$98,493,900.00	$98,493,900.00
5.5	Terminal Facilities	1.00	LS	$12,000,000.00	$12,000,000.00
5.6	Environmental Mitigation	1.00	LS	$1,120,000.00	$1,120,000.00
5.7	Engineering/Survey/Construction Management/Legal	1.00	LS	$9,800,000.00	$9,800,000.00
8					$194,328,896.00

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CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
6	**Port MacKenzie - Houston - Rail Spur Road**	1.00	LS	$98,751,274.88	$98,751,274.88
6.1	Houston Intermodal/Storage Yard	1.00	LS	$1,726,205.47	$1,726,205.47
6.1.1	Clearing and Grubbing	3.00	Acre	$11,971.11	$35,913.34
6.1.2	Cut/Excavation	150.00	CY	$14.74	$2,210.91
6.1.3	Subgrade Fill	16,000.00	CY	$34.09	$545,454.02
6.1.4	Aggregate Base Course	2,300.00	CY	$54.99	$126,479.02
6.1.5	Aggregate Surface Course	1,500.00	CY	$60.49	$90,736.31
6.1.6	Concrete Hardstands	530.00	CY	$1,096.06	$580,911.86
6.1.7	Fencing and Gates	1,630.00	LF	$211.35	$344,500.00
6.2	Segment 2 - Embankment / Road	1.00	LS	$51,977,126.21	$51,977,126.21
6.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$4,100,000.00	$4,100,000.00
6.2.2	Clearing and Grubbing	43.50	Acre	$11,971.11	$520,743.47
6.2.3	Excavation and Disposal	1,230,000.00	CY	$14.74	$18,129,483.09
6.2.4	Subgrade Fill	303,000.00	CY	$34.09	$10,329,535.54
6.2.5	Structural Fill, Type A	105,000.00	CY	$39.04	$4,099,292.02
6.2.6	Aggregate Base Course	58,500.00	CY	$54.99	$3,216,966.27
6.2.7	Cross Drainage Culverts - Assumed @ 500' max spacing	75.00	EA	$31,590.02	$2,369,251.15
6.2.8	Bridge - Reddane Drive	1.00	LS	$2,043,854.67	$2,043,854.67
6.2.8.1	Sheetpile Abutments	2.00	EA	$297,398.93	$594,797.86
6.2.8.2	Pile Supported Piers (Assumes 30' max spans)	1.00	EA	$296,601.96	$296,601.96
6.2.8.3	Superstructure	160.00	LF	$7,202.84	$1,152,454.85
6.2.9	Design and Permitting (Assumes 6%)	1.00	LS	$2,688,000.00	$2,688,000.00
6.2.10	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$4,480,000.00	$4,480,000.00
6.3	Grade Preparation/ Road Surfacing - Segments 1,3,4,5,6	1.00	LS	$29,624,157.69	$29,624,157.69
6.3.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$2,320,000.00	$2,320,000.00
6.3.2	Grade Preparation - Clearing/Grubbing	1.00	LS	$355,656.00	$355,656.00
6.3.3	Structural Fill, Type A	302,000.00	CY	$39.04	$11,790,344.66
6.3.4	Aggregate Base Course	202,000.00	CY	$54.99	$11,108,157.03
6.3.5	Design and Permitting (Assumes 6%)	1.00	LS	$1,500,000.00	$1,500,000.00
6.3.6	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$2,550,000.00	$2,550,000.00
6.4	On-Site Rail in Houston	1.00	LS	$5,812,285.51	$5,812,285.51
6.4.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$456,000.00	$456,000.00
6.4.2	Rail Track	10,400.00	LF	$376.83	$3,919,043.23
6.4.3	Turnouts and Switches	3.00	EA	$212,414.09	$637,242.27
6.4.3.1	Rail Track - Turnouts	1,500.00	LF	$374.83	$562,242.27
6.4.3.2	Switches	3.00	EA	$25,000.00	$75,000.00
6.4.4	Design and Permitting (Assumes 6%)	1.00	LS	$300,000.00	$300,000.00
6.4.5	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$500,000.00	$500,000.00
6.5	Materials Handling Equipment	1.00	LS	$5,920,000.00	$5,920,000.00
6.5.1	Container Reach Stacker	4.00	EA	$1,480,000.00	$5,920,000.00
6.6	Ancillary Equipment	1.00	LS	$75,000.00	$75,000.00
6.6.1	Utility Truck	1.00	EA	$75,000.00	$75,000.00
6.7	Administration	1.00	LS	$1,147,500.00	$1,147,500.00
6.7.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$112,500.00	$112,500.00
6.7.2	Admin Building	1,000.00	SF	$550.00	$550,000.00
6.7.3	Guard House	1.00	EA	$250,000.00	$250,000.00
6.7.4	Refuling Station	1.00	EA	$12,000.00	$12,000.00
6.7.5	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
6.7.6	Design and Permitting (Assumes 6%)	1.00	LS	$74,000.00	$74,000.00
6.7.7	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$124,000.00	$124,000.00
6.8	Electrical, Instrumentation and Controls	1.00	LS	$2,469,000.00	$2,469,000.00
6.8.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$262,000.00	$262,000.00
6.8.2	Transformers, Small	1.00	EA	$6,000.00	$6,000.00
6.8.3	Distribution Panel, Small	1.00	EA	$10,000.00	$10,000.00
6.8.4	Lighting Control Panel	1.00	EA	$5,000.00	$5,000.00
6.8.5	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	23.00	EA	$25,000.00	$575,000.00

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
6.8.6	RFID Inventory Control Package	0.75	LS	$1,400,000.00	$1,050,000.00
6.8.7	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
6.8.8	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
6.8.9	Design and Permitting (Assumes 6%)	1.00	LS	$173,000.00	$173,000.00
6.8.10	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$288,000.00	$288,000.00
61					$98,751,274.88

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231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
7	**Port of Alaska (Anchorage)**	1.00	LS	$45,437,071.52	$45,437,071.52
7.1	Civil Works	1.00	LS	$5,438,071.52	$5,438,071.52
7.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$426,000.00	$426,000.00
7.1.2	Site Preparation - Survey, Clearing and Grubbing	15.00	Acre	$15,961.49	$239,422.29
7.1.3	Gravel Yard	9.00	Acre	$76,884.79	$691,963.07
7.1.3.1	Aggregate Base Course	7,260.00	CY	$54.99	$399,233.76
7.1.3.2	Aggregate Surface Course	4,839.23	CY	$60.49	$292,729.31
7.1.4	Concrete Hardstands	2,385.00	CY	$1,096.06	$2,614,103.37
7.1.5	Yard Access Road (1-way)	2,600.00	LF	$159.74	$415,332.21
7.1.5.1	Subbase	2,311.00	CY	$39.04	$90,223.47
7.1.5.2	Aggregate Base Course	770.00	CY	$54.99	$42,342.97
7.1.5.3	Asphalt Concrete Surfacing	770.00	CY	$367.23	$282,765.77
7.1.6	Truck Turnaround	2.00	EA	$150,625.29	$301,250.58
7.1.6.1	Subbase	1,660.00	CY	$39.04	$64,807.85
7.1.6.2	Aggregate Base Course	560.00	CY	$54.99	$30,794.89
7.1.6.3	Asphalt Concrete Surfacing	560.00	CY	$367.23	$205,647.83
7.1.7	Design and Permitting (Assumes 6%)	1.00	LS	$281,000.00	$281,000.00
7.1.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$469,000.00	$469,000.00
7.2	Materials Handling Equipment	1.00	LS	$33,220,500.00	$33,220,500.00
7.2.1	Yard Haul Tractor	9.00	EA	$177,000.00	$1,593,000.00
7.2.2	Yard Haul Trailer	9.00	EA	$110,000.00	$990,000.00
7.2.3	Container Reach Stacker	5.00	EA	$1,480,000.00	$7,400,000.00
7.2.4	Revolver Attachment	2.00	EA	$380,000.00	$760,000.00
7.2.5	Bulk Material Container	3,330.00	EA	$6,750.00	$22,477,500.00
7.3	Process Equipment	1.00	LS	$21,000.00	$21,000.00
7.3.1	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
7.4	Ancillary Equipment	1.00	LS	$215,000.00	$215,000.00
7.4.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
7.4.2	Forklift	1.00	EA	$65,000.00	$65,000.00
7.5	Administration	1.00	LS	$1,435,500.00	$1,435,500.00
7.5.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$112,500.00	$112,500.00
7.5.2	Admin Building	2,000.00	SF	$550.00	$1,100,000.00
7.5.3	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
7.5.4	Design and Permitting (Assumes 6%)	1.00	LS	$74,000.00	$74,000.00
7.5.5	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$124,000.00	$124,000.00
7.6	Electrical, Instrumentation and Controls	1.00	LS	$5,107,000.00	$5,107,000.00
7.6.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$400,000.00	$400,000.00
7.6.2	Transformers, Small	3.00	EA	$6,000.00	$18,000.00
7.6.3	Transformers, Medium	1.00	EA	$70,000.00	$70,000.00
7.6.4	Distribution Panel, Small	3.00	EA	$10,000.00	$30,000.00
7.6.5	Distribution Panel, Medium	1.00	EA	$30,000.00	$30,000.00
7.6.6	Lighting Control Panel	1.00	EA	$5,000.00	$5,000.00
7.6.7	Lighting (Road) - Poles, Foundations and Fittings - Assume 1 per 100 LF	27.00	EA	$25,000.00	$675,000.00
7.6.8	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	67.00	EA	$25,000.00	$1,675,000.00
7.6.9	RFID Inventory Control Package	1.00	LS	$1,400,000.00	$1,400,000.00
7.6.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
7.6.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
7.6.12	Design and Permitting (Assumes 6%)	1.00	LS	$264,000.00	$264,000.00
7.6.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$440,000.00	$440,000.00
49					$45,437,071.52

 akdown Structure (CBS) Register

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
8	**Port MacKenzie**	1.00	LS	$74,522,831.13	$74,522,831.13
8.1	Dock Upgrades	1.00	LS	$14,873,635.24	$14,873,635.24
8.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$1,160,000.00	$1,160,000.00
8.1.2	Demolition	1.00	LS	$902,112.20	$902,112.20
8.1.2.1	Ship Loader Removal	1.00	LS	$450,445.83	$450,445.83
8.1.2.2	Dolphin Demolition	1.00	LS	$451,666.37	$451,666.37
8.1.3	Breasting Dolphins	2.00	EA	$1,188,506.99	$2,377,013.99
8.1.3.1	Provide and Install Piles	10.00	EA	$150,102.47	$1,501,024.67
8.1.3.2	CIP Reinforced Concrete Infill of Pile	10.00	EA	$40,309.95	$403,099.49
8.1.3.3	Provide and Install Steel Cap	2.00	EA	$236,444.91	$472,889.83
8.1.4	Fenders	2.00	EA	$724,703.04	$1,449,406.09
8.1.4.1	Provide and Install Piles	4.00	EA	$140,602.47	$562,409.87
8.1.4.2	Provide and Install Fender Panel	2.00	EA	$443,498.11	$886,996.22
8.1.5	Mooring Dolphins	4.00	EA	$1,188,506.99	$4,754,027.97
8.1.5.1	Provide and Install Piles	20.00	EA	$150,102.47	$3,002,049.34
8.1.5.2	CIP Reinforced Concrete Infill of Pile	20.00	EA	$40,309.95	$806,198.97
8.1.5.3	Provide and Install Steel Cap	4.00	EA	$236,444.91	$945,779.66
8.1.6	Provide and Install Catwalks	520.00	LF	$4,196.30	$2,182,075.00
8.1.7	Design and Permitting (Assumes 6%)	1.00	LS	$769,000.00	$769,000.00
8.1.8	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$1,280,000.00	$1,280,000.00
8.2	Civil Works	1.00	LS	$10,311,695.88	$10,311,695.88
8.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$800,000.00	$800,000.00
8.2.2	Site Preparation - Survey, Clearing and Grubbing	37.70	Acre	$15,961.49	$601,748.01
8.2.3	Rail Loop Access Road	1.00	LS	$1,225,550.13	$1,225,550.13
8.2.3.1	Clearing and Grubbing	4.50	Acre	$11,971.11	$53,870.01
8.2.3.2	Cut/Excavation	67,500.00	CY	$14.74	$994,910.66
8.2.3.3	Subgrade Fill	200.00	CY	$27.75	$5,549.37
8.2.3.4	Structural Fill, Type A	3,600.00	CY	$32.70	$117,708.58
8.2.3.5	Surface Course	1,100.00	CY	$48.65	$53,511.51
8.2.4	Concrete Hardstands	2,385.00	CY	$1,096.06	$2,614,103.37
8.2.5	In-Yard Access Road (1-way)	2,500.00	LF	$159.74	$399,357.90
8.2.5.1	Subbase	2,222.12	CY	$39.04	$86,753.33
8.2.5.2	Aggregate Base Course	740.38	CY	$54.99	$40,714.40
8.2.5.3	Asphalt Concrete Surfacing	740.38	CY	$367.23	$271,890.16
8.2.6	In-Yard Access Road (1-way) - Overflow	3,100.00	LF	$159.74	$495,203.79
8.2.6.1	Subbase	2,755.42	CY	$39.04	$107,574.13
8.2.6.2	Aggregate Base Course	918.08	CY	$54.99	$50,485.85
8.2.6.3	Asphalt Concrete Surfacing	918.08	CY	$367.23	$337,143.80
8.2.7	In-Yard Access Road (2-way)	7,500.00	LF	$213.02	$1,597,687.40
8.2.7.1	Subbase	8,884.62	CY	$39.04	$346,863.17
8.2.7.2	Aggregate Base Course	2,962.50	CY	$54.99	$162,910.47
8.2.7.3	Asphalt Concrete Surfacing	2,962.50	CY	$367.23	$1,087,913.76
8.2.8	In-Yard Access Road (2-way) - Overflow	800.00	LF	$213.02	$170,419.99
8.2.8.1	Subbase	947.69	CY	$39.04	$36,998.74
8.2.8.2	Aggregate Base Course	316.00	CY	$54.99	$17,377.12
8.2.8.3	Asphalt Concrete Surfacing	316.00	CY	$367.23	$116,044.13
8.2.9	In-Yard Truck Turnaround	1.00	EA	$150,625.29	$150,625.29
8.2.9.1	Subbase	830.00	CY	$39.04	$32,403.93
8.2.9.2	Aggregate Base Course	280.00	CY	$54.99	$15,397.45
8.2.9.3	Asphalt Concrete Surfacing	280.00	CY	$367.23	$102,823.92
8.2.10	Fencing and Gates	4,900.00	LF	$170.41	$835,000.00
8.2.10.1	Fencing	4,900.00	LF	$150.00	$735,000.00
8.2.10.2	Gate	1.00	EA	$100,000.00	$100,000.00
8.2.11	Design and Permitting (Assumes 6%)	1.00	LS	$533,000.00	$533,000.00
8.2.12	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$889,000.00	$889,000.00
8.3	Materials Handling Equipment	1.00	LS	$36,011,500.00	$36,011,500.00

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
8.3.1	Mobile Harbor Crane - LHM 550 or Eqiv.	1.00	EA	$4,800,000.00	$4,800,000.00
8.3.2	Yard Haul Tractor	2.00	EA	$177,000.00	$354,000.00
8.3.3	Yard Haul Trailer	2.00	EA	$110,000.00	$220,000.00
8.3.4	Container Reach Stacker	5.00	EA	$1,480,000.00	$7,400,000.00
8.3.5	Revolver Attachment	2.00	EA	$380,000.00	$760,000.00
8.3.6	Bulk Material Container	3,330.00	EA	$6,750.00	$22,477,500.00
8.4	Process Equipment	1.00	LS	$21,000.00	$21,000.00
8.4.1	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
8.5	Ancillary Equipment	1.00	LS	$215,000.00	$215,000.00
8.5.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
8.5.2	Forklift	1.00	EA	$65,000.00	$65,000.00
8.6	Administration	1.00	LS	$3,382,000.00	$3,382,000.00
8.6.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$265,000.00	$265,000.00
8.6.2	Workshop	2,500.00	SF	$550.00	$1,375,000.00
8.6.3	Guard House	3.00	EA	$250,000.00	$750,000.00
8.6.4	Refuling Station	1.00	EA	$500,000.00	$500,000.00
8.6.5	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
8.6.6	Design and Permitting (Assumes 6%)	1.00	LS	$175,000.00	$175,000.00
8.6.7	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$292,000.00	$292,000.00
8.7	Electrical, Instrumentation and Controls	1.00	LS	$9,708,000.00	$9,708,000.00
8.7.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$761,000.00	$761,000.00
8.7.2	Transformers, Small	3.00	EA	$6,000.00	$18,000.00
8.7.3	Transformers, Medium	2.00	EA	$70,000.00	$140,000.00
8.7.4	Distribution Panel, Small	3.00	EA	$10,000.00	$30,000.00
8.7.5	Distribution Panel, Medium	2.00	EA	$30,000.00	$60,000.00
8.7.6	Lighting Control Panel	2.00	EA	$5,000.00	$10,000.00
8.7.7	Lighting (Road) - Poles, Foundations and Fittings - Assume 1 per 100 LF	158.00	EA	$25,000.00	$3,950,000.00
8.7.8	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	76.00	EA	$25,000.00	$1,900,000.00
8.7.9	RFID Inventory Control Package	1.00	LS	$1,400,000.00	$1,400,000.00
8.7.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
8.7.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
8.7.12	Design and Permitting (Assumes 6%)	1.00	LS	$502,000.00	$502,000.00
8.7.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$837,000.00	$837,000.00
89					$74,522,831.13

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CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
9	**Port of Seward**	1.00	LS	$51,993,162.85	$51,993,162.85
9.1	Civil Works	1.00	LS	$6,387,662.85	$6,387,662.85
9.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$500,000.00	$500,000.00
9.1.2	Site Preparation - Survey, Clearing and Grubbing	12.60	Acre	$15,961.49	$201,114.72
9.1.3	Gravel Yard	12.60	Acre	$76,884.79	$968,748.30
9.1.3.1	Aggregate Base Course	10,164.00	CY	$54.99	$558,927.27
9.1.3.2	Aggregate Surface Course	6,774.92	CY	$60.49	$409,821.03
9.1.4	Concrete Hardstands	2,385.00	CY	$1,096.06	$2,614,103.37
9.1.5	In-Yard Access Road (1-way)	1,650.00	LF	$159.74	$263,576.21
9.1.5.1	Subbase	1,466.60	CY	$39.04	$57,257.20
9.1.5.2	Aggregate Base Course	488.65	CY	$54.99	$26,871.50
9.1.5.3	Asphalt Concrete Surfacing	488.65	CY	$367.23	$179,447.51
9.1.6	In-Yard Access Road (2-way)	3,800.00	LF	$213.02	$809,494.95
9.1.6.1	Subbase	4,501.54	CY	$39.04	$175,744.01
9.1.6.2	Aggregate Base Course	1,501.00	CY	$54.99	$82,541.31
9.1.6.3	Asphalt Concrete Surfacing	1,501.00	CY	$367.23	$551,209.64
9.1.7	In-Yard Truck Turnaround	1.00	EA	$150,625.29	$150,625.29
9.1.7.1	Subbase	830.00	CY	$39.04	$32,403.93
9.1.7.2	Aggregate Base Course	280.00	CY	$54.99	$15,397.45
9.1.7.3	Asphalt Concrete Surfacing	280.00	CY	$367.23	$102,823.92
9.1.8	Design and Permitting (Assumes 6%)	1.00	LS	$330,000.00	$330,000.00
9.1.9	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$550,000.00	$550,000.00
9.2	Materials Handling Equipment	1.00	LS	$37,733,500.00	$37,733,500.00
9.2.1	Mobile Harbor Crane - LHM 550 or Eqiv.	1.00	EA	$4,800,000.00	$4,800,000.00
9.2.2	Yard Haul Tractor	8.00	EA	$177,000.00	$1,416,000.00
9.2.3	Yard Haul Trailer	8.00	EA	$110,000.00	$880,000.00
9.2.4	Container Reach Stacker	5.00	EA	$1,480,000.00	$7,400,000.00
9.2.5	Revolver Attachment	2.00	EA	$380,000.00	$760,000.00
9.2.6	Bulk Material Container	3,330.00	EA	$6,750.00	$22,477,500.00
9.3	Process Equipment	1.00	LS	$21,000.00	$21,000.00
9.3.1	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
9.4	Ancillary Equipment	1.00	LS	$215,000.00	$215,000.00
9.4.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
9.4.2	Forklift	1.00	EA	$65,000.00	$65,000.00
9.5	Administration	1.00	LS	$3,340,000.00	$3,340,000.00
9.5.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$300,000.00	$300,000.00
9.5.2	Admin Building	2,000.00	SF	$550.00	$1,100,000.00
9.5.3	Workshop	2,500.00	SF	$550.00	$1,375,000.00
9.5.4	Refuling Station	1.00	EA	$12,000.00	$12,000.00
9.5.5	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
9.5.6	Design and Permitting (Assumes 6%)	1.00	LS	$198,000.00	$198,000.00
9.5.7	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$330,000.00	$330,000.00
9.6	Electrical, Instrumentation and Controls	1.00	LS	$4,296,000.00	$4,296,000.00
9.6.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$337,000.00	$337,000.00
9.6.2	Transformers, Small	2.00	EA	$6,000.00	$12,000.00
9.6.3	Transformers, Medium	1.00	EA	$70,000.00	$70,000.00
9.6.4	Distribution Panel, Small	2.00	EA	$10,000.00	$20,000.00
9.6.5	Distribution Panel, Medium	1.00	EA	$30,000.00	$30,000.00
9.6.6	Lighting Control Panel	2.00	EA	$5,000.00	$10,000.00
9.6.7	Lighting (Road) - Poles, Foundations and Fittings - Assume 1 per 100 LF	21.00	EA	$25,000.00	$525,000.00
9.6.8	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	48.00	EA	$25,000.00	$1,200,000.00
9.6.9	RFID Inventory Control Package	1.00	LS	$1,400,000.00	$1,400,000.00
9.6.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
9.6.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
9.6.12	Design and Permitting (Assumes 6%)	1.00	LS	$222,000.00	$222,000.00
9.6.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$370,000.00	$370,000.00

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231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
56					$51,993,162.85

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akdown Structure (CBS) Register

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
10	**Port of Whittier**	1.00	LS	$124,793,663.13	$124,793,663.13
10.1	Marginal Wharf Reconstruction	1.00	LS	$76,587,674.53	$76,587,674.53
10.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$6,000,000.00	$6,000,000.00
10.1.2	Demolition and Disposal	1.00	LS	$3,039,734.54	$3,039,734.54
10.1.2.1	Sheet Pile and Debris Removal	1.00	LS	$893,619.07	$893,619.07
10.1.2.2	Subexcavation and Disposal	67,300.00	CY	$31.89	$2,146,115.47
10.1.3	Sheet Pile Dock	1.00	LS	$29,853,812.38	$29,853,812.38
10.1.3.1	Provide Sheet Pile Materials - Galvanized	6,830.00	Ton	$2,950.00	$20,148,500.00
10.1.3.2	Set Templates and Temporary Supports	54.00	EA	$25,327.64	$1,367,692.49
10.1.3.3	Drive Sheet Pile	4,420.00	EA	$1,838.32	$8,125,371.87
10.1.3.4	Cutoff Sheet Pile and Weld Interlocks	1,090.00	EA	$194.72	$212,248.02
10.1.4	Provide and Place Fill	1.00	LS	$10,525,978.90	$10,525,978.90
10.1.4.1	Provide and Place Imported Gravel Fill	247,300.00	CY	$39.09	$9,666,873.62
10.1.4.2	Provide and Place Base/Subbase	10,500.00	CY	$59.99	$629,891.46
10.1.4.3	Provide and Place Surface Course	3,500.00	CY	$65.49	$229,213.82
10.1.5	Vibracompaction / Ground Modifications	1.00	LS	$5,710,232.76	$5,710,232.76
10.1.5.1	Vibracompaction Probes	2,300.00	EA	$2,150.93	$4,947,140.97
10.1.5.2	Vibracompaction Fill	16,100.00	CY	$47.40	$763,091.79
10.1.6	Dock Appurtenances and Fenders	1.00	LS	$8,145,978.39	$8,145,978.39
10.1.6.1	Facebeam, Bullrail and Bollards	1,355.00	LF	$1,785.77	$2,419,717.75
10.1.6.2	Fenders	14.00	EA	$409,018.62	$5,726,260.64
10.1.7	Surfacing	1.00	LS	$1,266,937.55	$1,266,937.55
10.1.7.1	Asphalt Concrete Surfacing	3,450.00	CY	$367.23	$1,266,937.55
10.1.8	Marine Mammal Observation	1.00	LS	$1,485,000.00	$1,485,000.00
10.1.9	Design and Permitting (Assumes 6%)	1.00	LS	$3,960,000.00	$3,960,000.00
10.1.10	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$6,600,000.00	$6,600,000.00
10.2	Civil Works	1.00	LS	$5,180,920.22	$5,180,920.22
10.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$400,000.00	$400,000.00
10.2.2	Site Preparation - Survey, Clearing and Grubbing	4.00	Acre	$15,961.49	$63,845.94
10.2.3	Gravel Yard	3.90	Acre	$76,884.79	$299,850.66
10.2.3.1	Aggregate Base Course	3,146.00	CY	$54.99	$173,001.30
10.2.3.2	Aggregate Surface Course	2,097.00	CY	$60.49	$126,849.37
10.2.4	Concrete Hardstands	2,385.00	CY	$1,096.06	$2,614,103.37
10.2.5	In-Yard Access Road (2-way)	3,800.00	LF	$213.02	$809,494.95
10.2.5.1	Subbase	4,501.54	CY	$39.04	$175,744.01
10.2.5.2	Aggregate Base Course	1,501.00	CY	$54.99	$82,541.31
10.2.5.3	Asphalt Concrete Surfacing	1,501.00	CY	$367.23	$551,209.64
10.2.6	Truck Turnaround	1.00	LS	$150,625.29	$150,625.29
10.2.6.1	Subbase	830.00	CY	$39.04	$32,403.93
10.2.6.2	Aggregate Base Course	280.00	CY	$54.99	$15,397.45
10.2.6.3	Asphalt Concrete Surfacing	280.00	CY	$367.23	$102,823.92
10.2.7	Fencing and Gates	260.00	LF	$534.62	$139,000.00
10.2.7.1	Fencing	260.00	LF	$150.00	$39,000.00
10.2.7.2	Gate	1.00	EA	$100,000.00	$100,000.00
10.2.8	Design and Permitting (Assumes 6%)	1.00	LS	$264,000.00	$264,000.00
10.2.9	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$440,000.00	$440,000.00
10.3	On-Site Rail	1.00	LS	$2,740,068.37	$2,740,068.37
10.3.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$215,000.00	$215,000.00
10.3.2	Site Preparation	1.00	LS	$160,444.64	$160,444.64
10.3.2.1	Demolition and Debris Removal	1.00	LS	$112,611.46	$112,611.46
10.3.2.2	Subexcavation and Disposal	1,500.00	CY	$31.89	$47,833.18
10.3.3	Rail Track	3,600.00	LF	$374.83	$1,349,381.46
10.3.3.1	Provide and Install Rail Ties	3,600.00	LF	$168.13	$605,257.27
10.3.3.2	Mainline Ballast	1,500.00	CY	$121.84	$182,754.02
10.3.3.3	Provide and Install Rail	3,600.00	LF	$155.94	$561,370.17
10.3.4	Turnouts and Switches	3.00	EA	$212,414.09	$637,242.27

231099--Ambler Port Feasibility Study

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
10.3.4.1	Rail Track - Turnouts	1,500.00	LF	$374.83	$562,242.27
10.3.4.2	Switches	3.00	EA	$25,000.00	$75,000.00
10.3.5	Design and Permitting (Assumes 6%)	1.00	LS	$142,000.00	$142,000.00
10.3.6	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$236,000.00	$236,000.00
10.4	Materials Handling Equipment	1.00	LS	$35,437,500.00	$35,437,500.00
10.4.1	Mobile Harbor Crane - LHM 550 or Eqiv.	1.00	EA	$4,800,000.00	$4,800,000.00
10.4.2	Container Reach Stacker	5.00	EA	$1,480,000.00	$7,400,000.00
10.4.3	Revolver Attachment	2.00	EA	$380,000.00	$760,000.00
10.4.4	Bulk Material Container	3,330.00	EA	$6,750.00	$22,477,500.00
10.5	Process Equipment	1.00	LS	$21,000.00	$21,000.00
10.5.1	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
10.6	Ancillary Equipment	1.00	LS	$150,000.00	$150,000.00
10.6.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
10.7	Administration	1.00	LS	$1,084,500.00	$1,084,500.00
10.7.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$85,000.00	$85,000.00
10.7.2	Admin Building	1,500.00	SF	$550.00	$825,000.00
10.7.3	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
10.7.4	Design and Permitting (Assumes 6%)	1.00	LS	$56,000.00	$56,000.00
10.7.5	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$93,500.00	$93,500.00
10.8	Electrical, Instrumentation and Controls	1.00	LS	$3,592,000.00	$3,592,000.00
10.8.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$280,000.00	$280,000.00
10.8.2	Transformers, Small	2.00	EA	$6,000.00	$12,000.00
10.8.3	Transformers, Medium	1.00	EA	$70,000.00	$70,000.00
10.8.4	Distribution Panel, Small	2.00	EA	$10,000.00	$20,000.00
10.8.5	Distribution Panel, Medium	1.00	EA	$30,000.00	$30,000.00
10.8.6	Lighting Control Panel	2.00	EA	$5,000.00	$10,000.00
10.8.7	Lighting (Road) - Poles, Foundations and Fittings	17.00	EA	$25,000.00	$425,000.00
10.8.8	Ligting (Yard) - Poles, Foundations and Fittings	30.00	EA	$25,000.00	$750,000.00
10.8.9	RFID Inventory Control Package	1.00	LS	$1,400,000.00	$1,400,000.00
10.8.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
10.8.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
10.8.12	Design and Permitting (Assumes 6%)	1.00	LS	$185,000.00	$185,000.00
10.8.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$310,000.00	$310,000.00
89					$124,793,663.13

APPENDIX F.2 – PORT MACKENZIE CAPEX COST ESTIMATE

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akdown Structure (CBS) Register

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
	JOB	1.00	LS	$252,067,594.68	$252,067,594.68
1	**Port MacKenzie - Statewide Export ROM Estimate**	1.00	LS	$252,067,594.68	$252,067,594.68
1.1	Marine Infrastructure	1.00	LS	$25,640,568.39	$25,640,568.39
1.1.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$1,865,000.00	$1,865,000.00
1.1.2	Demolition	1.00	LS	$902,112.20	$902,112.20
1.1.3	Breasting Dolphins	2.00	EA	$1,188,506.99	$2,377,013.99
1.1.4	Fenders	2.00	EA	$724,703.04	$1,449,406.09
1.1.5	Mooring Dolphins	4.00	EA	$1,188,506.99	$4,754,027.97
1.1.6	Provide and Install Catwalks	520.00	LF	$4,196.30	$2,182,075.00
1.1.7	Ice Breaking Dolphins	4.00	EA	$1,745,983.29	$6,983,933.14
1.1.8	Design and Permitting (Assumes 15%)	1.00	LS	$3,077,000.00	$3,077,000.00
1.1.9	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$2,050,000.00	$2,050,000.00
1.2	Civil Works	1.00	LS	$26,553,424.57	$26,553,424.57
1.2.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$1,930,000.00	$1,930,000.00
1.2.2	Site Preparation - Survey, Clearing and Grubbing	171.50	Acre	$15,961.49	$2,737,394.80
1.2.3	Gravel Topped Surfacing	1,405,850.00	SF	$3.21	$4,513,586.58
1.2.4	Rail Loop Access Road	1.00	LS	$1,225,550.13	$1,225,550.13
1.2.5	Asphalt Pad	39,600.00	SF	$5.86	$231,971.21
1.2.6	Concrete Pad	1,872.00	CY	$1,096.06	$2,051,824.53
1.2.7	In-Yard Access Road (2-way)	12,700.00	LF	$213.02	$2,705,417.34
1.2.8	Fencing and Gates	11,050.00	LF	$170.41	$1,883,010.20
1.2.9	Yard Rails	4,350.00	LF	$376.83	$1,639,215.20
1.2.10	Yard Rails - Stacker Reclaimer	3,350.00	LF	$376.83	$1,262,384.12
1.2.11	Turnouts and Switches	5.00	EA	$212,414.09	$1,062,070.46
1.2.12	Design and Permitting (Assumes 15%)	1.00	LS	$3,186,000.00	$3,186,000.00
1.2.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$2,125,000.00	$2,125,000.00
1.3	Onsite Rail	1.00	LS	$2,534,101.73	$2,534,101.73
1.3.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$184,000.00	$184,000.00
1.3.2	Spare Track	3,000.00	LF	$376.83	$1,130,493.24
1.3.3	Bad Order Siding	200.00	LF	$376.83	$75,366.22
1.3.4	Turnouts and Switches	3.00	EA	$212,414.09	$637,242.27
1.3.5	Design and Permitting (Assumes 15%)	1.00	LS	$304,000.00	$304,000.00
1.3.6	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$203,000.00	$203,000.00
1.4	Materials Handling Equipment - Berth and Marine	1.00	LS	$16,405,500.00	$16,405,500.00
1.4.1	Shiploader, Multicommodity	1.00	EA	$10,500,000.00	$10,500,000.00
1.4.2	Misting System, Hatch Dust Supression	1.00	EA	$85,500.00	$85,500.00
1.4.3	Mobile Harbor Crane - LHM550 or Equiv	1.00	EA	$5,820,000.00	$5,820,000.00
1.5	Materials Handling Equipment - Containerized Concentrates	1.00	LS	$15,409,500.00	$15,409,500.00
1.5.1	Yard Haul Tractor	11.00	EA	$177,000.00	$1,947,000.00
1.5.2	Yard Haul Trailer	11.00	EA	$110,000.00	$1,210,000.00
1.5.3	Container Reach Stacker	5.00	EA	$1,480,000.00	$7,400,000.00
1.5.4	Revolver Attachment	2.00	EA	$380,000.00	$760,000.00
1.5.5	Thawing System- Containerized, Continuous Loading	1.00	EA	$1,782,500.00	$1,782,500.00
1.5.6	Hopper, Containerized Concentrate Outload	1.00	EA	$1,310,000.00	$1,310,000.00
1.5.7	In-yard Tracmobile Concentrate Rail Allowance	1.00	EA	$1,000,000.00	$1,000,000.00
1.6	Materials Handling Equipment - Bulk Concentrates	1.00	LS	$56,816,000.00	$56,816,000.00
1.6.1	Concentrate Storage Building	200,000.00	SF	$250.00	$50,000,000.00
1.6.2	Truck Wash Station	1.00	EA	$450,000.00	$450,000.00
1.6.3	Bulk Concentrate Outload Hoppers	4.00	EA	$175,000.00	$700,000.00
1.6.4	Bulk Concentrate Outload Conveyors	2.00	EA	$1,858,000.00	$3,716,000.00
1.6.5	Front End Loader	3.00	EA	$650,000.00	$1,950,000.00
1.7	Materials Handling Equipment - Coal and Multiuse	1.00	LS	$73,934,500.00	$73,934,500.00
1.7.1	Thawing System and Building - Coal Rail Car	1.00	LS	$3,840,000.00	$3,840,000.00
1.7.2	Coal Railcar Dumper with Icebreaker	1.00	LS	$4,200,000.00	$4,200,000.00
1.7.3	Railcar Indexer	1.00	LS	$3,737,500.00	$3,737,500.00
1.7.4	Receiving Hopper and Grizzly	1.00	LS	$2,100,000.00	$2,100,000.00
1.7.5	Coal Yard Stacker Reclaimer	1.00	LS	$25,000,000.00	$25,000,000.00
1.7.6	Coal Yard Auxilary Stacker	1.00	LS	$8,500,000.00	$8,500,000.00
1.7.7	Coal Yard Conveyor (CV001)	1.00	LS	$1,575,000.00	$1,575,000.00

CBS Position Code	Description	Material Quantity	Unit of Measure	Total Unit Cost	Total Cost
1.7.8	Coal Inload Transfer Towers (TT1, TT2)	1.00	LS	$355,000.00	$355,000.00
1.7.9	Coal Yard Conveyor (CV002)	1.00	LS	$921,000.00	$921,000.00
1.7.10	Coal Yard Conveyor (CV003)	1.00	LS	$5,284,000.00	$5,284,000.00
1.7.11	Coal Outload Transfer Towers (TT3)	1.00	LS	$355,000.00	$355,000.00
1.7.12	Coal Yard Conveyor (CV004)	1.00	LS	$5,156,000.00	$5,156,000.00
1.7.13	Coal Surge Bin	1.00	LS	$1,556,000.00	$1,556,000.00
1.7.14	Coal Feeder	1.00	LS	$752,000.00	$752,000.00
1.7.15	Multiuse Outload Transfer Towers (TTM4)	1.00	LS	$532,500.00	$532,500.00
1.7.16	Multiuse Outload Conveyor (CVM001)	1.00	LS	$890,000.00	$890,000.00
1.7.17	Multiuse Outload Transfer Towers (TTM5)	1.00	LS	$532,500.00	$532,500.00
1.7.18	Multiuse Outload Conveyor (CVM002)	1.00	LS	$1,680,000.00	$1,680,000.00
1.7.19	Multiuse Outload Transfer Towers (TTM6)	1.00	LS	$710,000.00	$710,000.00
1.7.20	Multiuse Outload Conveyor (CVM003)	1.00	LS	$6,258,000.00	$6,258,000.00
1.8	Bulk Concentrate Import Equipment	1.00	LS	$18,130,000.00	$18,130,000.00
1.8.1	Hopper - Ship Unloading	1.00	LS	$1,960,000.00	$1,960,000.00
1.8.2	Conceptrate Inload Trestle Conveyor	1.00	LS	$1,350,000.00	$1,350,000.00
1.8.3	Conceptrate Inload Transfer Tower	1.00	LS	$355,000.00	$355,000.00
1.8.4	Conceptrate Inload Tripper Conveyor	1.00	LS	$1,155,000.00	$1,155,000.00
1.8.5	Concentrate Inload Tripper Car	1.00	LS	$300,000.00	$300,000.00
1.8.6	Front End Loader	2.00	EA	$650,000.00	$1,300,000.00
1.8.7	Industrial Vacuum Station	1.00	LS	$160,000.00	$160,000.00
1.8.8	Warehouse, Short Term Concentrate Storage	46,200.00	SF	$250.00	$11,550,000.00
1.9	Process Equipment	1.00	LS	$2,324,000.00	$2,324,000.00
1.9.1	Truck Scales	2.00	EA	$370,000.00	$740,000.00
1.9.2	Rail Weigh Scales	2.00	EA	$500,000.00	$1,000,000.00
1.9.3	Load Sensing System	1.00	EA	$21,000.00	$21,000.00
1.9.4	Truck Wash Station	1.00	EA	$563,000.00	$563,000.00
1.10	Ancillary Equipment	1.00	LS	$215,000.00	$215,000.00
1.10.1	Utility Truck	2.00	EA	$75,000.00	$150,000.00
1.10.2	Forklift	1.00	EA	$65,000.00	$65,000.00
1.11	Administration	1.00	LS	$3,644,000.00	$3,644,000.00
1.11.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$265,000.00	$265,000.00
1.11.2	Workshop	2,500.00	SF	$550.00	$1,375,000.00
1.11.3	Guard House	3.00	EA	$250,000.00	$750,000.00
1.11.4	Refuling Station	1.00	EA	$500,000.00	$500,000.00
1.11.5	Office IT and Telecom	1.00	LS	$25,000.00	$25,000.00
1.11.6	Design and Permitting (Assumes 15%)	1.00	LS	$437,000.00	$437,000.00
1.11.7	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$292,000.00	$292,000.00
1.12	Electrical, Instrumentation and Controls	1.00	LS	$10,461,000.00	$10,461,000.00
1.12.1	Mobilization / Demobilization (Assumes 10%)	1.00	LS	$761,000.00	$761,000.00
1.12.2	Transformers, Small	3.00	EA	$6,000.00	$18,000.00
1.12.3	Transformers, Medium	2.00	EA	$70,000.00	$140,000.00
1.12.4	Distribution Panel, Small	3.00	EA	$10,000.00	$30,000.00
1.12.5	Distribution Panel, Medium	2.00	EA	$30,000.00	$60,000.00
1.12.6	Lighting Control Panel	2.00	EA	$5,000.00	$10,000.00
1.12.7	Lighting (Road) - Poles, Foundations and Fittings - Assume 1 per 100 LF	158.00	EA	$25,000.00	$3,950,000.00
1.12.8	Ligting (Yard) - Poles, Foundations and Fittings - Assume 1 per 10,000 SF	76.00	EA	$25,000.00	$1,900,000.00
1.12.9	RFID Inventory Control Package	1.00	LS	$1,400,000.00	$1,400,000.00
1.12.10	Tie-In RFID and Scales Controls	1.00	LS	$50,000.00	$50,000.00
1.12.11	Tie-In Lighting, Admin and Security Electrical	1.00	LS	$50,000.00	$50,000.00
1.12.12	Design and Permitting (Assumes 15%)	1.00	LS	$1,255,000.00	$1,255,000.00
1.12.13	Construction Administration, Management and Inspection (Assumes 10%)	1.00	LS	$837,000.00	$837,000.00
111					$252,067,594.68

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							030 - MACKENZIE MULTICOMMODITY	
		Note 1 - Model and Parameters	**Note 2 - General Basis / Remarks**	**Specialist Unit Cost ($USD)**	**UOM**	**Pricing Year**	**Qty**	**Remarks**
1	**Civil Works**							
	Surveying, clearing and grubbing			N/A	SQ FT		7,470,711	See detailed qty sheet
	Gravel Topped Surfaces			N/A	SQ FT		1,405,846	See detailed qty sheet
	Concrete Pad	In-place medium strength concrete including formwork and rebar, 12 inches thk.		N/A	CU FT		50,559	See detailed qty sheet
	Ashphalt Pad	General parking lot and workshop outside area	PND to determine thickness	N/A	SQ FT		39,611	See detailed qty sheet
	Rail Loop Track Access Road	Acess road to entire rail loop track. 12 ft wide, gravel topped		N/A	FT		5,890	Around rail loop, exclude elevated overpass
	In-Yard Truck Access Road 2-way	Truck road within intermodal yard, 2-way traffic, 24 ft wide asphaltic concrete		N/A	FT		12,705	All roads inside of security gates
	Fencing & Gates	Chainlink type	C/W (4) gates: Northwest (Rail), Southwest (Aux), North Central (Concentrates) and East (Main)	N/A	FT		11047	Around entire PMAC facility, down to water
	Demolition, Structural Steel and Remediation			PND	TON		250	Demolition of shiploader and complete trestle conveyors x 2.
	Yard Rails, Train	Excluded - port primary rail loop, assumed already built out	Include subballast, ballast, ties and rail	PND	FT		4,348	See detailed qty sheet
	Yard Rails, Stacker Reclaimer	East and West Running rails, individual ballast and ties	Include subballast, ballast, ties and rail	PND	FT		3,348	
	Rail Switches			PND	EA		5	
2	**Rail On Site**							
	Primary Rail Loop	Excluded - assumed that will be installed and completed by other funding	Excluded	Excluded	EA	Excluded	Excluded	Excluded
	Spare Track	New spare track on premises, sufficient for 1 train.		PND	FT		3000	Assume primary rail loop at Port Mac already in place. Additonal track herein is spare track for additional train, 3000 ft allowance. All other rail assumed by ARRC
	Bad Order Siding	2 cars		PND	FT		200	2 car bad order siding of 200 ft.
	Turn outs and Switches	Generic		PND	EA		3	2x spare track Y-junction; 1x bad order switch
3	**Material Handing Equipment - Berth and Marine**							
	Shiploader, Multicommodity	3000 mtph, fixed pedestal slewing, telescopic.	Bruks siwertell Budgetary quote July 2025 ($7m without shipping, assy, commissioning). Added allowance for shipping, assy, installation and commissioning.	$ 10,500,000	EA	2025	1	
	Misting System, Hatch Dust Suppression	Bluewater Misting 7.5kW, 400V Water Spraying System, 70 bar, 20 Lpm	Bluewater Misting 2024, includes $9500 shipping allowance	$ 85,500	EA	2024	1	
	Mobile Harbour Crane (MHC)	Liebherr LHM 550 or equiv.	Liebherr quotation 2023 EUR 4,385,000). Added allowance for shipping, assy, installation and commissioning.	$ 5,820,000	EA	2024	1	
4	**Material Handing Equipment - Containerized Concentrates**							
	Bulk Material Container (Rotainers)	Excluded	Excluded - assumed that producers will supply own fleet	Excluded	EA	Excluded	Excluded	Excluded
	Truck, Tractor Trailer, Highway	Tandem B-train, 20 axle, 122,000 lb payload, 196,000 lb gross.	Excluded - assumed that producers will contract own fleet	Excluded	EA	Excluded	Excluded	Excluded
	Tractor, Yard Haul	Kalmar Ottawa T2 or equiv.	Single container per tractor trailer (RWC Alaska quotation $177K) Neat pricing delivered to ANC Alaska	$ 177,000	EA	2024	11	2 in use, linking upper and lower yard

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	Trailer, Yard Haul	Magnum Bomb Cart, Twin-20 spaced layout, Rotainer/revolver compatible 70 tonne payload. (Single per haul)	RWC Group Jun 2024 $55000US supply + 5000 shipping allowance	$ 60,000	EA	2024	11	2 in use, linking upper and lower yard
	Reach stacker (mobile), Container, 5 high	Generic reach stacker, 20 ft ISO, stack 5 high capable, Kalmar DRG450-82S5XS or equiv		$ 1,480,000	EA	2024	5	3 in lower container storage area, 2 in train unloading operations. No spare
	Revolver attachment, Specialized Container Revolving	RAM 4151LW Lightweight Series; 33 tonnes (36 US ton) SWL; 11.7 tonnes tare.	Neat pricing without shipping; Ex Works Shanghai; Ram quotation 2023 eddie.mills@ramspreaders.com	$ 380,000	EA	2024	2	2 in service, no additional spare / reserve
	Thawing System, containerized, continuous loading	APEC Thawing System Design and Equipment - 2 Heating Stations, Electric - 1 loading station - 1 unloading station - 500 ft long nominal - 15 car/hour nominal Includes 500 ft long building	Apex Thermal Quotation Jul 2025 Continuous thaw station (2-bay) budgetary: $850,000 Loading station: $350,000 Unloading station: $350,000 Plus 15% delivery, installation and commissioning	$ 1,782,500	EA	2025	1	
	Hopper, Containerized Concentrate Outload	With ice breaking grizzly	2022 Reference Project Bencmark (LeHigh DGF), scaled to Ambler estiamte steel tons, add ice breaker allowance, plus 15% delivery, installation and commissioning	$ 1,309,793	EA	2025	1	
	Trackmobile	In-yard concentrate rail car advancing	Allowance	$ 1,000,000	EA	2025	1	
5	**Material Handling Equipment - Bulk Concentrates**							
	Building, Concentrate Storage	80,000 ton capacity, dual lane truck access. 4x truck doors, 2x conveyor penetrations	Above grade building only. Foundation and flooring excluded. Recommend gravel floor finish	PND	SQFT		200,000	
	Wash Station, Truck	Drive-through truck wash. 240-300 gpm; 16 spray heads; with concrete collection pad, with concrete water settling sumps for FEL clean up, with water recycling and reclamation in containerized equipment module.	Noviclean Canada quotation April 2025. Includes concrete pad, sump pit and foundation. Includes power and utilities tie-in allowance of $38,000. Total $CAD 604,000. Include design, supply, shipping and site installation.	$ 454,135	EA	2025		Excludes bulk civil.
	Bulk Concentrate Outload Hoppers	In concentrate storage building, FEL use for concentrate outload, 20 cu.yard approx.	Allowance, IEM Quote $200k CAD supply only. $173k USD assumed to include 15% shipping, installation, and commissioning.	$ 172,932	EA	4		
	Bulk Concentrate Outload Conveyors (CVC001,002)	From concentrate storage building	772 FT	$ 1,858,000	EA	2		
	Front end loaders	CAT 966K or equivalent		PND	EA	3		2 working shiploading; 1 working truck unloading. Permanently assigned to bulk concentrates
6	**Material Handing Equipment - Coal and Multiuse**							
	Thawing System and Building, Coal Rail Car	APEC Thawing System Design and Equipment - (4) Power/ Control Enclosures, 480VAC, 3-Phase, 2500-3000A Each - (120) 60KW Electric Infrared Heating, Bottom, Diagonal, Sides (Heat Load of 7200kW) - 6-8 Heating Stations - 2 Soak Stations - 500 ft long nomimal - 15 car/hour nominal Includes 500 ft long building	Apex Thermal Quotation Jul 2025 Includes full turn-key installation, building installation, tie-in and commissioning.	$ 3,840,000	EA	2025		
	Coal Railcar dumper with ice breaker	Metso Rotaside XL with ice breaker, above grade dumping, 15-25 cars per hour	Metso Quotation Aug 2025. $3.5m US Includes design supply and ship. Add 20% for concrete undeground works, installation support and installation labour	$ 4,200,000	LOT	2025		
	Railcar indexer	Rack and Pinion Type, 45-car pull With rack and pinion and indexer running rail	Metso Quotation Aug 2025. $3.25m US Includes design supply and ship. Add 15% for foundation, installation support and installation labour	$ 3,737,500	LOT	2025		

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	Receiving Hopper and Grizzly	15-25 cars per hour, 110 ton per car	Metso Quotation Aug 2025. $1.1m US hopper and grizzly, with $60k 0lump breaker. Includes design supply and ship. Add 10% for foundation, installation support and installation labour	$ 2,100,000	LOT	2025		
	Coal Yard Stacker Reclaimer	3,000 tph, bucket wheel type, traverse, luffing and slewing	Benchmark data, scaled, includes delivery, installation and commissioning	$ 25,000,000	EA	2025		
	Coal Yard Auxiliary Stacker	1,000 tph,fixed boom, Y-shaped	Benchmark data, scaled, includes delivery, installation and commissioning	$ 8,500,000	EA	2025		
	Coal Yard Conveyor (CV001)	From rail car dumper	733 FT	$ 1,575,000	EA	2025	1	
	Coal Inload Transfer Towers (TT1, TT2)	Coal yard towers	225 SF	$ 355,000	EA	2025	2	
	Coal Yard Conveyor (CV002)	Transverse to yard conveyor	300 FT	$ 921,000	EA	2025	1	
	Coal Yard Conveyor (CV003)	Full length of yard, feed stacker reclaimer	2460 FT	$ 5,284,000	EA	2025	1	
	Coal Outload Transfer Tower (TT3)	From yard conveyor	225 SF	$ 355,000	EA	2025	1	
	Coal Outload Conveyor (CV004)	Transvers to yard, before surge bin	2400 FT	$ 5,156,000	EA	2025	1	
	Coal Surge Bin (SB001)	N/A	1300 CU YARD (1000 CU M, 12 M DIA x 10 M H); IEM budgetary quotation 2025. $1.8m CAD. $1.556m USD assumed to include 15% shipping, installation, and commissioning.	$ 1,556,391	EA	2025	1	
	Coal Feeder (FE001)	N/A	Benchmark data	$ 751,880	EA	2025	1	
	Multiuse Outload Transfer Tower (TTM4)	After surge bin, before tie-in with coal	225 SF	$ 532,500	EA	2025	1	
	Multiuse Outload Conveyor (CVM001)	After tie-in with coal	290 FT	$ 890,000	EA	2025	1	
	Multiuse Outload Transfer Tower (TTM5)	Before descending bulff	225 SF	$ 532,500	EA	2025	1	
	Multiuse Outload Conveyor (CVM002)	Descending bulff	560 FT	$ 1,680,000	EA	2025	1	
	Multiuse Outload Transfer Tower (TTM6)	Elevated TT, after bluff descend	225 SF	$ 710,000	EA	2025	1	
	Multiuse Outload Conveyor (CVM003)	Before shiploader	1300 FT	$ 6,258,000	EA	2025	1	
7	**Bulk concentrate imports**							
	Hopper, ship unloading	Samson Aumund Eco Hopper – EH0612R or equivalent	Samson Aumund Ecohopper Quotation 2022 $1.55m USD / 115 mt steel basis. Include 15% shipping, installation, and commissioning. Indexed to 2025	$ 1,959,327	EA	2025	1	
	Concentrate inload trestle conveyor (CVI001)	From unloading hopper to abutment	560 FT	$ 1,347,882	EA	2025	1	
	Concentrate inload transfer tower (TTI7)	Between trestle and transfer conveyors	225 SF	$ 355,000	EA	2025	1	
	Concentrate inload tripper conveyor (CVI001)	From abutment into storage shed	480 FT	$ 1,155,327	EA	2025	1	
	Concentrate inload tripper car (TC001)	In import storage shed	Auseco Benchmark, Indexed to 2025	$ 300,000	EA	2025	1	
	Front End Loader	CAT 966K or equivalent	Storage Management and Truck Loading use	PND	EA		2	
	Industrial Vacuum Station, wheel cleaning	PowerLift Industrial Vacuum System, Model PL50-BTE-BH; 37 kW 1290m3/hr @ 310mbar; 99.9% @0.5 microns; 1.5m3 capacity; 65mm ID hose x 8m long Nema 4X control panel;	DustControlTech Jul 2024 (Dave Goff) Benchmark 2015 Las Bambas.Include 15% shipping, installation, and commissioning. Indexed to 2025	$ 160,000	EA	2025	2	
	Warehouse, short term concentrate storage	165 ft x 280 ft, spring fabric on frame, pre-fabricated; With two (2) truck doors and one conveyor penetration. With 3-high lockblock foundation. With support steel structure for tripper car running rails With heat		PND	SQFT		46,200	
8	**Process Equipment**							

	Scales, Truck	Weighbridge truck scale; 5 modules; Mettler Toledo Powercell PDX;115 ft long x 10 ft wide; 20lb resolution; with IND 780 Weight Terminal	Two scales required: One scale at truck entry, one at truck exit. Each scale 5 modules of x 24.3 ft long. Mettler Toledo VBT Utah Quotation July 2024, 47 ft long, scaled up for 115 ft 20 axle truck. EA price includes dig down, concrete foundation S&I, scales S&I, controls and power tie-in.	$ 370,891	EA	2024	2	
	Truck scales - Foundation	Included	Included	Included	Included	Included	Included	Included
	Weigh Scales, Rail	Mettler-Toledo VRS241 Railroad Track Scale System	Scaled 2024 Benchmark. Two locations (before and after dumping) 'Includes controls integration, concrete foundations; includes rail cut and splice; includes - 25ft approach and departure slabs installation and shipping; Excludes RFID "AEI" container data reader. Excludes rails, embeds and drainage	$ 500,000	EA	2024	2	
	Load sensing system	"Loadrite" L2180, or equiv, Stacker Reclaimer mounted. 1% accuracy	Back up use only, for bad orders and discrepancy investigations; Loadrite Quotation Jan 2024, Includes installation labour	$ 21,000	EA	2024	---	
	Truck Wash Station	Single Lane, 12 spinner nozzles, 75hp, with concrete settling pit, filtration and containerized pump house	Truck Wash Package, per NoviClean Quotation 2025 Include bulk civil, bulk pit, concrete pit and truck washing lane and drainage bain Includes misc steels, grating, handrails etc.s Include package design, supply, shipping and site supervision and installation labour ($750k CAD)	$ 563,910	EA	2025		
9	**Ancilliaries**							
	Truck, Utility General Purpose	4x4 (double cabin)	General administration / runabout	**Suggest $75,000**	EA	2024	6	
	Vans, crew carry-all	8 passenger	General administration / runabout	**Suggest $55,000**	EA	2024	2	
	Truck, 5 ton flat bed	General cargo	Maintenance Use	PND	EA		1	
	Truck, Mobile Repair	Electrical mechanical repair	Maintenance Use	**Suggest $100,000**	EA	2025	4	
	Crane, general purpose	TEREX RT-500 or equiv	Maintenance Use	PND	EA		1	
	Forklift, general purpose	General Purpose 10,000 lbs capacity	General support, empty container maintenance use	**Suggest $65,000**	EA	2024	2	
	Grader		Snow and Ice Removal use	PND	EA		1	
	Front End Loader	CAT 966K or equivalent	Snow and Ice Removal use	PND	EA		1	
10	**Administration**							
	Admin and Labour Building	Excluded - assumed will use existing PMAC admin building	Excluded	Excluded	EA	Excluded	Excluded	Excluded
	Workshop	Electrical, mechanical, welding, 4 bays		PND	SQFT		12,000	
	Guard House	Modular, 20ft ISO container conversion Footprint 20 ft x 2.5 ft		PND	EA		3	1x upper overflow storage area; 1x lower core storage area; 1 rail loop area
	Refuelling Station	Skid mounted, 9,000L Capacity, 110% bunded, 100 LPM pump	Emiliana Serbatoi TF-9 Series; Quotation Jan 2024	**Suggest $15,000**	EA	2024	1	
	Office IT and Telecom	Allowance LOT	Allowance LOT	PND	LOT		1	
11	**Electrical, Instrumentation and Control**							
	Electrical Rooms, Small			PND	EA		2	Bulk concentrate storage area Berth area
	Electrical Rooms, Medium			PND	EA		2	Rail loop / Coal Storage area Container yard / thaw system
	Transformers, Small	45kVA, 600-120/208V, DRY TYPE, INDOOR XFMR		**Suggest $6,000**	EA	2024	4	Workshop area Guardhouses x 3

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	Transformers, Medium	2 MVA, 25/0.6KV, ONAN		Suggest $70,000	EA	2024	4	Rail loop / Coal Storage area Bulk concentrate storage area Container yard / thaw system Berth area
	Distribution Panel, Small	208-120V/100A FRAME/3PH/42 CCTS	Admin Buildings, Workshop, Guardhouse where applicable	Suggest $10,000	EA	2024	5	
	Distribution Panel, Medium	2000A, 600V, 3PH, 65kA	Yard Main Switchboard	Suggest $30,000	EA	2024	4	
	Lighting Contactor Panel		Contactor Panel for Yard Lighting	Suggest $5,000	EA	2024	10	Allowance for 10
	Lighting, ROADS 2-WAY including foundation, poles, and fittings				FT		12,910	Road lighting for Point Mackenzie road and Lu Young Lane down to upper and lower core storage areas Lighting for rail loop
	Lighting, AREA YARD, including foundation, poles, and fittings				SQFT		756,920	Upper overflow storage area; lower core storage area
	RFID Inventory Control Package	RFID Mobile inventory management system. Includes provisions for stacker-mounted mobile RFID readers, PLC in admin building, yard-wide wifi, GPS in-yard container tracking, and basic data reporting. Includes engineering, automation, HW/SW, installation sppt, commission sppt, training. Excludes extended data analytics Excludes installation and shipping.	QCA Systems Quotation Jan 2024 (+/-15%); Minus installation labour ($397k), minus fixed mounted RFID readers ($150k). = $1,400,000	Sugest $1,400,000	LOT	2024	1	
	Tie In - RFID and Scales Controls		Allowance LOT	PND	LOT		1	
	Tie In - Lighting, Admin and Guardhouse Electrical		Allowance LOT	PND	LOT		1	

APPENDIX G – PORT OPERATION CONCEPTS

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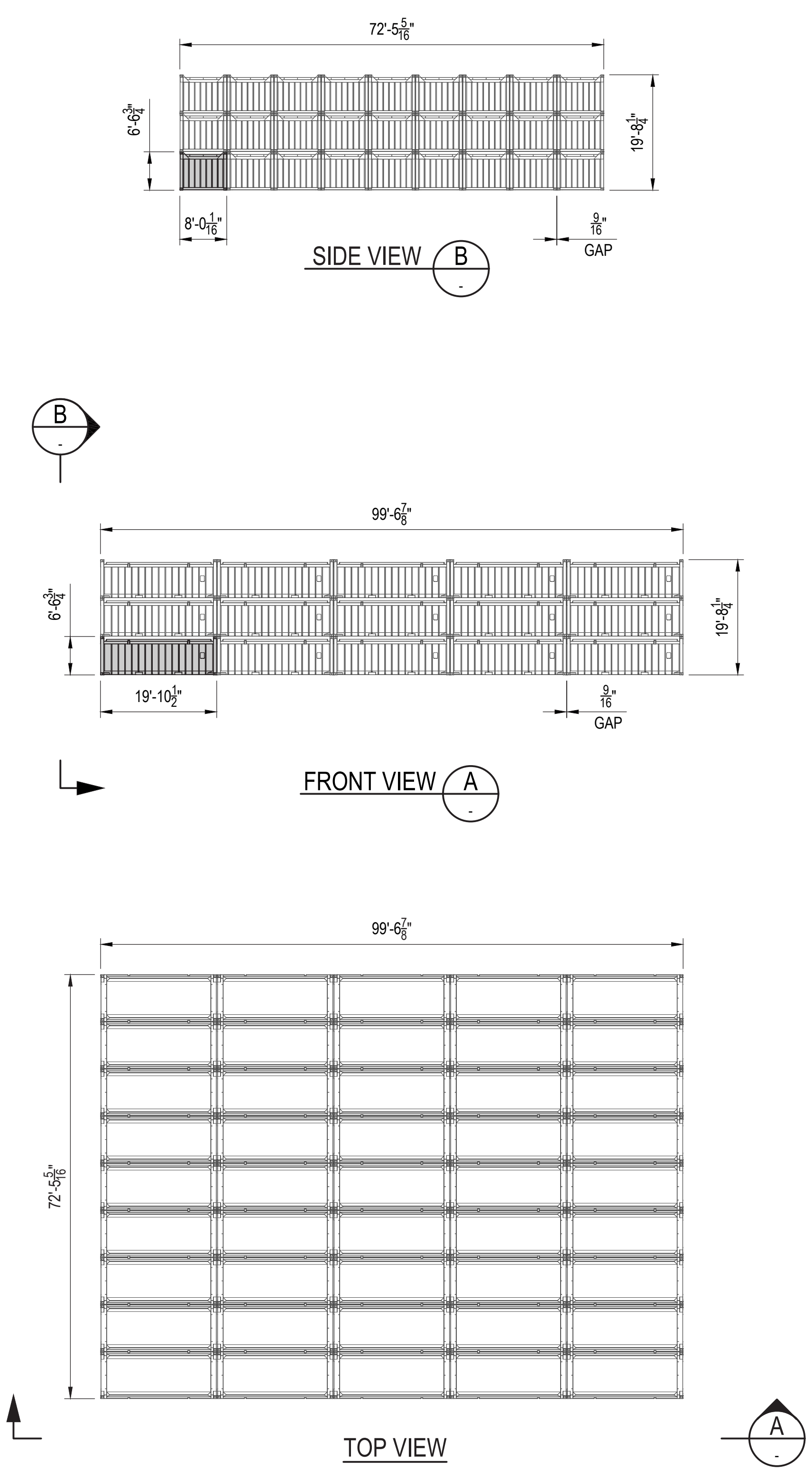
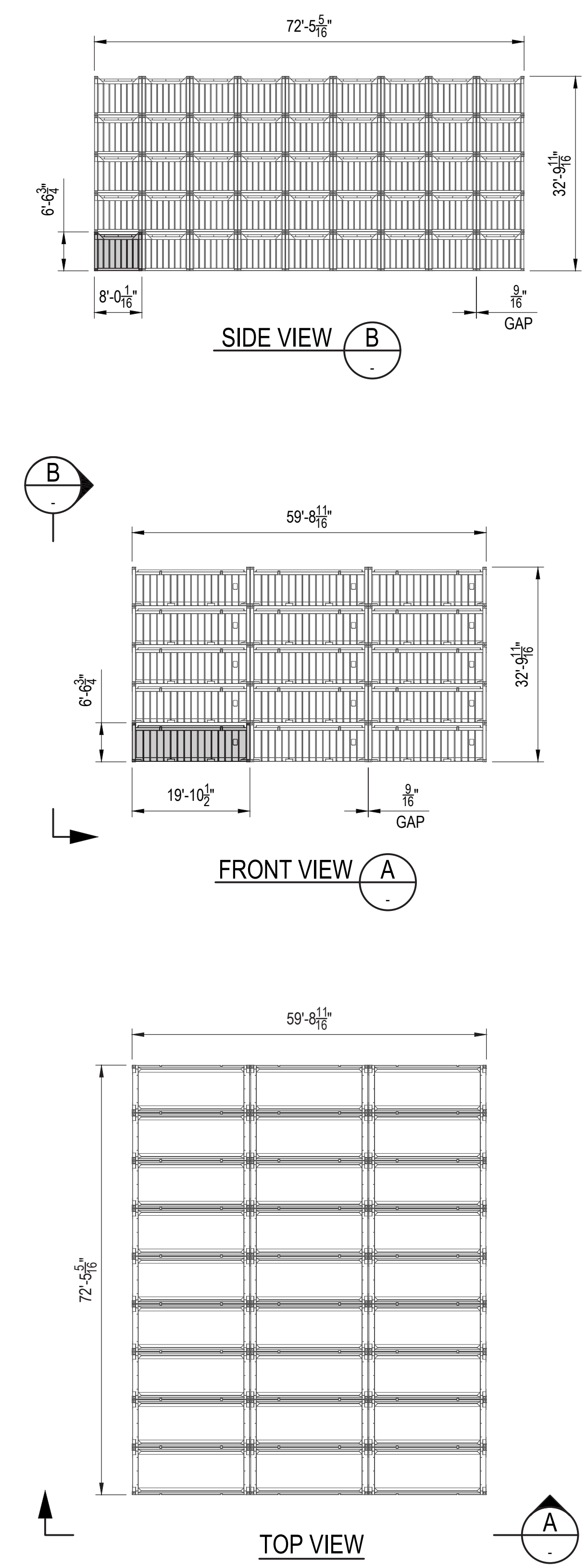
3 STACK - (NOTE 3)



5 STACK - (NOTE 4)



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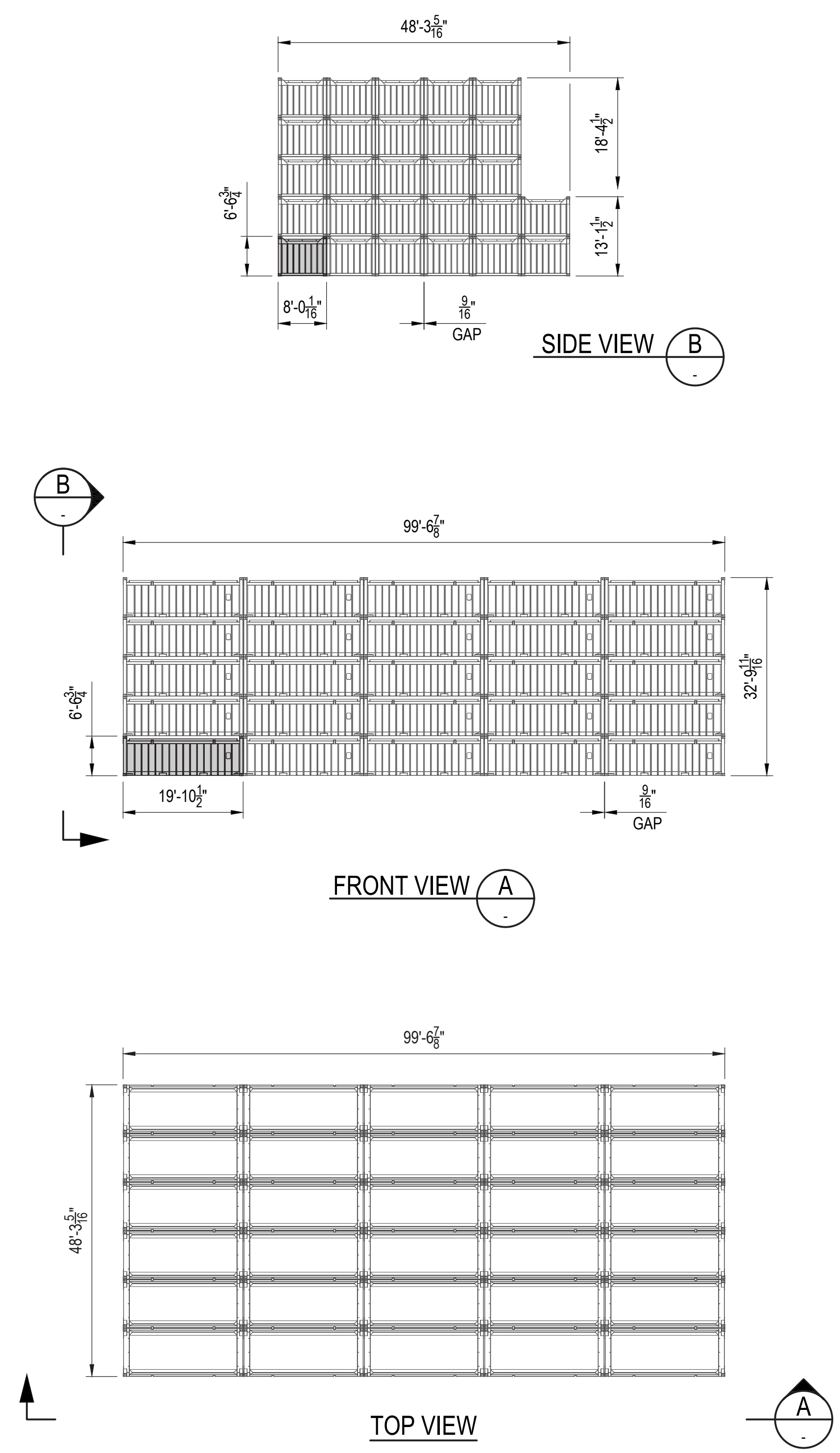

NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - 135 CONTAINERS ALIGNS WITH A FULL TRAIN LOAD.
3 - STACK OCCUPIES 7208 ft².
4 - STACK OCCUPIES 4323 ft².
5 - STACK OCCUPIES 4804 ft².

10'-0" 0 20'-0" 40'-0" 60'-0"
SCALE: 1/16"=1'-0"

AIDEA Alaska Industrial Development and Export Authority

REF.	DRAWING No.	REFERENCE DRAWING

No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
C	SR	19-01-2024	ISSUED FOR CLIENT REVIEW	BM	BM	LC
B	SR	06-12-2023	ISSUED FOR CLIENT REVIEW	BM	BM	LC
A	SR	03-11-2023	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	03NOV2023
DWG. CHECKED	BM	03NOV2023
DESIGNED	SR	03NOV2023
DES. APPR.	LC	03NOV2023
PROJ. APPR.	LC	03NOV2023

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TITLE AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
TYPICAL CONTAINER STACK
PLANVIEW AND VIEWS

PROJECT No.	SCALE	SIZE
107868-01	1/8" = 1'-0"	D

DRAWING No.	REV
107868-GX-00000-31344-001	C

Safety in all we do

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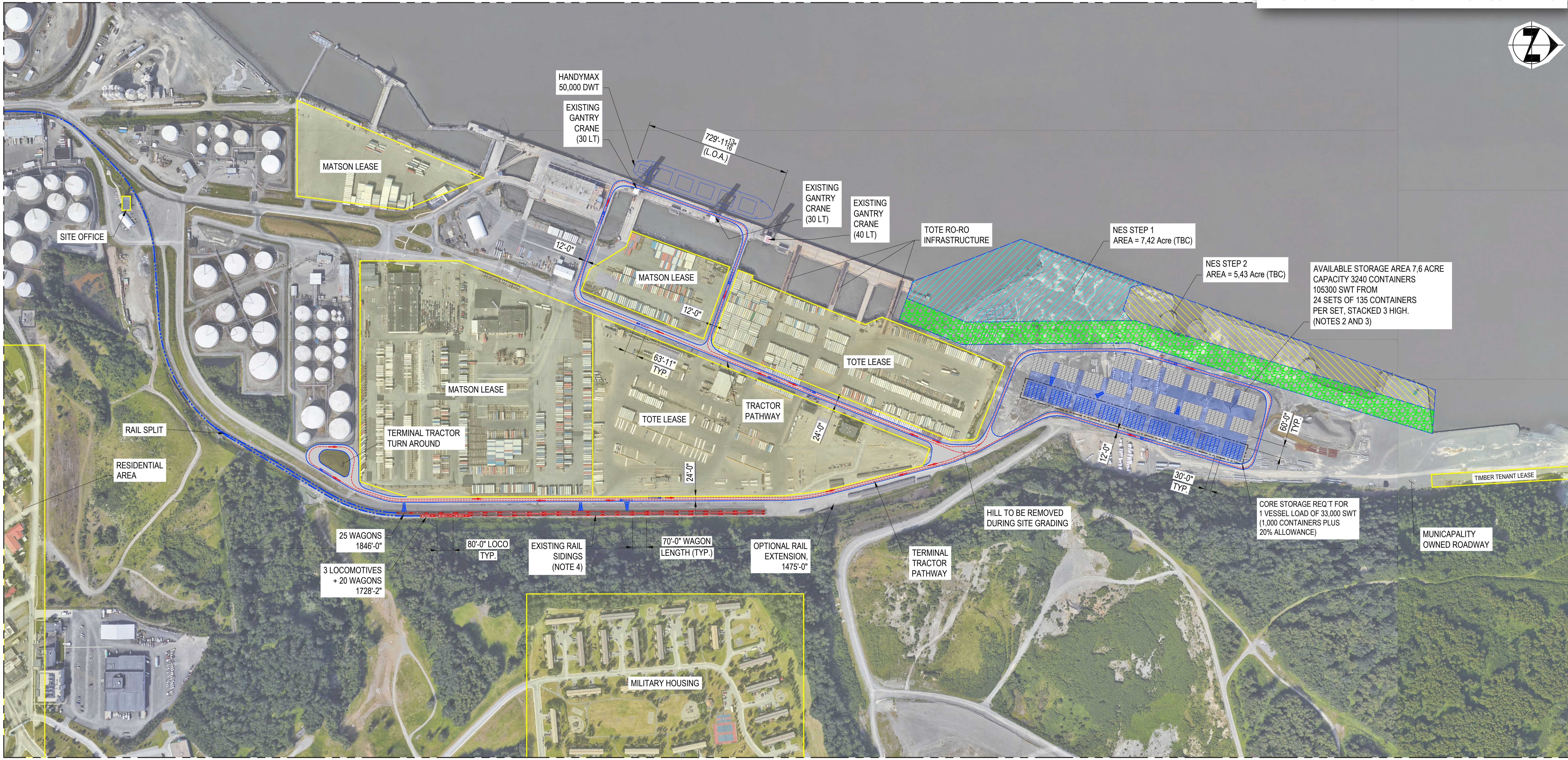

NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
3 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.
4 - A SECOND RAIL SWITCH IS ALREADY INSTALLED IF A 3rd RAIL SPUR WERE TO BE ADDED.

250' 0 250' 500' 750' 1000'
SCALE: 1"=250'

LEGEND:

- OPERATING BOUNDARY
- RAIL
- TRACTOR PATH
- NES STEP 1
- NES STEP 2
- SHORELINE PROTECTION

Safety in all we do

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			D	SR	19-01-2024	ISSUED FOR CLIENT REVIEW	LC	BM	LC
			C	SR	06-12-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
			B	SR	01-11-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
1	107868-GX-00000-31344-001	TYPICAL CONTAINER STACK	A	SR	23-10-2023	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	23OCT2023
DWG. CHECKED	BM	23OCT2023
DESIGNED	SR	23OCT2023
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PROJ. APPR.	LC	23OCT2023

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TITLE
AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
PORT OF ALASKA (ANCHORAGE)
PLOT PLAN

PROJECT No.	SCALE	SIZE
107868-01	1" = 250'	D

DRAWING No. 107868-GX-00000-31344-020
REV D

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NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
3 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.
4 - VESSEL WILL BE WARPED TO FILL REQUIRED HATCHES.
5 - WHARF DESIGNED FOR 400 PSF LOADING.

250' 0 250' 500' 750' 1000'
SCALE: 1"=250'

LEGEND:
- OPERATING BOUNDARY
- TRUCK PATH
- RAIL

Safety in all we do

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			D	SR	19-01-2024	ISSUED FOR CLIENT REVIEW	LC	BM	LC
			C	SR	06-12-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
			B	SR	01-11-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
1	107868-GX-00000-31344-001	TYPICAL CONTAINER STACK	A	SR	27-10-2023	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	27OCT2023
DWG. CHECKED	BM	27OCT2023
DESIGNED	SR	27OCT2023
DES. APPR.	LC	27OCT2023
PROJ. APPR.	LC	27OCT2023

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TITLE
AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
PORT MACKENZIE (ARRIVAL BY TRUCK)
PLOT PLAN

PROJECT No.	SCALE	SIZE
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DRAWING No.	REV
107868-GX-00000-31344-030	D

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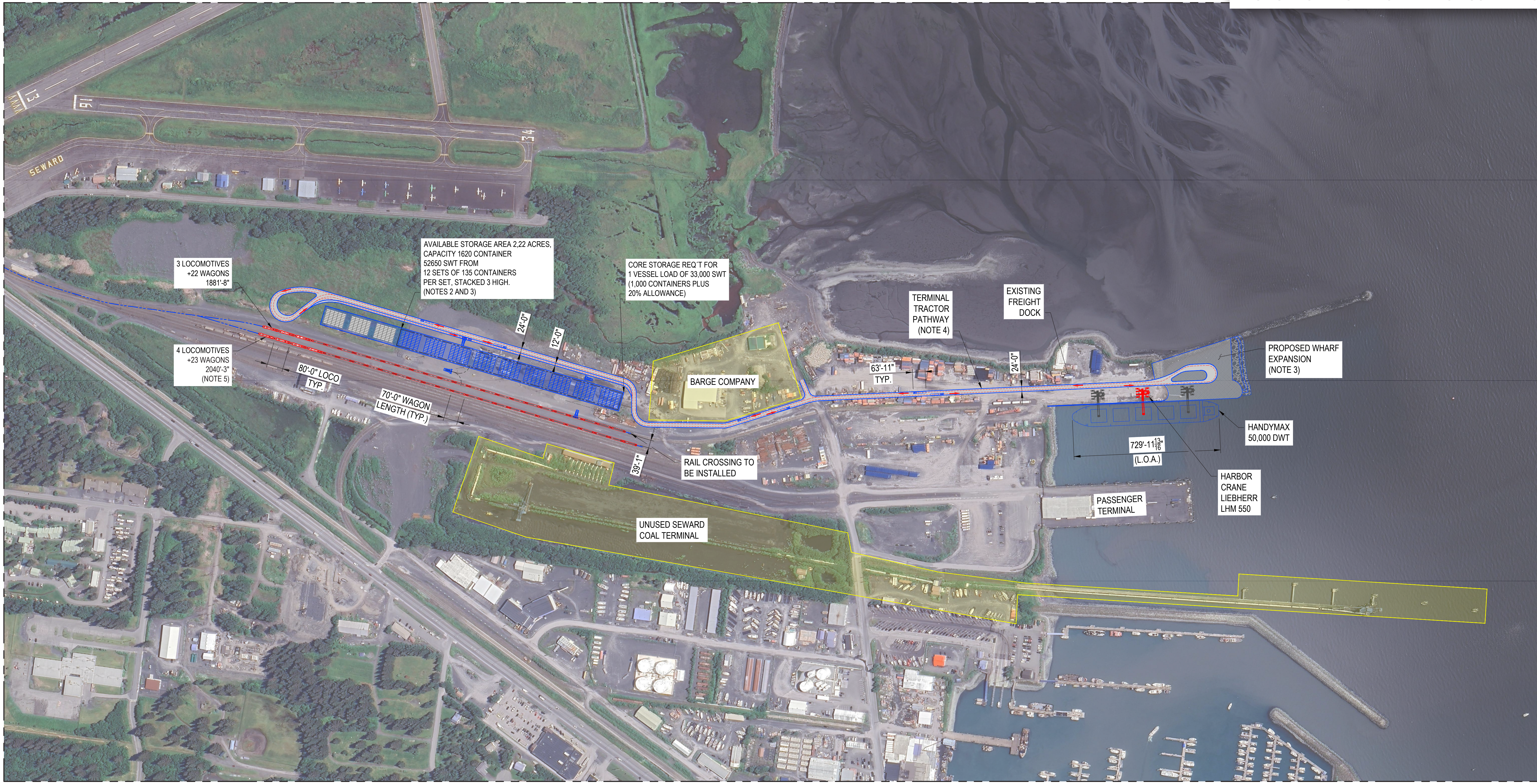

NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 3 HIGH CONTAINER STACKS.
3 - WHARF WILL BE EXPANDED TO SUIT LARGER VESSELS, REFER TO SEWARD MARINE TERMINAL EXPANSION MASTER PLAN.
4 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.
5 - 7 LOCOMOTIVES DUE TO PASSAGE GRADES SOUTH OF PORTAGE.

250' 0 250' 500' 750' 1000'
SCALE: 1"=250'

LEGEND:

- OPERATING BOUNDARY
- TERMINAL TRACTOR PATHWAY
- RAIL
- WHARF EXPANSION

Safety in all we do

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			B	SR	01-11-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
1	107868-GX-00000-31344-001	TYPICAL CONTAINER STACK	A	SR	26-10-2023	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	26OCT2023
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TITLE AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
SEWARD
PLOT PLAN

PROJECT No.	SCALE	SIZE
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DRAWING No.	REV
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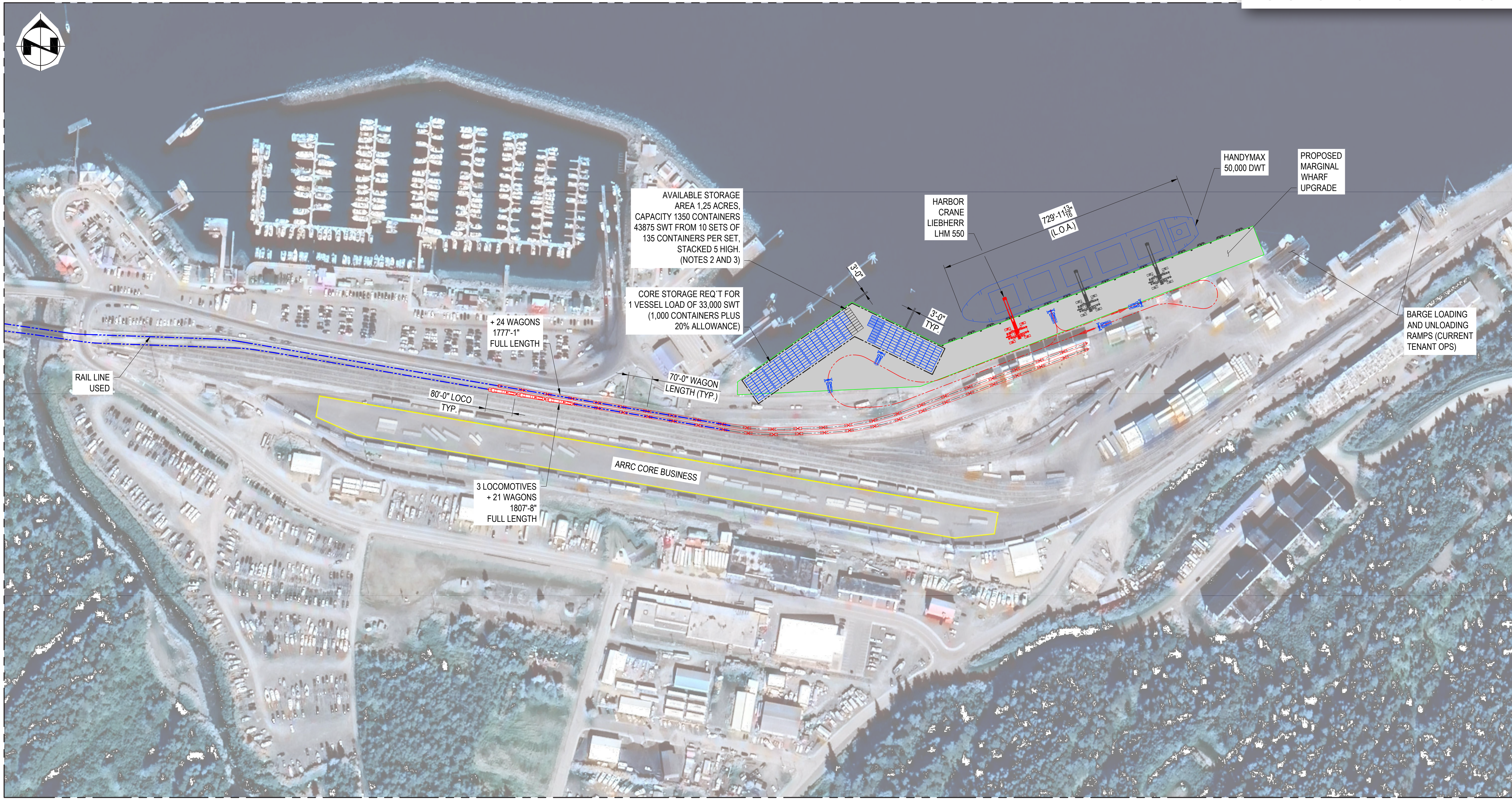

NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 5 HIGH CONTAINER STACKS.
3 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.
4 - ADDITIONAL STACKS CAN BE STORED EAST OF THE BARGE UNLOADING DOCK IF REQUIRED.

100' 0 100' 200' 300' 400' 500' 600'
SCALE: 1"=150'

LEGEND:
- OPERATING BOUNDARY
- HANDLER PATH
- RAIL

Safety In all we do

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			D	SR	19-01-2024	ISSUED FOR CLIENT REVIEW	LC	BM	LC
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DRAWN	SR	27OCT2023
DWG. CHECKED	BM	27OCT2023
DESIGNED	SR	27OCT2023
DES. APPR.	LC	27OCT2023
PROJ. APPR.	LC	27OCT2023

AIDEA Alaska Industrial Development and Export Authority

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CLIENT ALASKA INDUSTRIAL DEVELOPMENT AND EXPORT AUTHORITY

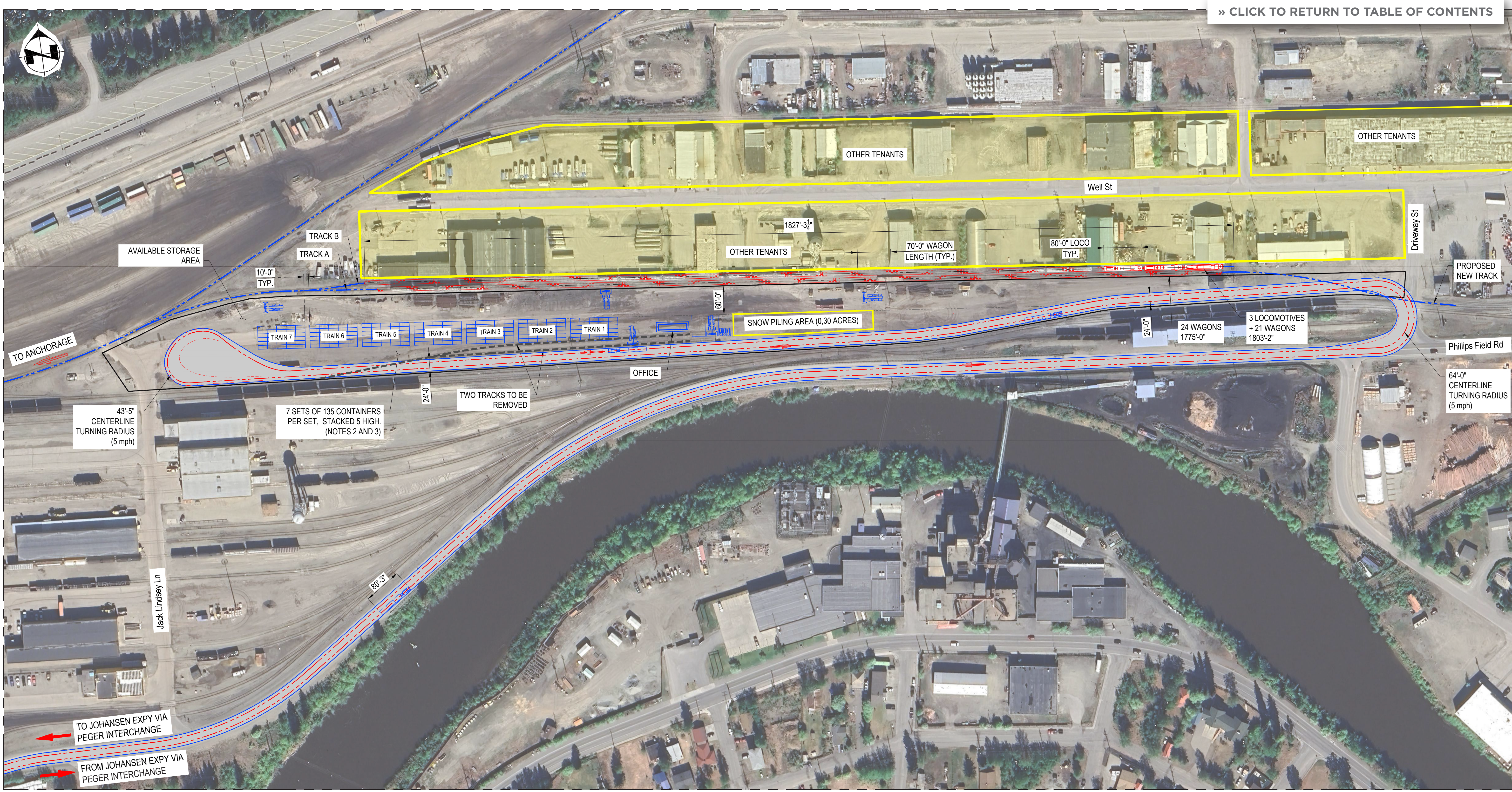
TITLE AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
WHITTIER
PLOT PLAN

PROJECT No. 107868-01 | SCALE 1" = 150' | SIZE D

DRAWING No. 107868-GX-00000-31344-050 | REV D

» CLICK TO RETURN TO TABLE OF CONTENTS

APPENDIX H – RAIL AND INTERMODAL CONCEPTS



NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - ASSUMED GROUND BEARING PRESSURE IS SUITABLE TO ALLOW 5 HIGH CONTAINER STACKS.
3 - MISCELLANEOUS OBSTRUCTIONS WILL BE REMOVED AS REQUIRED.

100' 0 100' 200' 300' 400'
SCALE: 1"=100'

LEGEND:
- ARRC LOT BOUNDARY
- OPERATING BOUNDARY
- TRUCK PATH
- RAIL

Safety in all we do

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REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
			D	SR	19-01-2024	ISSUED FOR CLIENT REVIEW	LC	BM	LC
			C	SR	06-12-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
			B	SR	01-11-2023	ISSUED FOR CLIENT REVIEW	MS	BM	LC
1	107868-GX-00000-31344-001	TYPICAL CONTAINER STACK	A	SR	27-10-2023	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	27OCT2023
DWG. CHECKED	BM	27OCT2023
DESIGNED	SR	27OCT2023
DES. APPR.	LC	27OCT2023
PROJ. APPR.	LC	27OCT2023

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TITLE
AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
ALASKAN RAIL ROAD CORPORATION YARD (FAIRBANKS)
PLOT PLAN

PROJECT No. 107868-01
SCALE 1/112" = 1'-0"
SIZE D
DRAWING No. 107868-GX-00000-31344-010
REV D

Jan 18,2024 - 6:50pm C:\Users\Samuel.Ragozini\AUSENCO\AMBLER PORT\107868-GX-00000-31344-010.dwg - Samuel.Ragozini

» CLICK TO RETURN TO TABLE OF CONTENTS

DETAIL "A"
SCALE : 1"=100'-0"

100' 0 100' 200' 300' 400'
SCALE: 1"=100'

250' 0 250' 500' 750' 1000'
SCALE: 1"=250'

LEGEND:
- EXISITING RAIL
- NEW RAIL
- OPERATING BOUNDARY
- PROPERTY BOUNDARIES

NOTES:

1 - DIMENSIONS IN FEET AND INCHES.
2 - RAIL SWITCH TO BE ADDED TO THE MAIN LINE TO ALLOW TRAIN TO RETURN TO FAIRBANKS.

Safety in all we do

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REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
			B	SR	19-01-2024	ISSUED FOR CLIENT REVIEW	BM	BM	LC
			A	SR	19-01-2024	ISSUED FOR INTERNAL REVIEW	BM	BM	LC

DRAWN	SR	12JAN2024
DWG. CHECKED	BM	12JAN2024
DESIGNED	SR	12JAN2024
DES. APPR.	LC	12JAN2024
PROJ. APPR.	LC	12JAN2024

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TITLE AMBLER ACCESS PROJECT
CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
HOUSTON (RAIL TO TRUCK INTERMODAL SITE)
PLOT PLAN

PROJECT No. 107868-01
SCALE 1" = 150'
SIZE D
DRAWING No. 107868-GX-00000-31344-031
REV B

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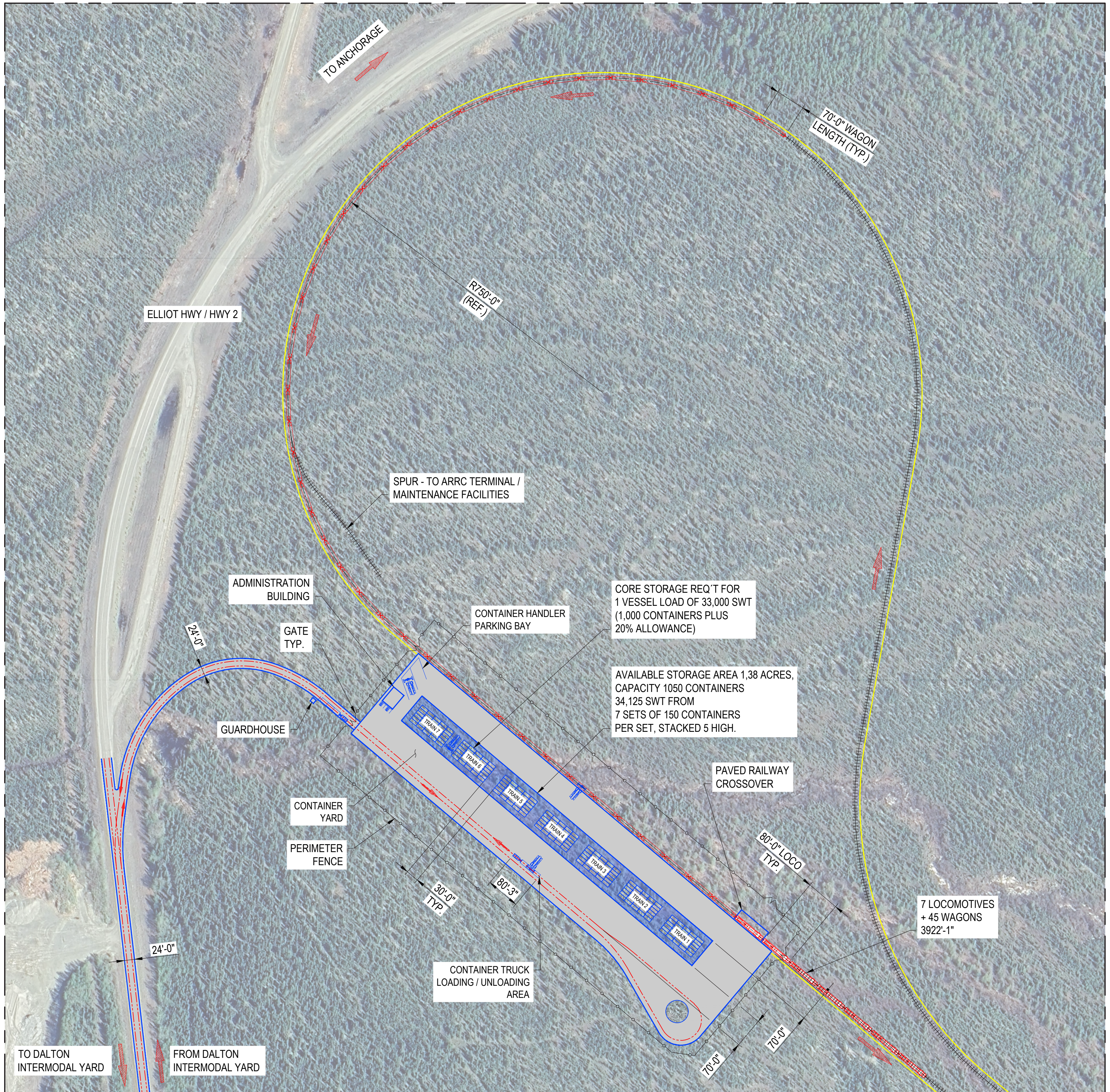

KEY PLAN
NTS

NOTES:

1 - DIMENSIONS IN FEET AND INCHES.

LEGEND:

- OPERATING BOUNDARY
- TRUCK PATH
- NEW RAIL
- LAND TO BE CLEARED

100' 0 100' 200' 300' 400' 500' 600'

SCALE: 1"=150'

REF.	DRAWING No.	REFERENCE DRAWING	No.	BY	DATE	REVISION DETAILS	CHKD	ENG	APPR
			B	SR	26-01-2024	ISSUED FOR CLIENT REVIEW	BM	BM	LC
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DRAWN	SR	23JAN2024
DWG. CHECKED	BM	23JAN2024
DESIGNED	SR	23JAN2024
DES. APPR.	LC	23JAN2024
PROJ. APPR.	LC	23JAN2024

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CONTAINERIZED CONCENTRATE EXPORT TERMINAL STUDY
LIVENGOOD (TRUCK TO RAIL INTERMODAL SITE)
PLOT PLAN

PROJECT No.	SCALE	SIZE
107868-01	1" = 150'-0"	D

DRAWING No.	REV
107868-GX-00000-31344-060	B

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APPENDIX I – EO BRIEF

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PORT MACKENZIE: UNLEASHING ALASKA'S EXTRAORDINARY RESOURCE POTENTIAL AND INCREASING AMERICAN MINERAL PRODUCTION

Ria Hanson, Ted Stevens Center for Arctic Security Studies

19 Sept 2025

Resource development in Alaska, the United States' portion of the Arctic, is slowed by insufficient transportation and export capacity. The region's energy, mineral, and maritime assets are of growing strategic importance, but development is hindered by inaccessibility. Recent executive orders by President Trump, particularly the January 20, 2025 Executive Order 14153, "Unleashing Alaska's Extraordinary Resource Potential" (EO14153), and March 20, 2025 Executive Order 14241, "Immediate Measures to Increase American Mineral Production" (EO 14241), highlight the national imperative of advancing Arctic resource projects and improving associated infrastructure.[i] **Among the most critical investments to achieve these objectives is the completion of the Port MacKenzie rail extension and the expansion of the port itself.** These projects would provide reliable, year-round access for resource extraction, reduce logistical costs, and open efficient pathways to global markets. Advancing the rail extension and port will not only accelerate economic opportunities for Alaska but also strengthen U.S. resilience and security in the Arctic domain.

BACKGROUND

Executive Order 14153, "Unleashing Alaska's Extraordinary Resource Potential," emphasizes several objectives related to developing Alaska's resources "to the fullest extent possible."[ii] These objectives include economic and national security, trade imbalances, global energy, and energy security in the face of geopolitical conflict. To achieve these objectives, the EO calls for the U.S. to "fully avail itself of Alaska's vast lands and resources for the benefit of the Nation" and maximize development and production of natural resources, including Liquified Natural Gas (LNG) in the state.

Executive Order 14241, "Immediate Measures to Increase American Mineral Production," emphasizes that U.S. economic and national security are "acutely threatened by our reliance upon hostile foreign power's mineral production."[iii] The EO calls for the U.S. to take action to facilitate domestic mineral production to the maximum extent possible.

A key infrastructure component to achieving the goals of both EOs is the further development of Port MacKenzie and completion of the Port MacKenzie rail extension.[1]

Port MacKenzie is a port in early-stage development. It sits in the Matanuska-Susitna Borough, across Knik Arm from the Port of Alaska in southcentral Alaska. Port MacKenzie is the only port in the U.S. Arctic with year-round accessibility and extensive development potential. It has unique characteristics to support resource development including a deep-draft dock, barge dock, 15 acres of wharf, a conveyor belt, terminal building and paved access road.[iv] It is surrounded by 9,000 acres of adjacent land available for commercial and industrial development or staging. Port MacKenzie can handle the world's largest bulk cargo vessels, like the ones that transport commodities through the Panama Canal, around the Cape of Africa and across the Pacific Ocean.

Port MacKenzie also has a partially completed rail extension connecting the port to the Alaska Railroad mainline and the heavily mineralized areas of Interior Alaska. The estimated cost to complete the rail line is $300 million, in addition to the $184 million (over $255 million in 2025 dollars) already contributed by the State of Alaska.[v] This rail extension must be completed to maximize the economic and national security benefits of Port MacKenzie.

ANALYSIS

With the completion of the rail extension, Port MacKenzie can help achieve the development of Alaska's LNG potential.

Section 3. Part (a)(ii) of EO 14153 emphasizes the importance of necessary LNG pipeline infrastructure. Completion of an LNG pipeline from the North Slope of Alaska will require the transportation of key development cargo from tidewater to inland locations. This cargo includes pipe, compressor station construction materials, compressor components, construction equipment, fuel, and construction camps and camp components. One gallon of fuel can move one ton of freight 130 miles by truck or 480 miles by train, making trucking miles a major expense relative to rail transport.[vi] Thus, transportation by rail is the most cost-effective way to transport the materials needed for LNG pipeline construction. Port MacKenzie, with its ample staging space and a completed rail extension, could be specifically used to transport pipe and materials for construction of the northern portion of the LNG pipeline. The southern end of the pipeline will likely be supported by the Port of Valdez.

Port MacKenzie and the completed rail extension contribute to developing mineral resources in Alaska that will reduce reliance on foreign mineral production.

The Railbelt corridor has significant mineral deposits with development potential, if production is economic.[vii] Figure 3 in the Appendix approximates the location of many of these mineral occurrences within a 100km buffer of the Railbelt. Dr. Paul Metz, a registered professional geologist, completed a two-phase economic analysis of future rail extension cargo operations.[viii] His analysis, in combination with information provided by local entrepreneurs, the Port Director and Borough staff, concluded that completion of the rail extension alongside increased Port investment would open the corridor along the Railbelt and into Interior Alaska for new exploration and development. This development could lead to the extraction of strategic minerals including lead, zinc, copper, molybdenum, lime, silver and antimony.[ix]

The mineral development that Port MacKenzie and the rail extension could stimulate will directly contribute to national security.

The Department of Defense uses approximately 750,000 tons of minerals annually.[x] Many of the mineral deposits along the Railbelt in Alaska are particularly important to the U.S. military. Lead is a major component of

[1] See Figures 1 and 2 in the Appendix for map visualizations.

ammunition; copper is used to make military vehicles including aircrafts and ships; copper combined with lead and nickel is used to make body armor; and molybdenum is a primary ingredient in stainless steel, lending strength and durability to structures.[xi] Molybdenum is also used in armored vehicles, missiles and aircrafts. Silver is used in the construction of C17s and Apache helicopters, as well as many other defense tools.

Particularly important is the potential development of antimony mines. There are currently no antimony mines in the U.S. and 60 percent of antimony used in the U.S. comes from China.[xii] Antimony is a critical mineral used in a wide array of military applications including bullet manufacturing, night vision goggles, laser sighting, nuclear weapons and production, communications equipment and more.[xiii] In the last year, Great Land Minerals, a U.S. Antimony subsidiary, acquired three claims for exploration in Interior Alaska. Two of these claims are near the Alaska Railroad. U.S. Antimony plans to truck the ore from Alaska to its processing plant in Montana – the only such plant in the U.S. "We can't get that antimony from Alaska to Montana fast enough," Joe Bardswich, U.S. Antimony's chief mining officer, stated.[xiv] The rail access to tidewater at Port MacKenzie, paired with shipping instead of trucking, can significantly reduce transport cost of getting antimony to Montana.

Port MacKenzie can contribute to ameliorating U.S. trade imbalances.

Alaska has a six-day shipping advantage to Asia, relative to ports in British Columbia and the Pacific Northwest.[xv] Companies including Fort Knox Gold, Shorty Creek Copper, Livengood Gold, Usibelli Coal and Prospect Copper have, in the past, expressed interest in seeing the port and rail extension developed for their use as a tidewater hub.[xvi] Previously, Usibelli Coal Mine trucked coal to export through Port MacKenzie. If Port MacKenzie and the rail extension can increase shipping directly to and from our international allies and partners, it will further boost the economy, signaling stability and resilience to U.S. adversaries.

The completion of the Port MacKenzie rail extension will contribute to improving cost ratios of new mines, increasing development potential and capacity for mineral export.

The completion of the Port MacKenzie rail extension would reduce the distance to port from Interior Alaska by approximately 147 miles compared to the Port of Seward, Alaska's other deep water, bulk commodities port. That distance is approximately 30% of the full length of the rail line in Alaska.[xvii] Transporting goods to the Port of Seward requires travelling uphill stretches through mountain passes that limit train load and speed.[xviii] The Port MacKenzie rail extension would provide an alternative to that route for bulk commodity export. Additionally, the Port MacKenzie rail extension would bypass the congested areas of Anchorage and Wasilla, further reducing shipping time and expense for producers.[xix]

Port MacKenzie and the rail extension will support timber development.

Port MacKenzie has already been used for the bulk export of birch, aspen and spruce chips to South Korea, Taiwan and Japan.[xx] With completion of the rail, the economics of transporting wood products from Interior Alaska to tidewater are measurably improved, compared to transport of wood chips to port via truck.

RECOMMENDATIONS

Port MacKenzie, with the completed rail extension, will directly contribute to domestic resource development and facilitate trade to enhance U.S. economic and national security. These projects are becoming more imperative as interest grows in developing warfighter presence in Alaska and between the Arctic and Pacific regions. The port and rail can support the development of an LNG pipeline, stimulate new and existing mines in Interior Alaska, and improve cost ratios of accessing and transporting other resources and materials. **Continued development of Port MacKenzie and completion of the Port MacKenzie rail extension are concrete, cost-effective goals that will move Alaska and the United States toward more robust economic and national**

security as laid out by EO 14153 and EO14241. To take advantage of this valuable infrastructure for "developing [Alaska's] resources to the fullest extent possible," high priority should be placed on:

1. **Completion of the Port MacKenzie Rail Extension**
    a. The rail extension will reduce transport costs for resource exports.
    b. The rail connection will provide tidewater access to new resource sites.
    c. The rail extension will increase mineral transport capacity and capability.
2. **Continued improvement of infrastructure at Port MacKenzie**
    a. Investment is required to handle increasing volumes of imports and exports.
    b. Investment is required to handle a broader variety of materials and resources.
3. **Developing partnerships with resource development entities to increase and secure domestic mineral use and export via Port MacKenzie**
    a. Mineral development in new locations depends on confidence in available transport infrastructure.
    b. Port development must occur in conjunction with demonstrated demand.
    c. Establishing public-private partnerships can achieve the above-mentioned conditions.

Author's Disclaimer: The views expressed in this Brief are those of the author and do not reflect the official policy or position of the U.S. Department of Defense or of the U.S. Government.

APPENDIX

Figure 1: Port MacKenzie Transportation Infrastructure

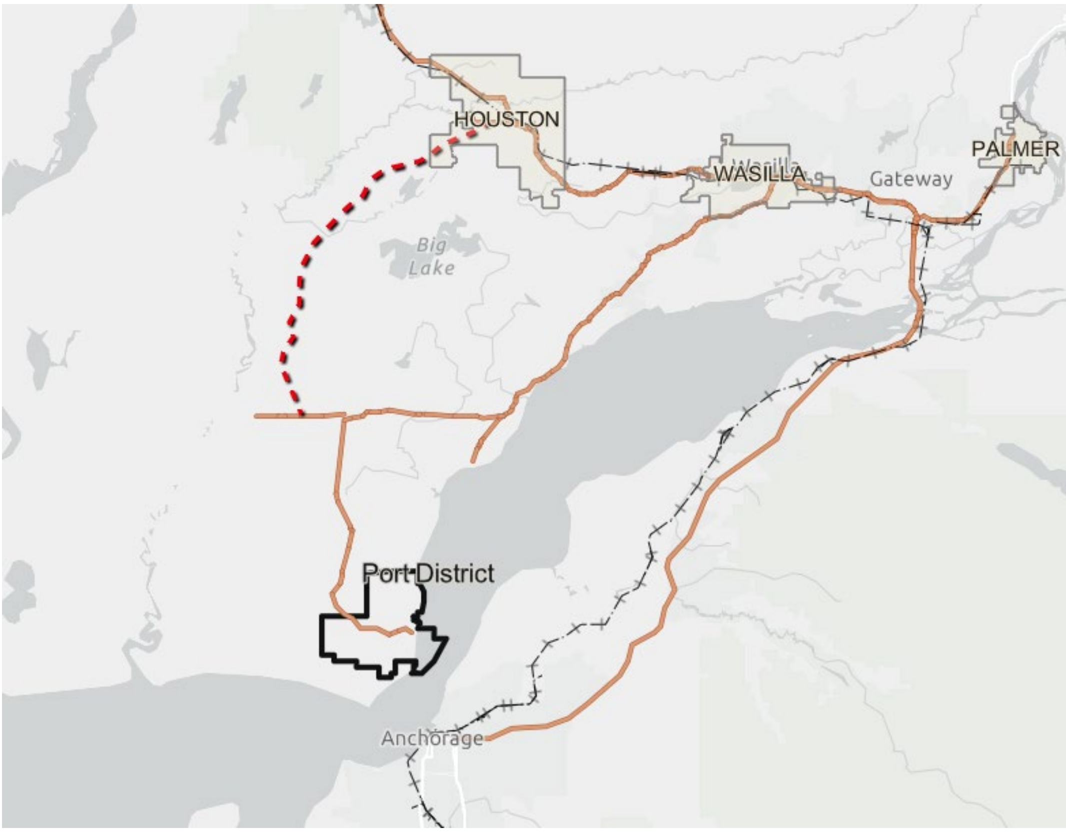

Figure 1: This map shows access infrastructure to Port MacKenzie: the orange lines indicated existing roadways, the black crosses indicate the Alaska Railroad mainline, and the red dashed indicates the general route of the rail extension, which, when complete, will connect Port MacKenzie to the mainline at Houston. The rail extension continues from the red dashed line to within the Port District.

Source: Matanuska-Susitna Borough, "Point MacKenzie Access," ArcGIS StoryMaps, June 4, 2025, https://storymaps.arcgis.com/stories/0b1cd52f4c47482d955a99e85f8af22c.

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Figure 2: Port MacKenzie Current and Proposed Access

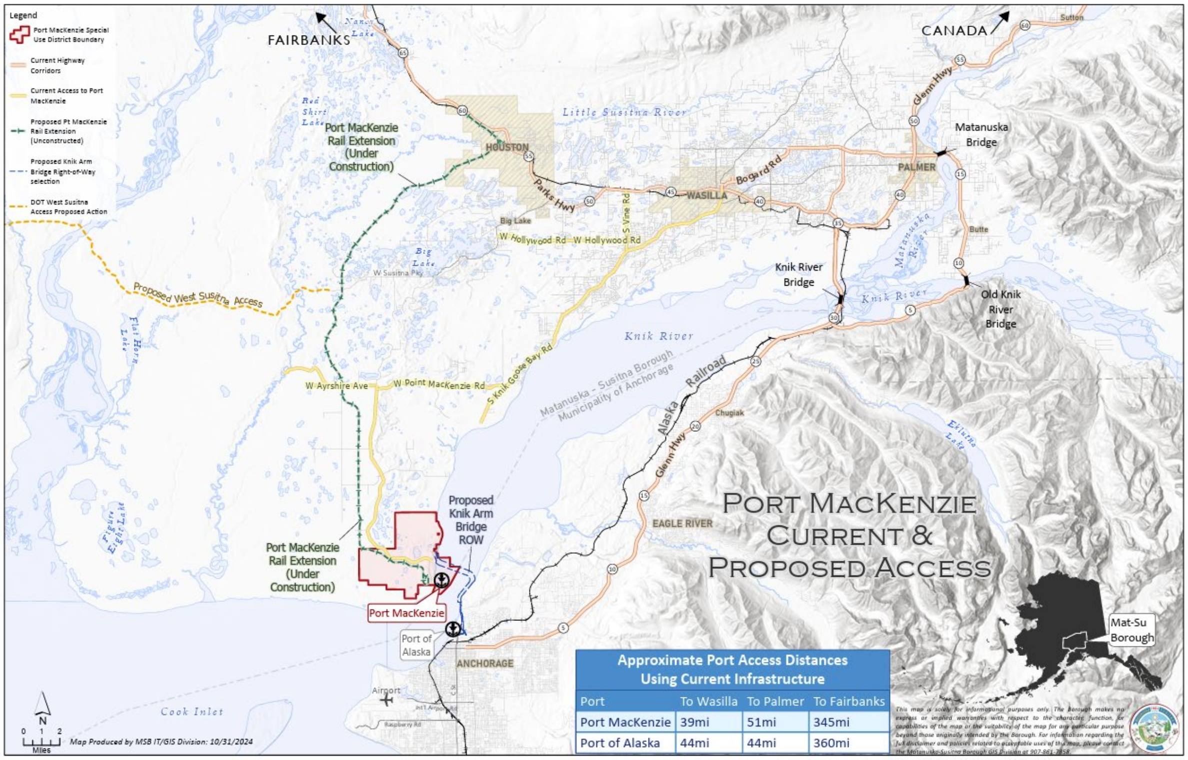

Figure 2: This map, current as of October 31, 2024, shows the location of Port MacKenzie and the route of the partially constructed rail extension relative to other major existing and proposed infrastructure in the region. Source: Matanuska-Susitna Borough, "Port MacKenzie | Planning," accessed September 16, 2025, https://portmackenzie.matsugov.us/pages/57ac92e23e784dd19ec8f302ce65e801.

Figure 3: Mineral Deposits Along the Alaska Railbelt

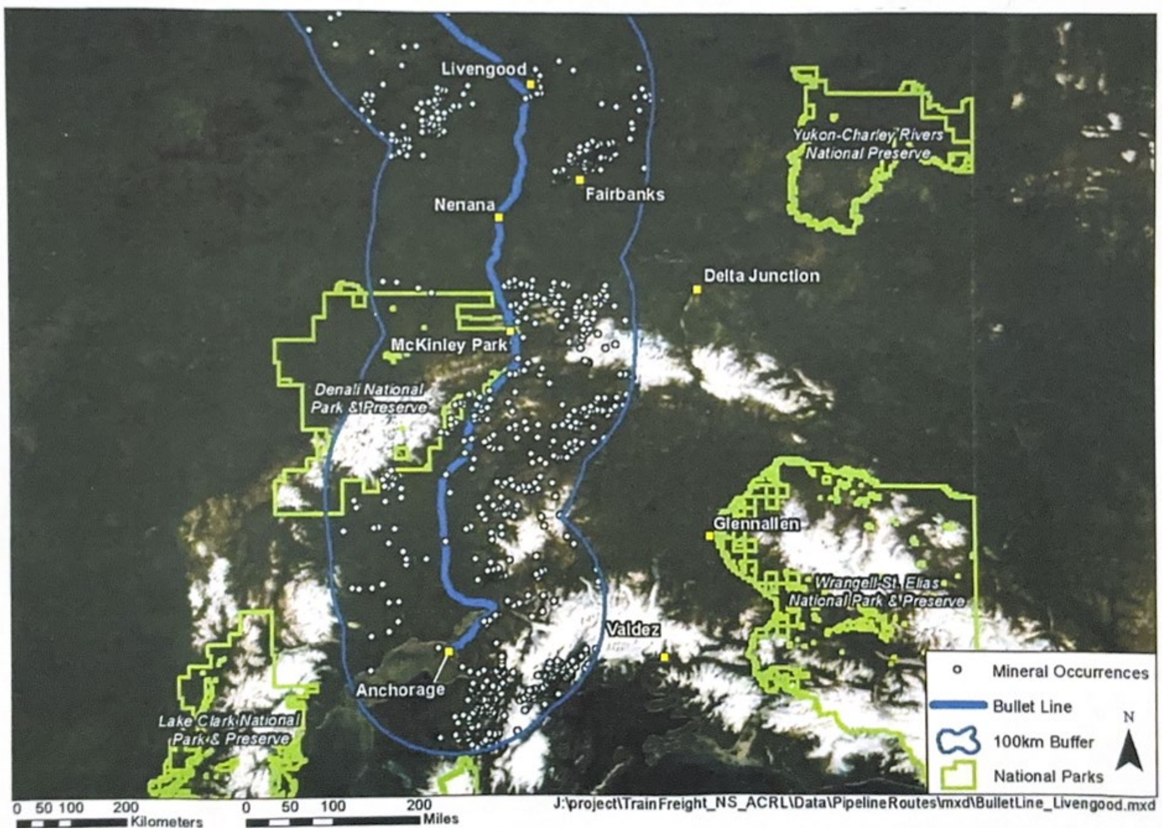

Figure 3: This map indicates known mineral deposits within 100 kilometers of the Alaska Railbelt. Some of these deposits hold critical minerals key to shoring up U.S. economic and national security.
Source: Paul Metz, *Economic Analysis of Rail Link Port MacKenzie to Willow, Alaska, Phase II* (2011).

End Notes

[i] President Donald Trump, "Unleashing Alaska's Extraordinary Resource Potential," Government, The White House, January 21, 2025, https://www.whitehouse.gov/presidential-actions/2025/01/unleashing-alaskas-extraordinary-resource-potential/; President Donald Trump, "Immediate Measures to Increase American Mineral Production," The White House, March 20, 2025, https://www.whitehouse.gov/presidential-actions/2025/03/immediate-measures-to-increase-american-mineral-production/.
[ii] President Donald Trump, "EO 14153."
[iii] President Donald Trump, "EO 14241."
[iv] Matanuska-Susitna Borough, "Port MacKenzie Website," Government, accessed August 24, 2025, https://portmackenzie.matsugov.us/.
[v] Matanuska-Susitna Borough, "Point MacKenzie Access," ArcGIS StoryMaps, June 4, 2025, https://storymaps.arcgis.com/stories/0b1cd52f4c47482d955a99e85f8af22c.
[vi] Matanuska-Susitna Borough, "Port MacKenzie Rail Extension: A Project of Statewide Significance and Benefit, Helping to Diversify the Alaskan Economy," 2011.
[vii] Matanuska-Susitna Borough, *Port MacKenzie Master Plan 2016 Update* (2016).
[viii] Paul Metz, *Economic Analysis of Rail Link Port MacKenzie to Willow, Alaska, Phase II* (2011).
[ix] Matanuska-Susitna Borough, *Port MacKenzie Master Plan 2016 Update*; Metz, *Rail Link Economic Analysis*.
[x] "Minerals and Metals Help Improve Our National Security," *National Mining Association*, February 3, 2017, https://nma.org/2017/02/03/minerals-and-metals-help-improve-our-national-security/.
[xi] Edelman, "The Top Eight Minerals That Support National Defense," *Minerals Make Life*, May 24, 2017, https://mineralsmakelife.org/blog/the-top-eight-minerals-that-support-national-defense/.
[xii] Max Graham, "Fueled by Trade Tensions and Foreign Wars, a Rush for an Obscure Mineral Heats up in Alaska," *Alaska Beacon, Northern Journal*, June 6, 2025, https://alaskabeacon.com/2025/06/06/fueled-by-trade-tensions-and-foreign-wars-a-rush-for-an-obscure-mineral-heats-up-in-alaska/.
[xiii] David Blackmon, "Antimony: The Most Important Mineral You Never Heard Of," accessed September 15, 2025, https://www.forbes.com/sites/davidblackmon/2021/05/06/antimony-the-most-important-mineral-you-never-heard-of/.
[xiv] Graham, "Fueled by Trade Tensions and Foreign Wars, a Rush for an Obscure Mineral Heats up in Alaska."
[xv] Matanuska-Susitna Borough, *Port MacKenzie Overview* (2010).
[xvi] Elizabeth Gray, "Response to Senator Hoffman, Co-Chair, Senate Finance Committee," personal communication, March 4, 2011.
[xvii] *Official State of Alaska Map*, n.d.
[xviii] Matanuska-Susitna Borough, *Port MacKenzie Overview*.
[xix] "Response to Ken Williamson, WorleyParsons Calgary," with David Hanson, Matanuska-Susitna Borough, December 1, 2010.
[xx] "Response to Ken Williamson, WorleyParsons Calgary."

APPENDIX J - 2025 ALASKA MINING INDUSTRY OVERVIEW

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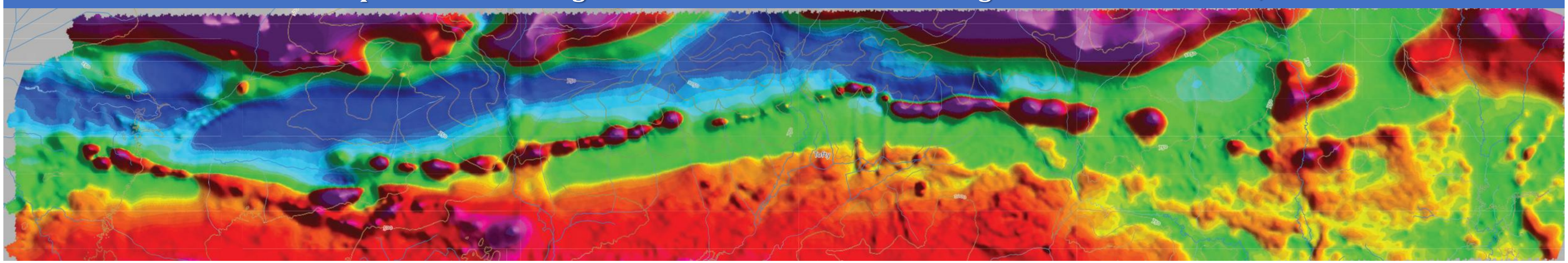
2025 Alaska Mining Industry Overview – Ready To Rumble

David Szumigala
Geologist, Mineral Resources Section
Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys

American Exploration & Mining Association 131th Annual Meeting December 10, 2025



ACKNOWLEDGEMENTS

Thank you

- Most data and images are from Alaskan mining and exploration companies
- Presentation and interpretation of data collected is solely the author's responsibility
- Incomplete full year picture at this time (volumes and values are preliminary estimates)
- Many more projects were active than can be mentioned due to time constraints

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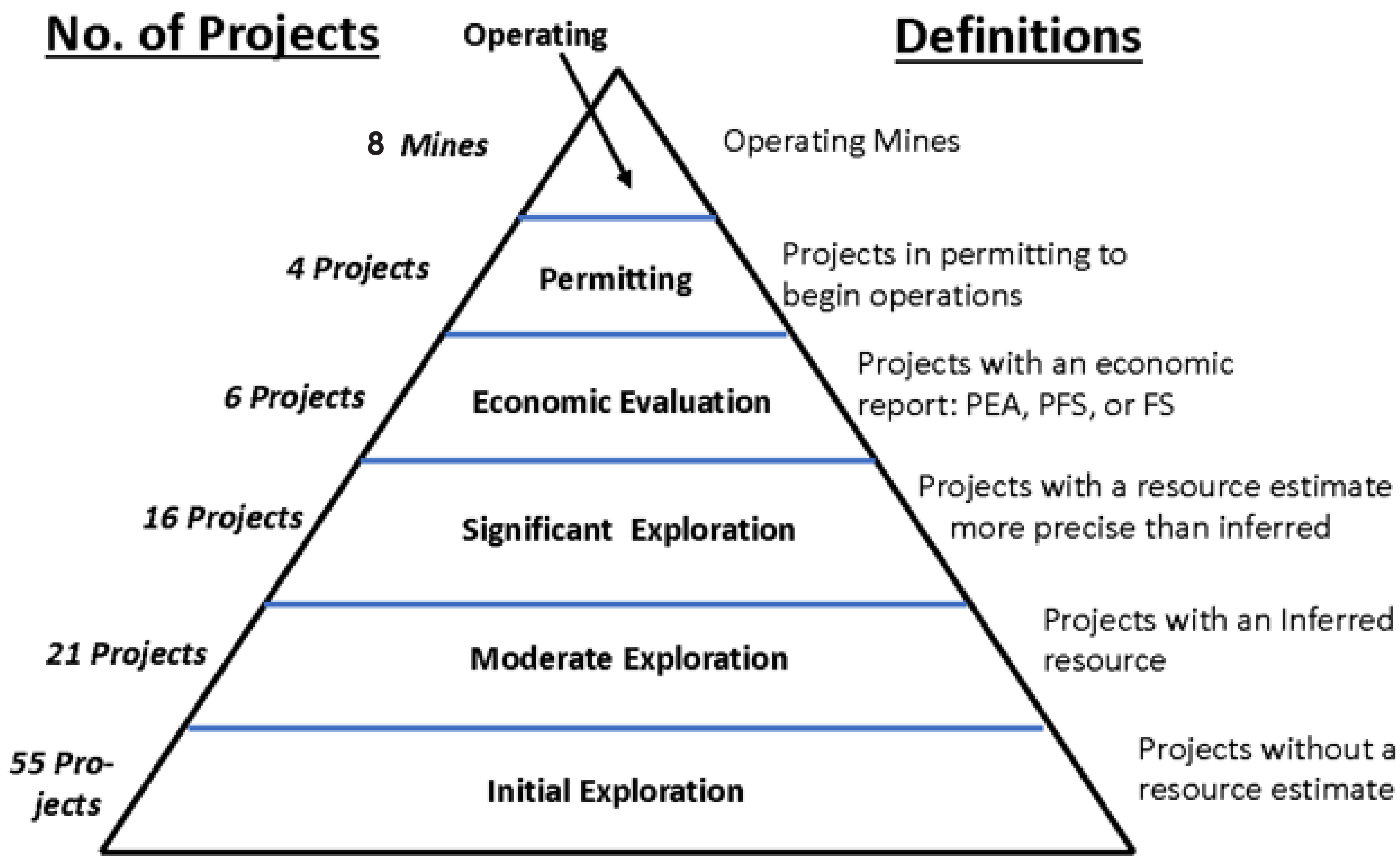
Source: McKinley Research Group - 2025 update

Alaska Mine Development Pyramid

- Significant investment needed to move a project up the pyramid

- Large number of mineral exploration projects needed to overcome low odds of an eventual mine developing

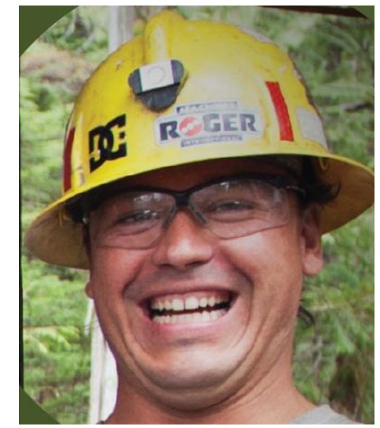


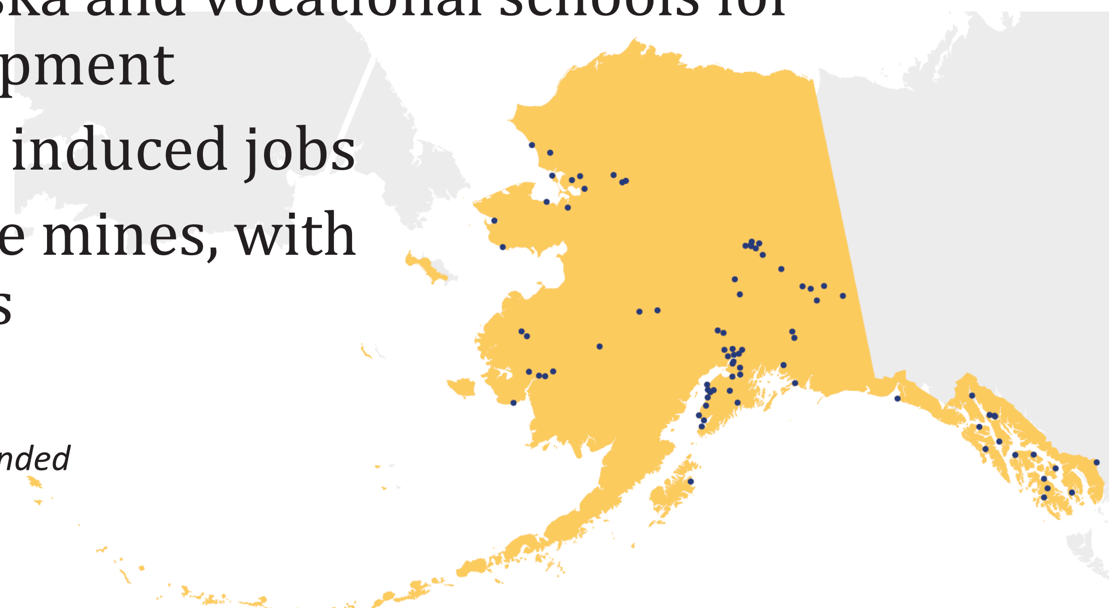
Credit: Loeffler and Watson

Economic Benefits of Mineral Industry

- $1.1 billion to 500+ local businesses for goods and services
- $47 million in local-tax and $92 million in state-government revenue for libraries, road repairs, airports, schools, public safety
- $425 million in royalty payments to Alaska Native Corporations
- $5.6 million in charitable contributions to 230 non-profit organizations
- $1.7 million to University of Alaska and vocational schools for education and workforce development
- 12,400 total direct, indirect, and induced jobs
- 75% Alaska resident hire at large mines, with employees from 85 communities
- $1.2 billion in wages statewide

Source: McKinley Research Group - 2024 update, slightly amended





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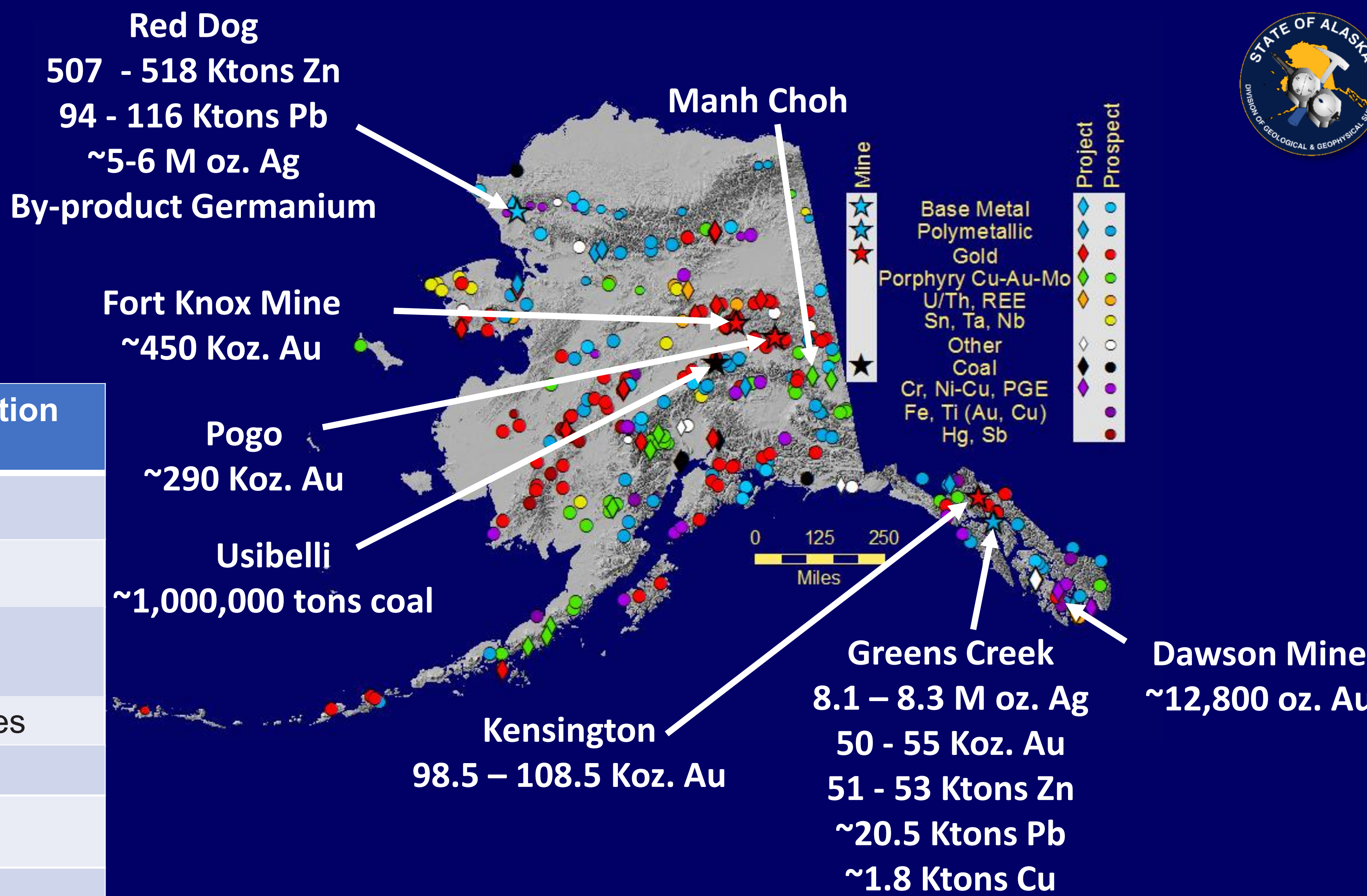
2025 Alaska Mineral Production Summary

- 8 lode mines
- 1 coal mine
- ~ 150 placer Au mines
- ~ 60 exploration projects
- 80 active sand and gravel operations

	2025 Mineral Production (Estimated)
Zinc (Zn)	560,000 – 575,000 tons
Lead (Pb)	105,000 – 136,000 tons
Gold (Au)	925,000 – 955,000 troy ounces
Silver (Ag)	13 - 15 million troy ounces
Copper (Cu)	1,500 – 2,000 tons
Coal	1,000,000 tons
Industrial Minerals	750,000 tons Rock 6.5 million tons Sand & Gravel



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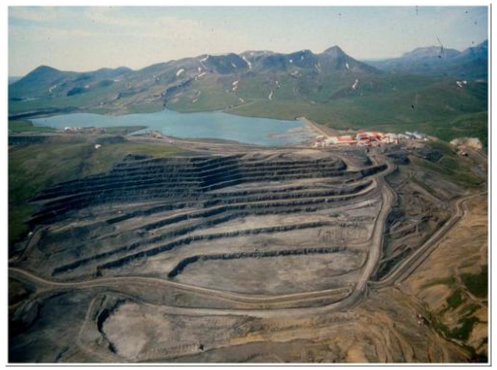
Teck Alaska - Red Dog Mine

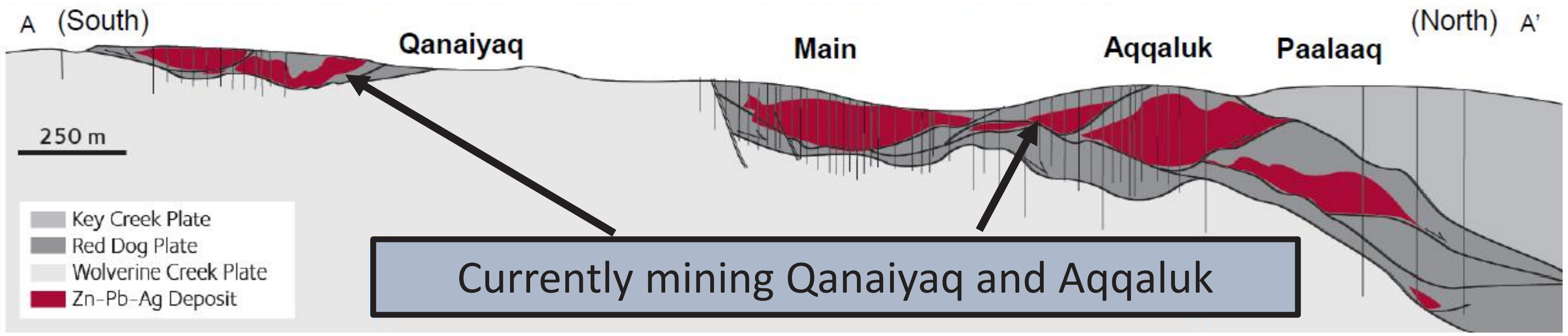
Sediment-hosted Zn-Pb-Ag deposit

Largest zinc mine in the United States (4% global production)
600 direct jobs and 700 contractors
(52% of all workers are NANA shareholders)
Open pit; Began operating in 1989
Mine life through 2031



2024 Production:
555,600 tonnes Zn;(595,027 tons)
109,100 tonnes Pb (102,927 tons)
~6.5 million ounces Ag
10 tons? By-product germanium

-2025 Red Dog zinc production forecast at 430,000-470,000 tonnes, with 85,000-105,000 tonnes lead (with continued decreased production in 2026-28)
2025 shipping season began July 11
2024 $327 M royalty payment



Data from Teck, 2025

Dec. 31, 2024	Million Tons	Zn %	Pb %	Ag g/T
Reserves	32.1	11.5	3.3	61.8
Indicated	5.2	7.9	6.4	124.5
Inferred	14.6	11.1	4.0	77.9
Total	**51.8**	**11.3**	**3.9**	**72.7**

Data from Kinross, 2025

» CLICK TO RETURN TO TABLE OF CONTENTS

KINROSS/CONTANGO ORE – MANH CHOH (PEAK)

Open-pit; Au-Ag-Cu skarn; Tetlin tribe native land

First gold pour on July 8, 2024 - 54,000 oz Au & 11,600 oz Ag

Kinross 70% interest: Contango ORE 30% interest

- Truck ore 225 mi north to Fort Knox mill (NE of Fairbanks), ~3,000 tons/day
- Utilizes existing mill and infrastructure at Fort Knox Mine
- Planned production mid-2024 – 2028, 500-600 jobs in Tok & Fairbanks

2024 production-137,750 oz Au, 55,877 oz. Ag
2025 YTD production –
~174,000 oz Au, 150,707 oz. Ag produced,
with one more batch to be run

Dec. 31, 2024	Million Tonnes	Au g/T	Ounces (million)	Ag g/T	Ounces (million)
Proven	0.439	6.4	0.090	9.9	0.140
Probable	2.873	7.7	0.712	14.2	1.313
Indicated	0.367	2.7	0.031	10.4	0.123
Total	**3.679**	**7.1**	**0.834**	**13.3**	**1.575**

Data from Kinross, 2025 and Contango ORE, 2025

Northern Star Resources - Pogo Mine

NORTHERN STAR

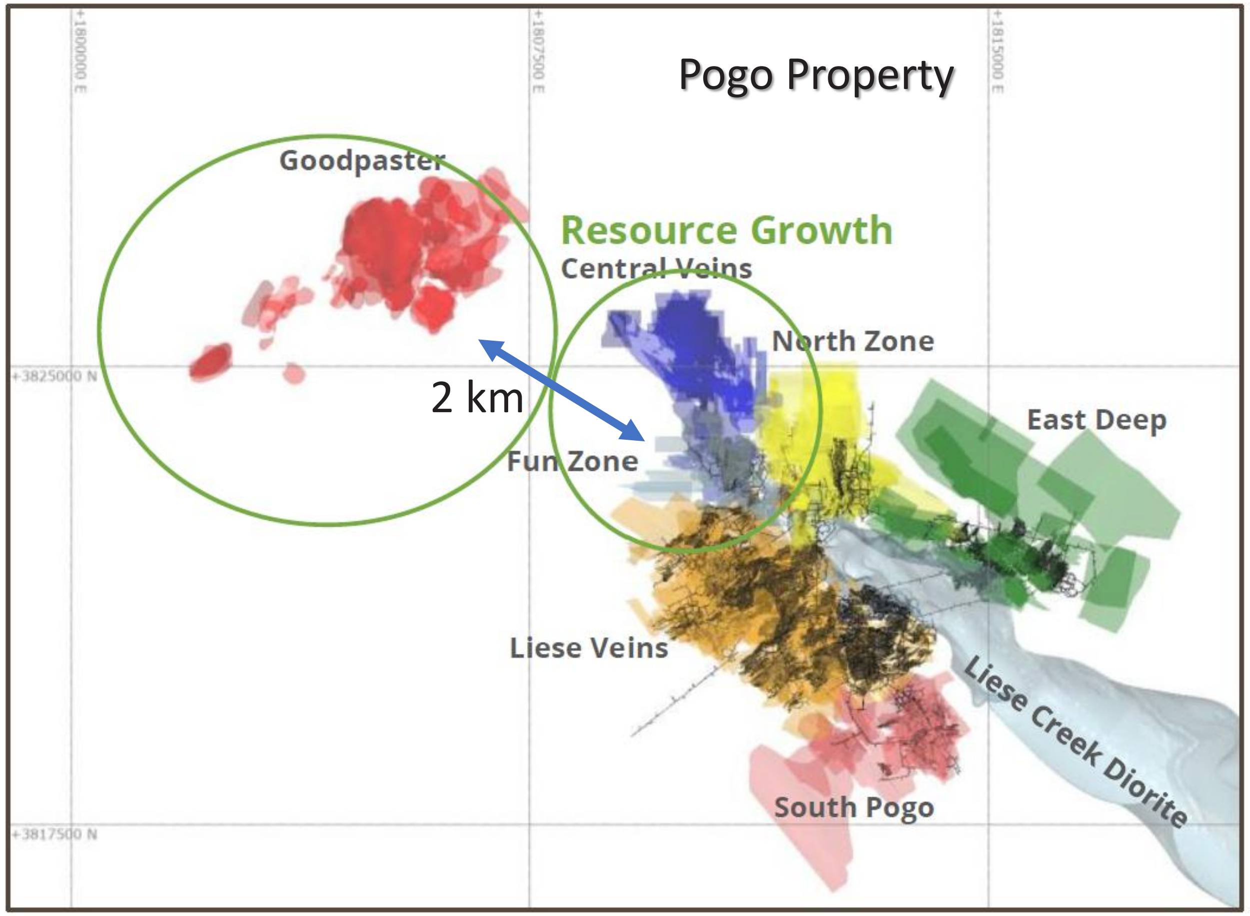
Underground, shear zone/quartz vein-hosted gold, 5.5Moz mined
650 Employees

- 5.5Moz produced to date
- FY25 gold production: 283koz
- FY26 production guidance: 270-300koz

- 87% gold recovery
- 10+ Year Minelife

-Focusing on optimization initiatives to reach 300,000 oz Au annual production rate

March 31, 2025	Million Tonnes	Au g/T	Ounces (million)
Proven	0.364	8.7	0.102
Probable	8.766	7.2	2.024
Measured	0.125	11.6	0.047
Indicated	9.532	10.3	3.152
Inferred	8.407	9.8	2.965
Total	**27.104**	**9.13**	**8.290**



Data from Northern Star Resources, 2025

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Pogo Mine Expansion

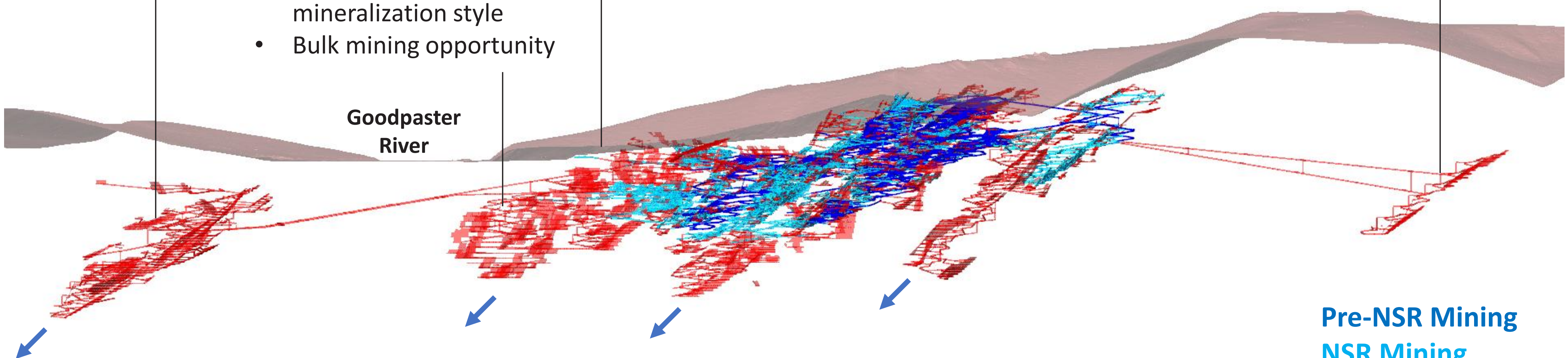
Looking North-East

Goodpaster:
- Access in progress
- Challenging mining under Goodpaster river
- +1mi development

New Portals:
- 2 x new portals mined this Summer
- Access to Northern orebodies
- Improved haulage & ventilation

Star:
- Follow-up drilling campaign completed this month
- Access commencing shortly
- ~1mi to ore

Central:
- New granite hosted mineralization style
- Bulk mining opportunity



Orebodies open at depth

Pre-NSR Mining
NSR Mining
2025 LOM

3.5mi

NW ⟷ SE

» CLICK TO RETURN TO TABLE OF CONTENTS

Usibelli Coal Mine

- **Mining since 1943**
- 2025 production steady at 1 million tons
- Regional Interior Alaska electrical generation

Currently mining on Jumbo Dome
104-110 person workforce
More than 50+ years of production on current permits with future expansion potential
Extended powerlines approximately 10 miles to connect Jumbo Dome to current infrastructure. Project will replace over 1M kWh of diesel-fired electricity generation per year

Data from Usibelli Coal Mine, 2025

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Coeur Alaska - Kensington Mine

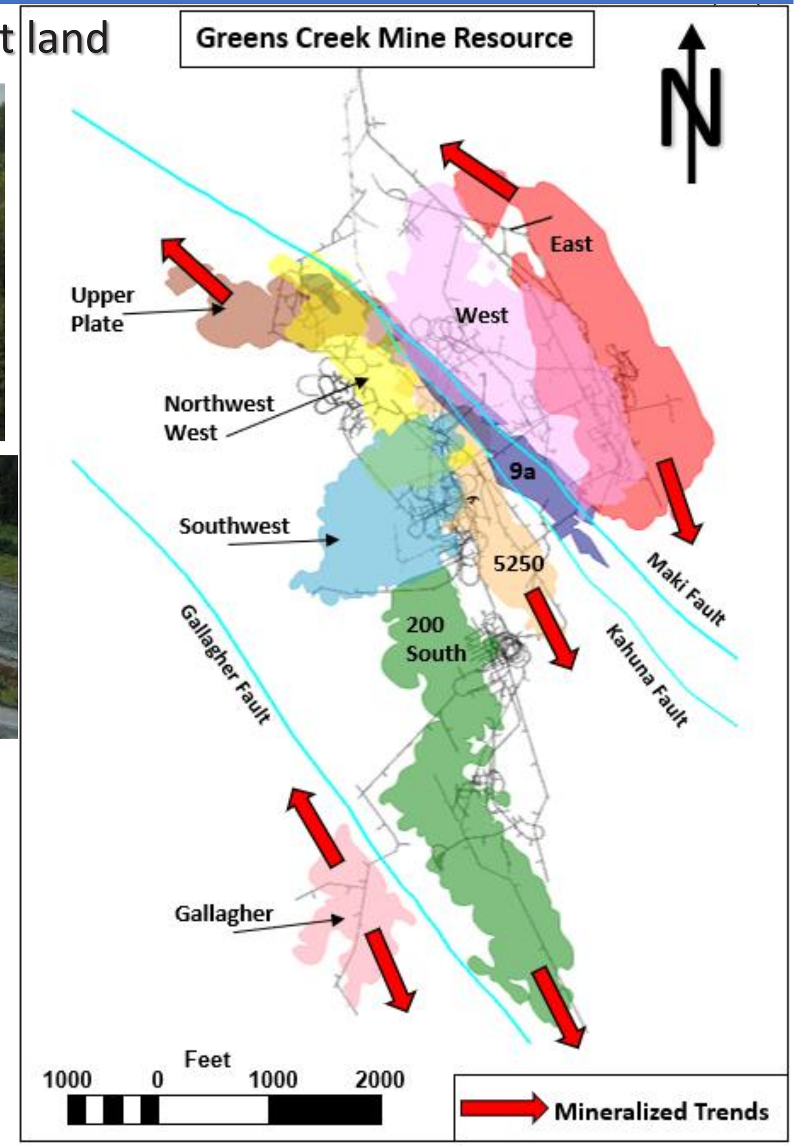
Underground mesothermal gold quartz-vein system
378 Employees

-Guidance (2025): 98,500-108,500 oz. Au
-2024 Produced 95,671 oz. Au
-Current mine life through 2027
-Mining Kensington, Jualin, Raven, Elmira veins
-Multi-year exploration program to extend mine life
-New zone (30C) drilled in Upper Kensington Vein
-Expansion & infill: Elmira, Kensington, Johnson veins

Dec. 31, 2024	Million Tons	Au (opt)	Au Ounces (million)
P&P Reserves	2.767	0.181	0.501
Measured & Indicated	3.600	0.246	0.886
Inferred	0.993	0.229	0.228
Total	**7.360**	**0.220**	**1.615**

Volcanogenic massive sulfide deposit, Southeast Alaska, Admiralty Island Nat'l Monument land

Dec. 31, 2024	Million Tons	Zn %	Pb %	Au opt	Ag opt
P&P reserves	10.447	6.2	2.4	0.08	9.9
Measured & Indicated	7.619	8.0	3.0	0.10	14.1
Inferred	1.878	6.9	2.9	0.08	13.4
Total	**19.944**	**7.0**	**2.6**	**0.09**	**11.8**



United States Largest Silver Producer
495 Direct Jobs
<u>2024 Production:</u>
8.480 M oz. Ag; 55,275 oz. Au; 51,288 tons Zn; 18,320 tons Pb, 1,874 tons Cu
<u>2025 Production Guidance – 8.4-8.8 Moz Ag, 53-55 Koz Au</u>

-Through 3 Quarters 2025, produced 6.773 Moz Ag, 47,093 oz Au, 14,178 tons Pb, 39,606 tons Zn, 250 tons Cu
-2,500 tons per day mill
-Reserve-only mine life increased out to 2037
-Ore tonnes have doubled in past 15 years
-Currently mining East Ore Zone and Upper Plate reserves
-Capital Expenditures forecast at $50M-$55M

Data from Hecla Mining, 2025

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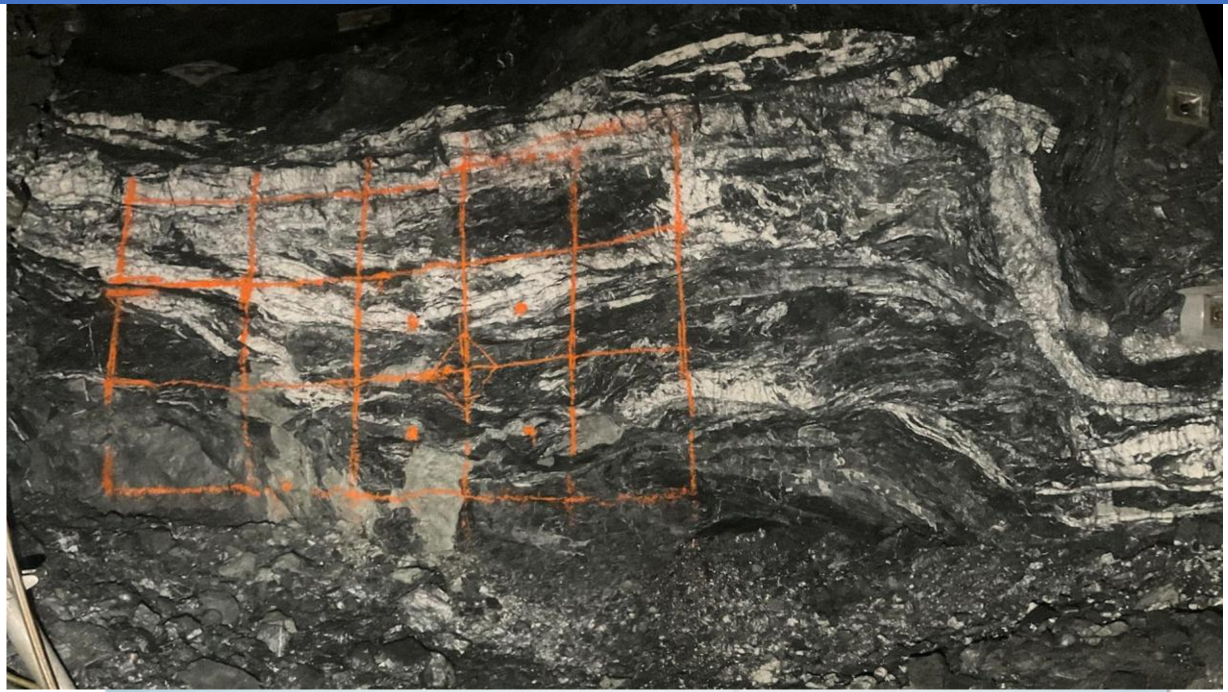
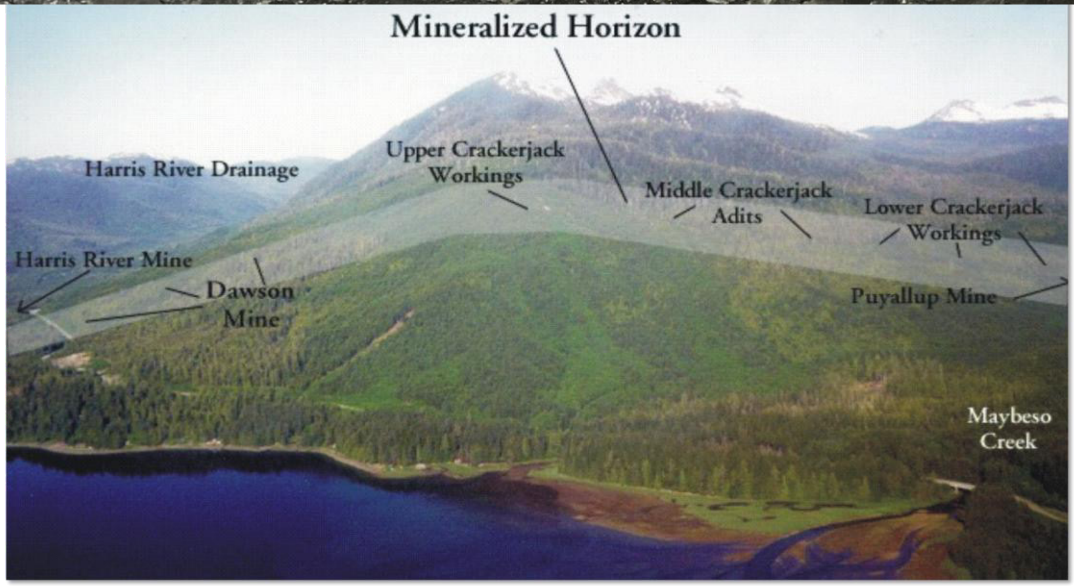
Sundance Mining Group – Dawson Mine

Underground orogenic gold quartz-vein system

-2.4-km-long, N-S-oriented, orogenic gold vein-fault system
-Vein thickness: generally, 0.6 m to 1.2 m (up to 1.8 m)
-Room-and-pillar, up-dip-jackleg-slusher underground mine
-Mill ~190 short tons/day (est.); gravity separation
-Average mill feed grade 2021 is 0.720 oz. Au/ton
-2021 average mill recovery = 86%
-Production: 12,800 oz. Au (2024), similar output in 2025
Announced 50-year mine life





Data from Sundance Mining Group, 2025

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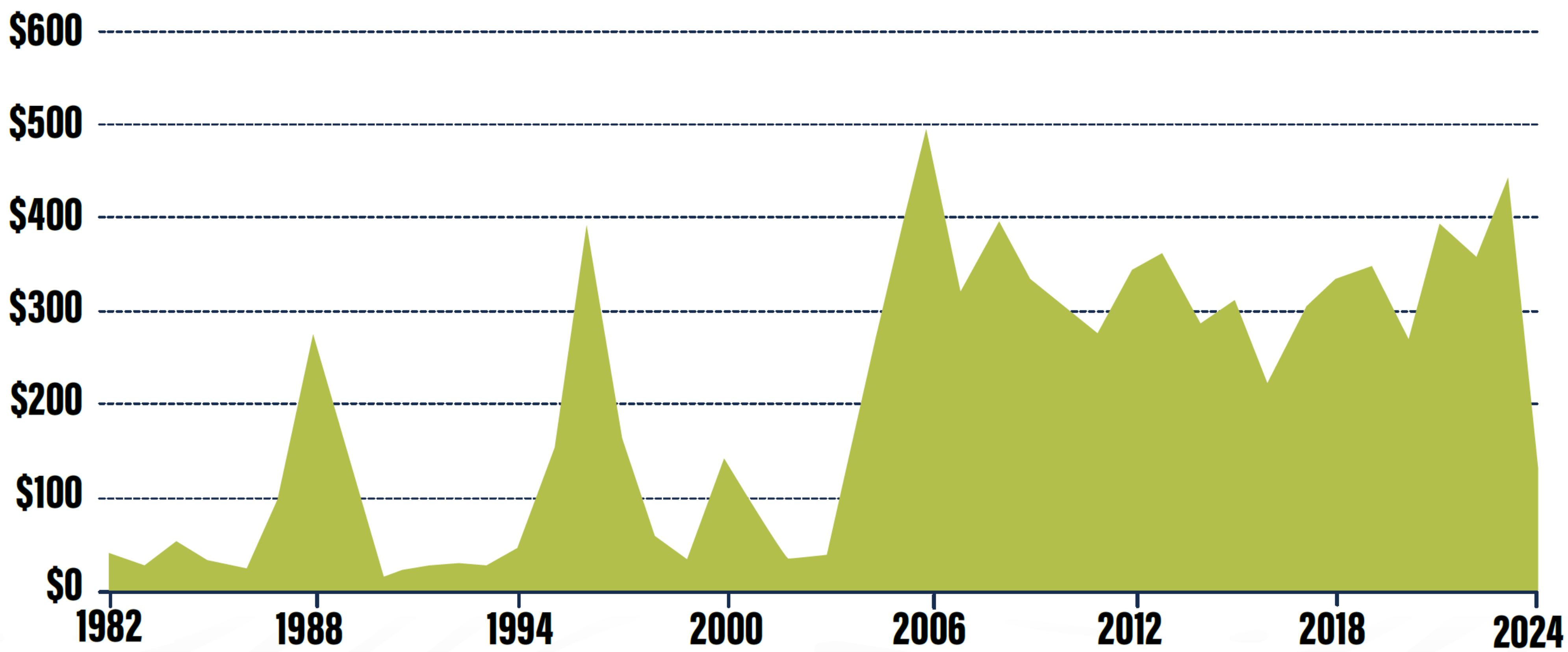
Alaska Mineral Development Spending

1982-2024 ($ MILLIONS)

$146M in 2024

$8.7B since 1982



McKINLEY RESEARCH GROUP, LLC

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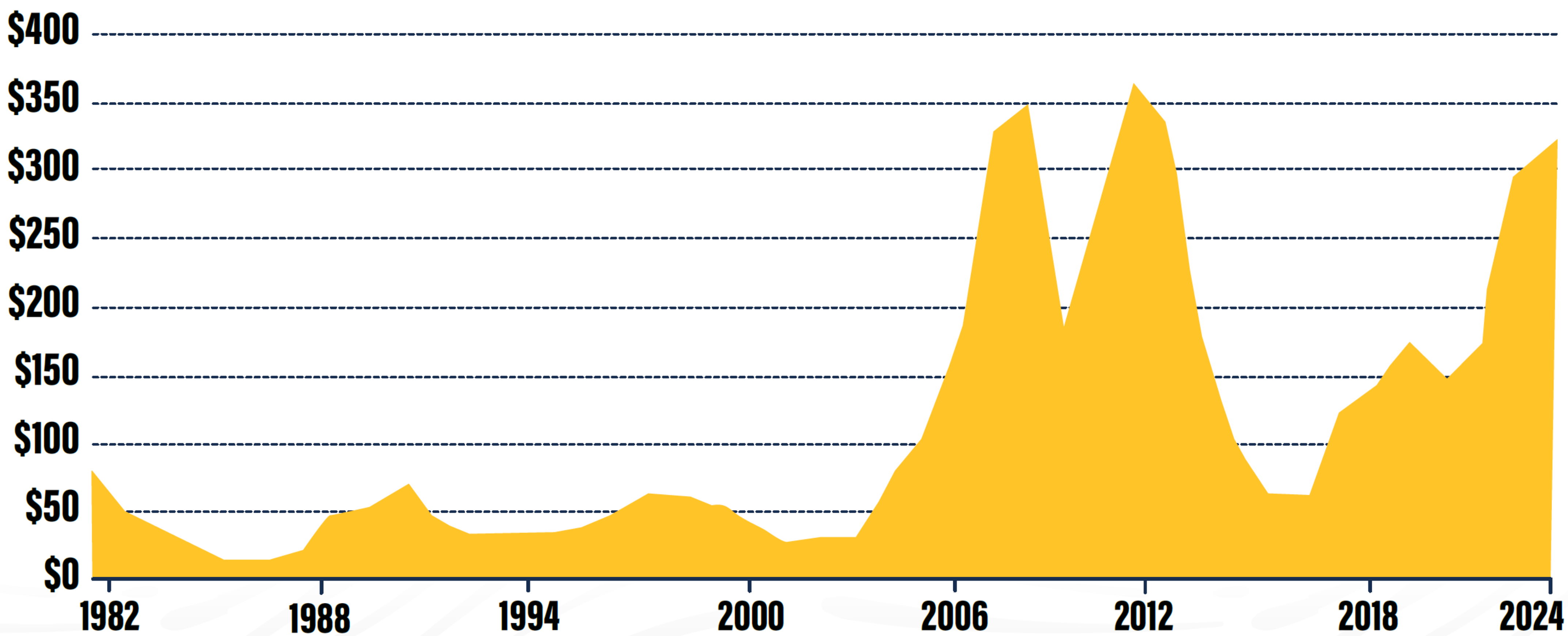
Alaska Mineral Exploration Spending

1981-2024 ($ MILLIONS)

$319M in 2024

$5.1B since 1981



McKINLEY RESEARCH GROUP, LLC

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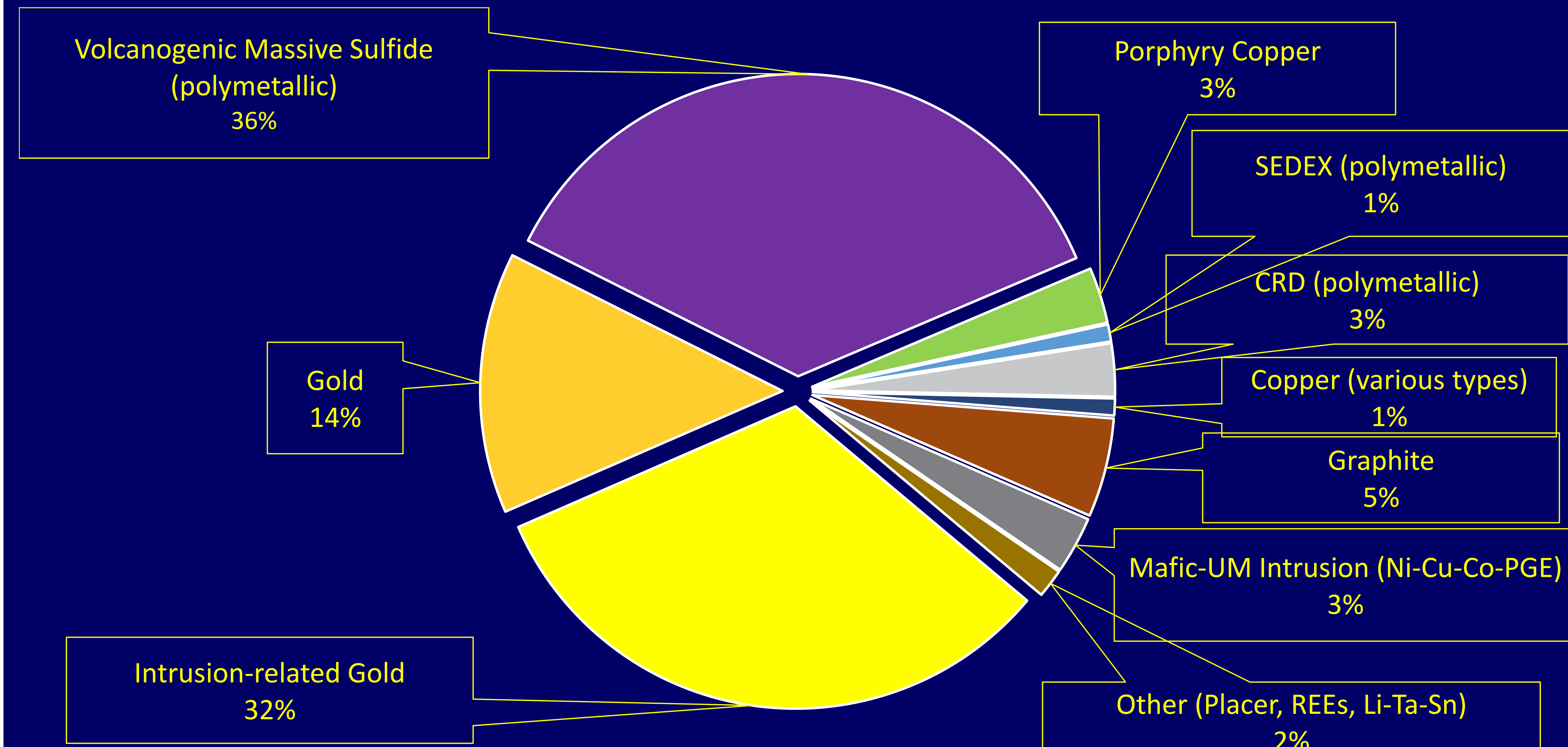
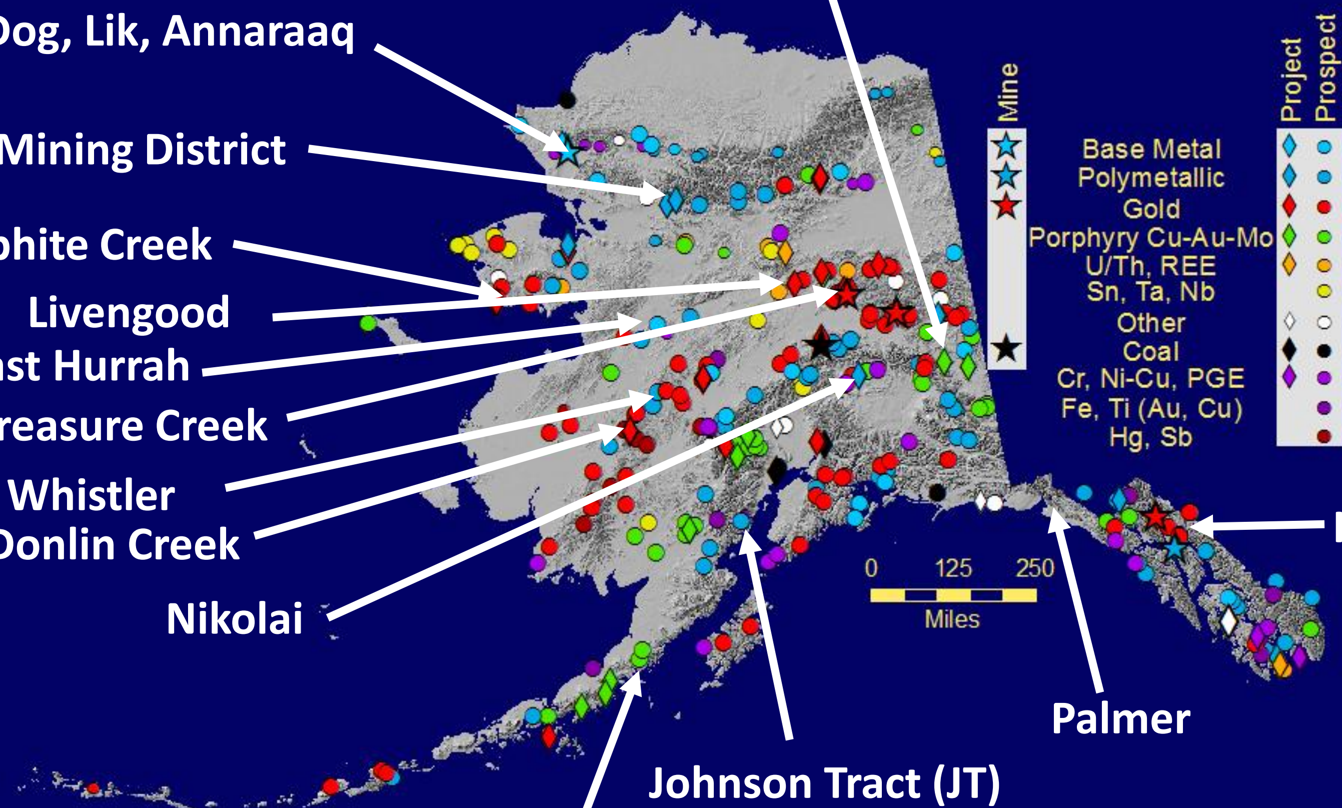
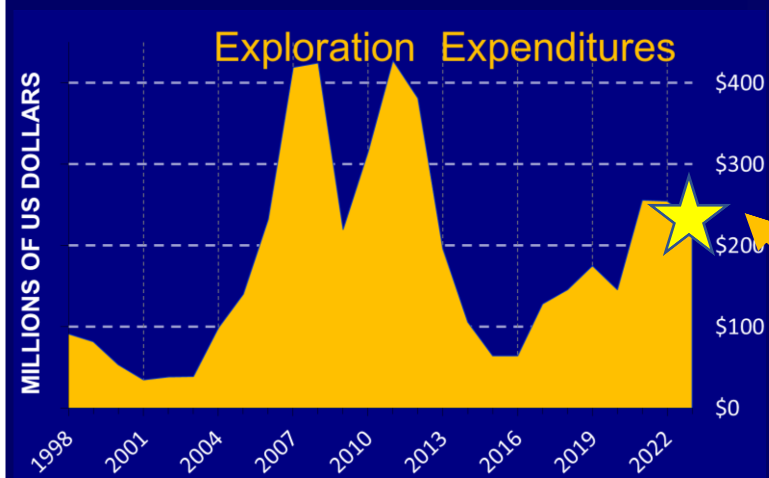
2023 - 2024 Alaska Exploration



2025 Exploration

Mix of advanced exploration and early exploration projects





2025 Exploration Spend Undetermined at this time

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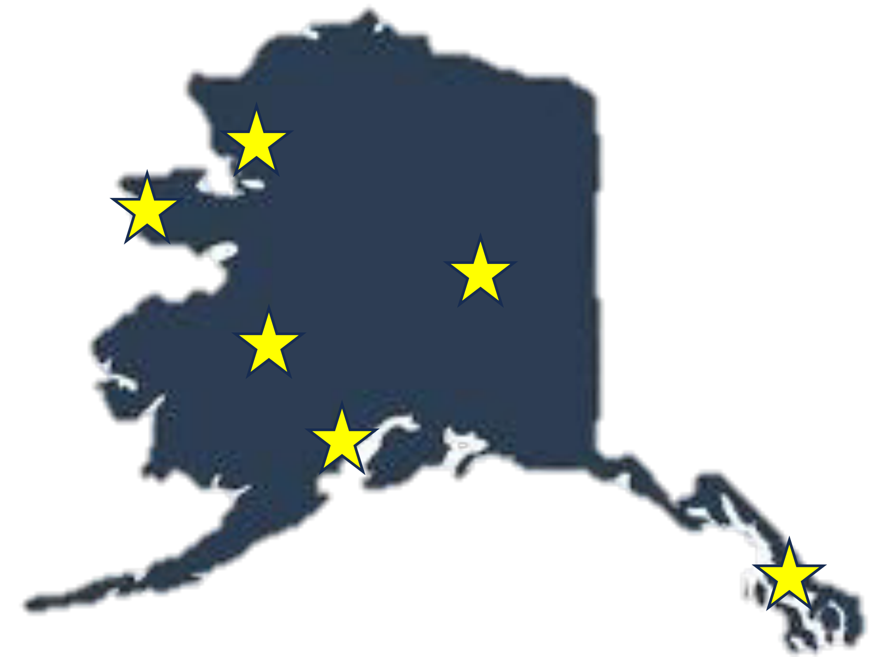
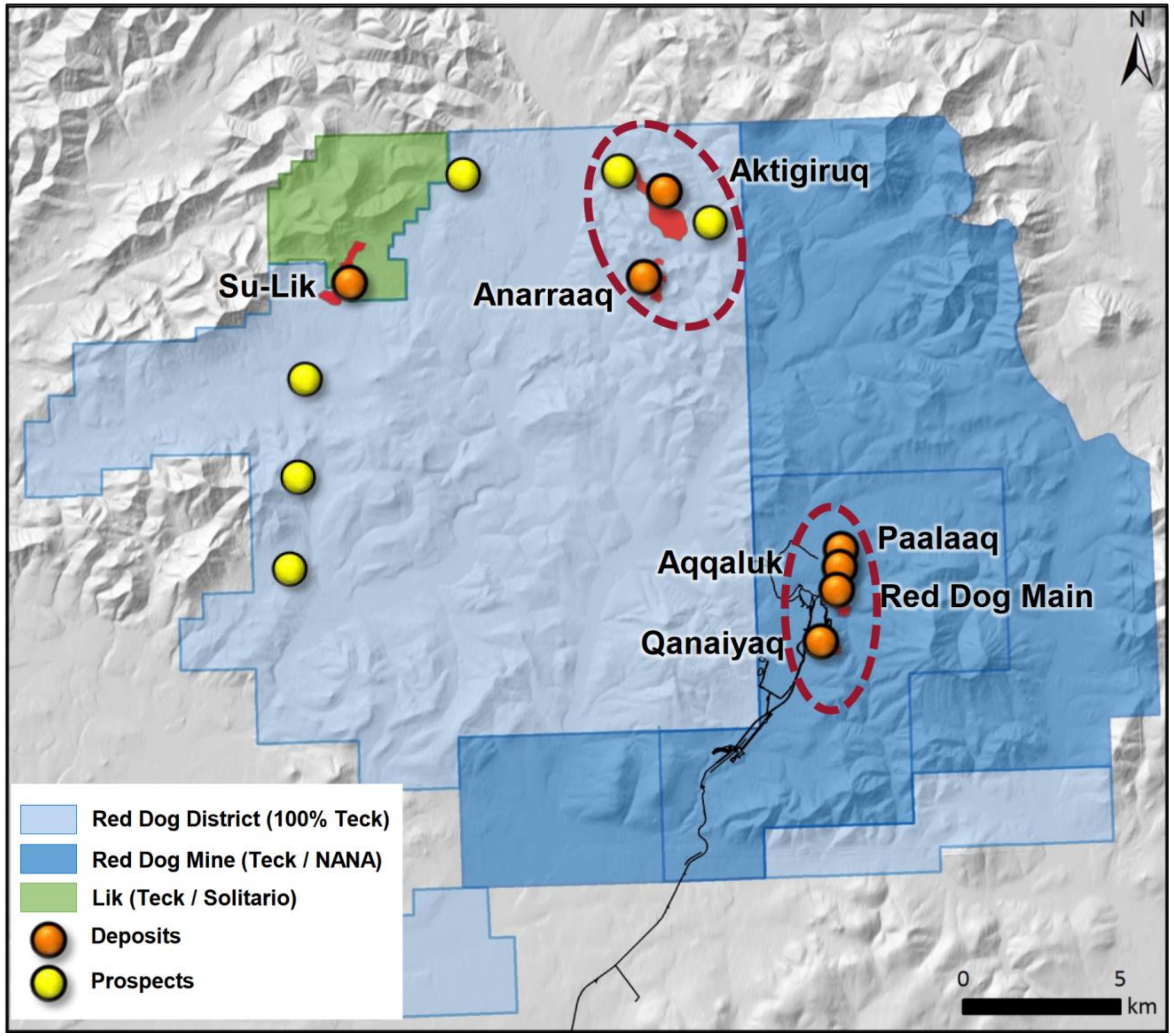
Alaska's FAST-41 Projects

Alaska FAST-41 Mining Projects (Covered & Transparency)			
Contango Ore Johnson Tract Critical Metals Project	US Army Corps of Engineers - Regulatory	Covered	Planned
Donlin Gold Project	US Army Corps of Engineers - Regulatory	Covered	Planned
Graphite Creek Project	US Army Corps of Engineers - Regulatory	Covered	In Progress
Aqqaluk Pit Exploration and Expansion	US Army Corps of Engineers - Regulatory	Transparency	Complete
Greens Creek Surface Exploration	Department of Agriculture, US Forest Service	Transparency	In Progress
Nikolai Nickel Project	US Army Corps of Engineers - Regulatory	Transparency	In Progress

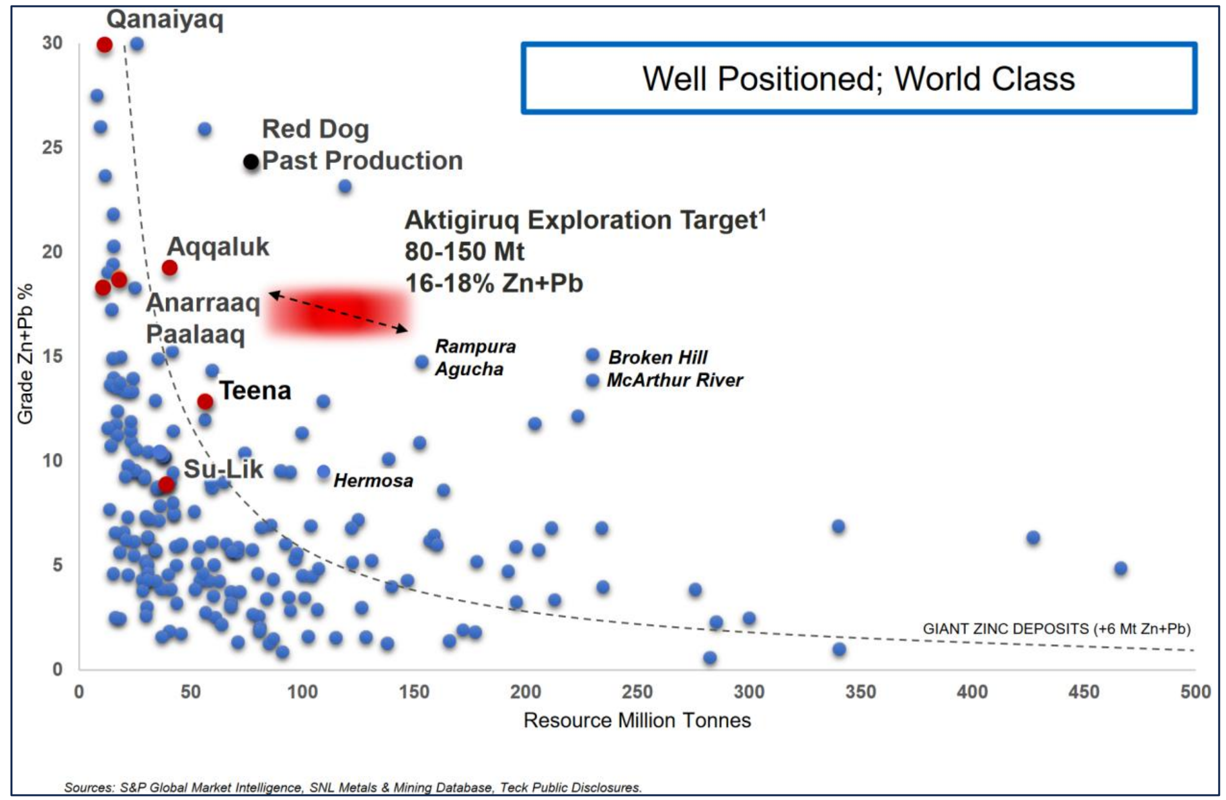


FAST-41
Increase Predictability
Develop timelines for permittees and permitters
Transparency
Possible decreased permitting timeframe

TECK - RED DOG AREA EXPLORATION



- • Significant land-holding
- • 350 km2 of highly prospective NANA and State lands
- • Focus on enhancing resource certainty and defining future developments
- • Multi-year program
- • Multi disciplinary approach



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TECK - RED DOG AREA EXPLORATION

Aktigiruq / Anarraaq / Lik(Su) Zn-Pb-Ag-Ba deposits

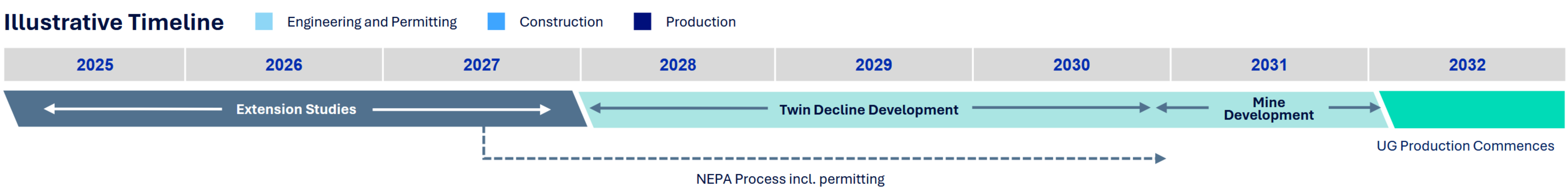
Sediment-hosted massive sulfide deposits

- Lik(Su): Indicated Resources of 18.1 M T @ 8.1% Zn, 2.7% Pb;
 Inferred Resources of 5.34M T @ 8.7% Zn, 2.7% Pb

<u>2023-2025 Programs:</u>

- Resource-definition drilling at Aktiguruq and Anarraaq
- Ore bodies are 400 to 1,000 m below surface
- Primary focus is Aktigiruq scoping-level studies for an underground mine leveraging existing mill and supporting facilities at Red Dog Mine.
- Entering PFS process.
- 2024 Surface road approved
- Announced resources are a 25-year mine life

	Dec. 31, 2024	Million Tons	Zn %	Pb %	Ag g/T
Aktigiruq	Indicated	36.0	16.2	4.2	73.4
Aktigiruq	Inferred	29.3	13.7	3.5	124.5
Anarraaq	Inferred	18.0	14.3	4.0	80.4
	Total	**83.3**	**14.5**	**4.0**	**76.0**



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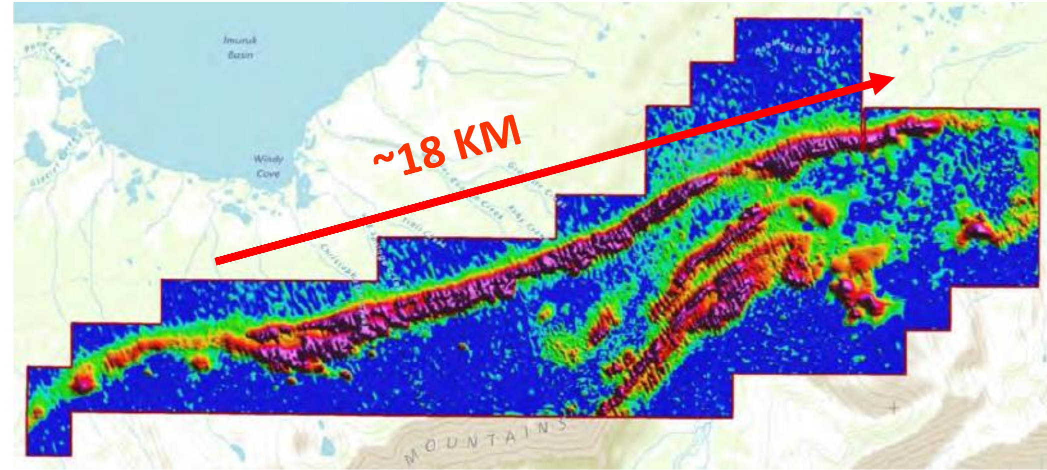
Graphite One – Graphite Creek

Graphite Creek, Seward Peninsula, Alaska

-USA's largest large-flake graphite deposit, among largest in world
- only 1 sq km of 16-sq-km geophysical anomaly explored to date

2024	Tonnes (Million)	Cg %	Graphite (M Tonnes)
Proven	4.10	5.80	0.238
Probable	67.12	5.18	3.480
Measured	5.11	5.33	0.272
Indicated	99.57	4.54	4.523
Inferred	268.10	4.31	11.568
Total	**444.00**	**5.16**	**20.082**



~18 km of potential revealed by Time-Domain EM Survey (red=conductive graphitic units)

Data from Graphite One, 2025

2025 program:
-Completed Feasibility Study with $37.5M U.S. DoD grant in April 2025; 20-year minelife producing 175,000 metric tons of graphite annually
- Mapping and Geochem sampling continued
- Offsite work focused on material manufacturing plant located in Warren, Ohio.
- 2005- 1st AK project on FAST-41 dashboard, permitting started

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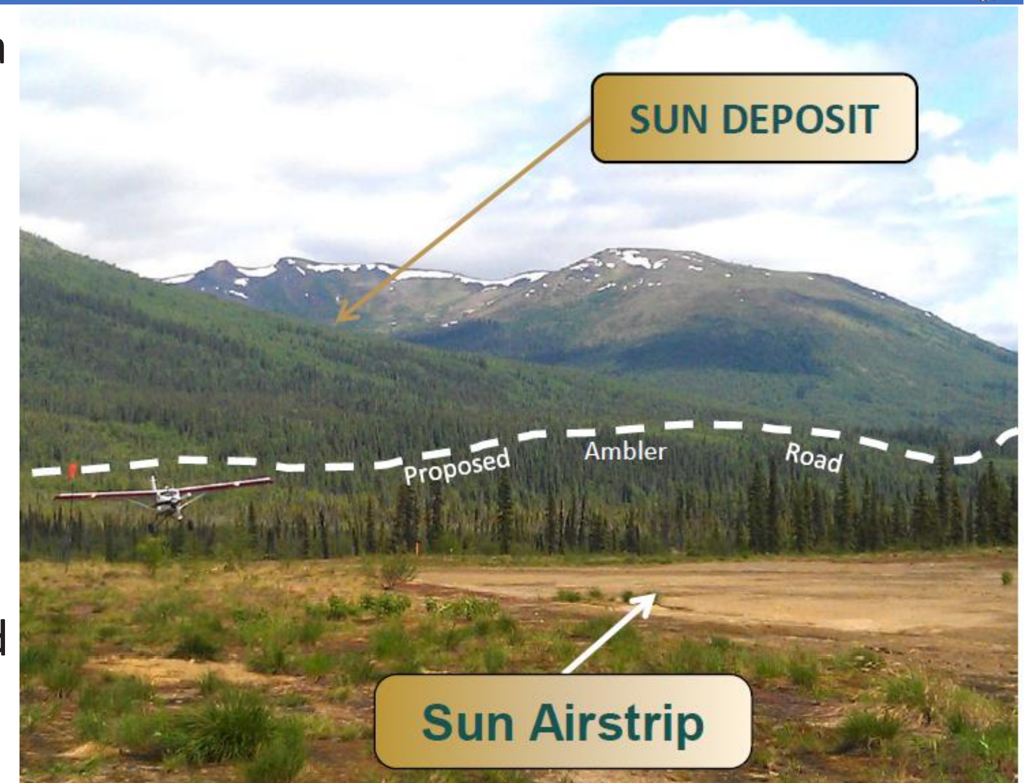
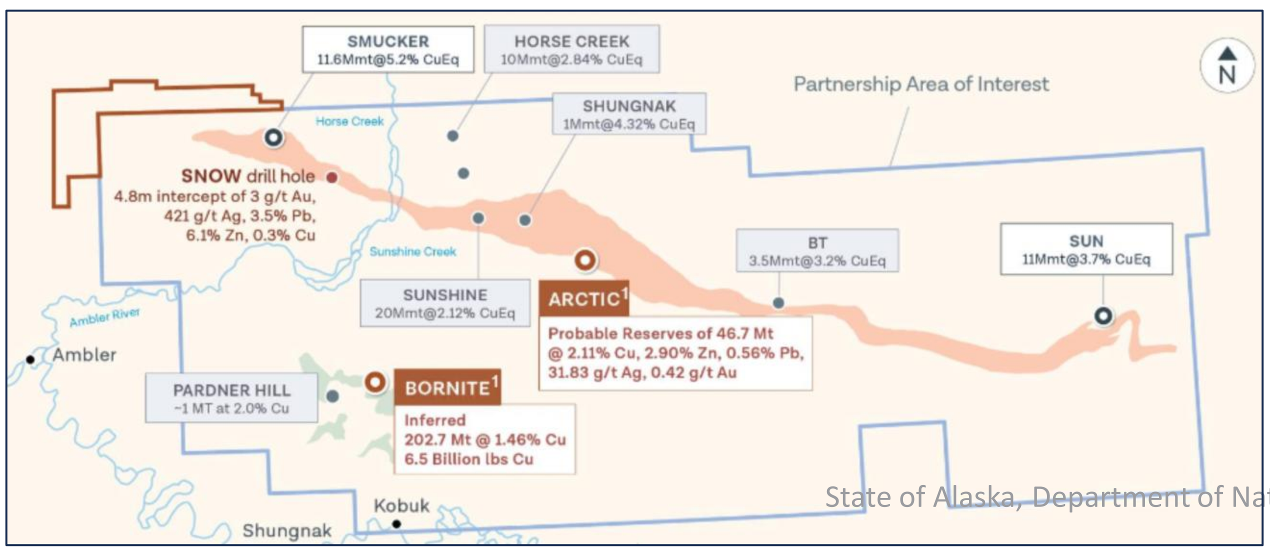
Ambler Mining District – Access

- October 6, 2025 President Trump approved the appeal of the Alaska Industrial Development and Export Authority (AIDEA), directing his Administration to promptly issue authorizations necessary for the establishment of the Ambler Road Project (proposed 211-mile controlled-use industrial access road to access the Ambler Mining District) (Deposits include Arctic, Sun, Sunshine, Smucker, and Bornite)
- October 6, 2025 "the U.S. government is announcing a partnership with Trilogy Metals, investing $35.6 million to support mining exploration in Alaska's Ambler Mining District. This investment makes the U.S. government a 10% shareholder in Trilogy Metals and includes warrants to purchase an additional 7.5% of the company."





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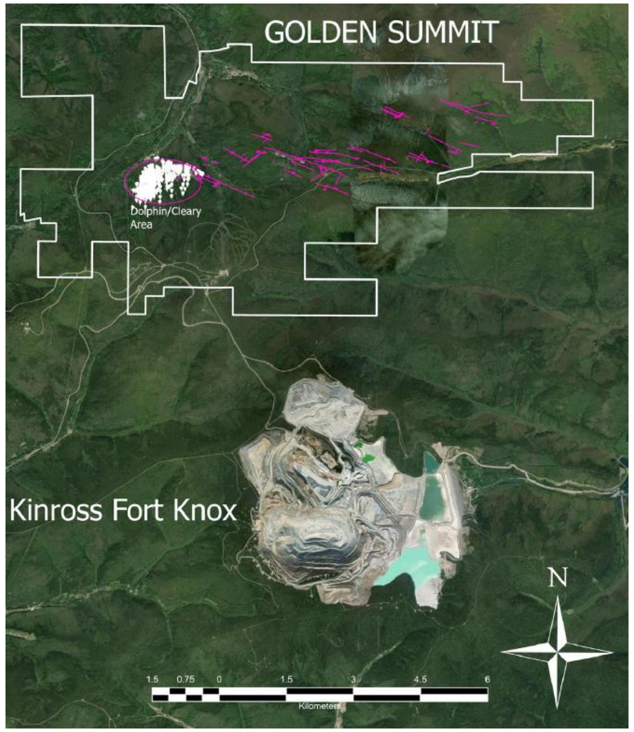
FREEGOLD - GOLDEN SUMMIT ★

Intrusion-related gold system - Fairbanks District

Golden Summit Area
+500,000 oz past UG production; >1 oz. Au/T in quartz veins
+6.75 M oz. placer Au recovered from streams draining project area
2025 Program:
-Announced updated mineral resource for Dolphin-Cleary, **17 Moz Au indicated resource and 12 Moz Au inferred resource**
-176,000 meters drilling to date (130K post 2020)
-~32,0000m completed (49 holes) in 2025 with emphasis on area west of Dolphin-Cleary resource
-Drilling ongoing, assays pending
Drilling Highlights are:
-110 meters averaging 1.08 g/t gold from a depth of 365 meters in hole GS2519 (WOW)

- 65.4 meters averaging 2.31 g/t gold from a depth of 424.4 meters in hole GS2505 (WOW)
- 119.1 meters averaging 1.41 g/t gold from a depth of 264 meters in hole GS2504 (Dolphin).



Data from Freegold Ventures, 2025

Dolphin Resource (July 2025)	Million Tonnes	Au Eq (g/T)	Ounces (million)
Indicated	431.949	1.24	17.236
Inferred	357.614	1.04	11.964
Total	**789.563**	**1.15**	**29.200**

hosted in schist

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Felix Gold – Treasure Creek & NE Fairbanks

Intrusion-related gold-antimony systems

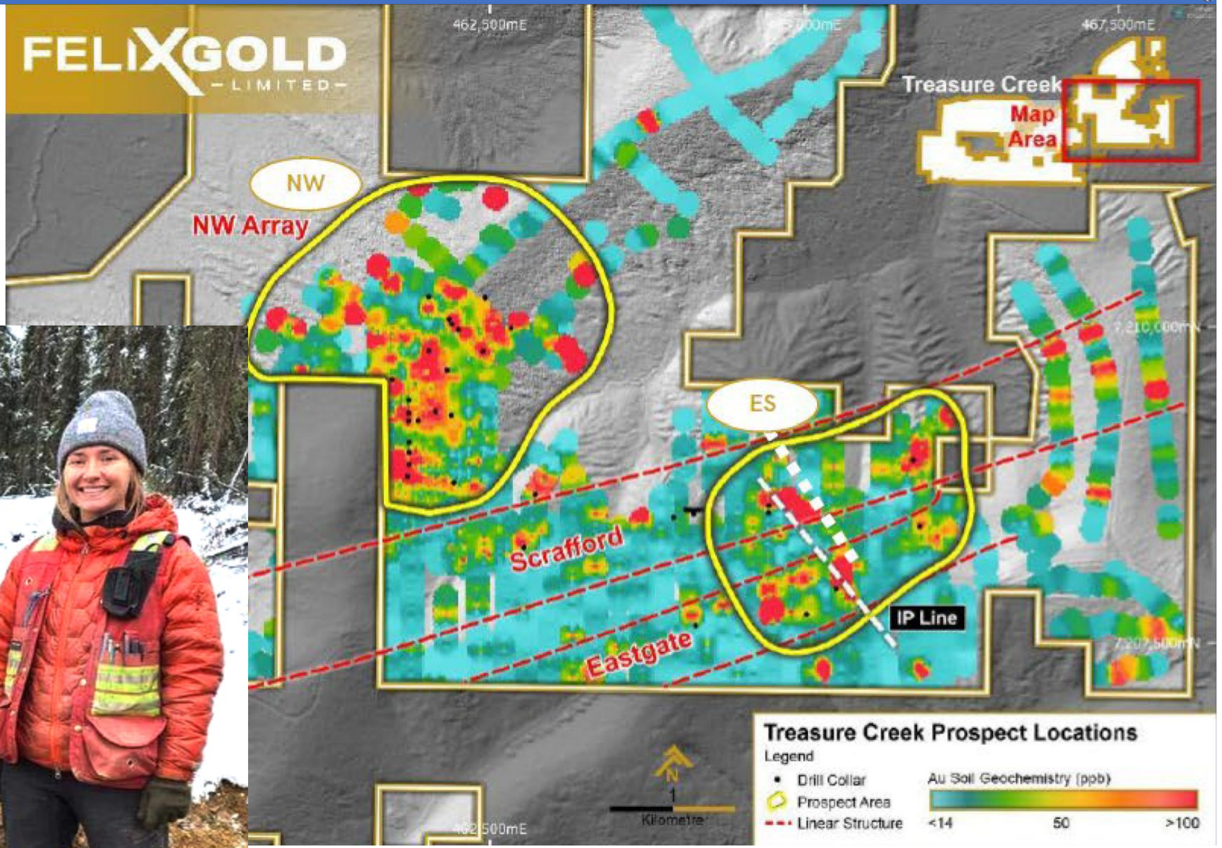
Treasure Creek

-20 km West of Fort Knox gold mine
-Placer gold production in creeks draining claims
-Multiple >1 km Au-in-soil anomalies
-Near-surface, bulk-tonnage potential

<u>2024 - 2025 Program:</u>

-Key targets: NW Array zone at Treasure Cr. Maiden Inferred Mineral Resource of 25Mt @ 0.58 g/t Au for 467,000 ounces of gold using a 0.25 g/t Au cut-off
Drilling program in 3Q for resource expansion

- Pursuing potential antimony targets for production by end of 2026 (historical Scrafford Mine)
- Trenching and drilling program
- Metallurgical testing



Gold-in-soil anomalies, Treasure Creek

Data from Felix Gold, 2024

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Alaska Energy Metals – Nikolai

Mafic intrusion-hosted Ni-Cu-Co-PGE project, southcentral Alaska

-2025 program :

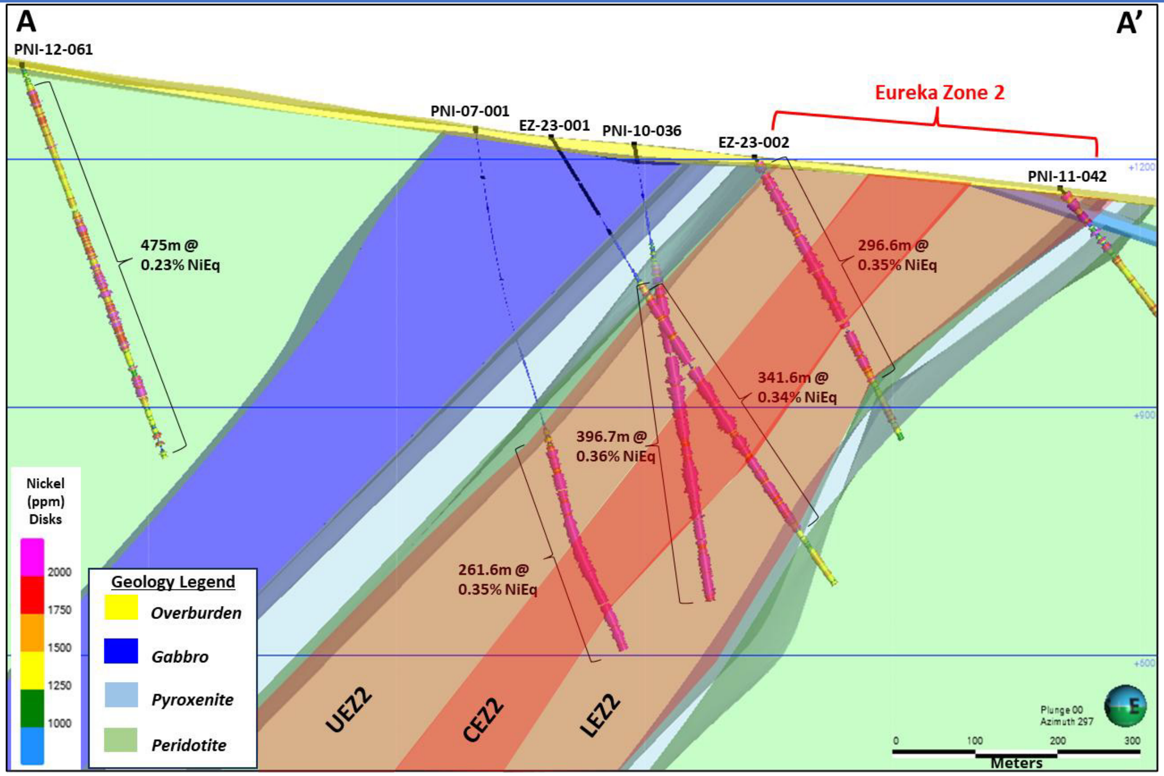
-New resource announced for Eureka Property

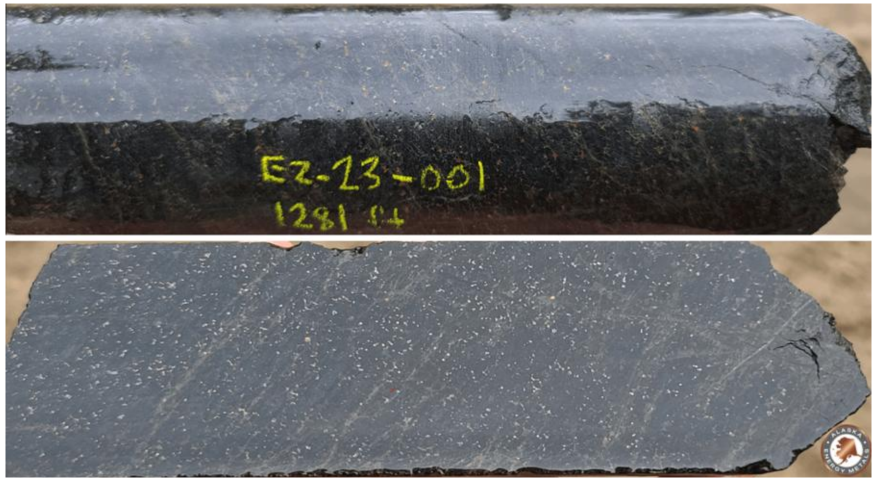
-Eureka Property (Central and West Eureka Areas) Indicated Resource of 1.189 billion tonnes grading 0.20% NiEq% & and Inferred Resource of 2.085 billion tonnes grading 0.20% NiEq%, with total metal contained:

12.447 billion pounds of nickel
4.198 billion pounds of copper
1.201 billion pounds of cobalt
3.877 million pounds of chromium
4,295,000 ounces of platinum
7,889,000 ounces of palladium
1,128,000 ounces of gold

July 2025 - Memorandum of Understanding signed with American Electric Vehicle Manufacturer Lucid And Other Mining And Processing Companies

Added to FAST-41 Project List





Serpentinized Dunite (`10% sulfides) (Pentlandite, Chalcopyrite, Pyrrhotite)
389.5m - 391.0m: 0.26% Ni, 0.21% Cu, 0.03% Co, 150 ppb Pd, 80 ppb Pt, 38 ppb Au (0.47% NiEq)

Data from Alaska Energy Metals, 2025

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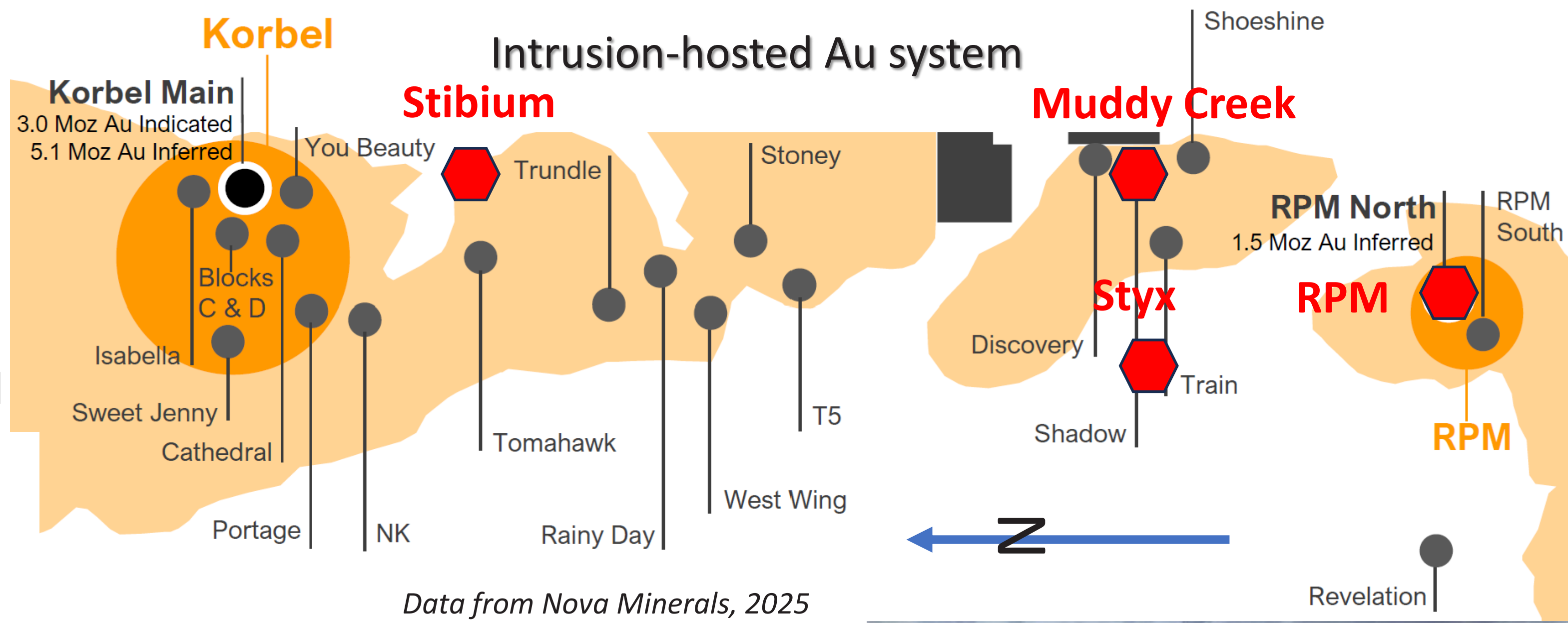
NOVA MINERALS – ESTELLE PROJECT

Subsidiary: **Alaska Range Resources**

- Drilling on RPM North gold deposit
- 2025 focus on antimony prospects, including Stibium, Styx, Stoney
- September 30 DOD/DOW awarded $43.4 M Defense Production Act (DPA) Title III grant to define antimony resources, complete metallurgical studies, complete permitting, initiate antimony processing facility in Alaska
- High-grade rock samples with > 30% Sb up to 60.5% Sb
- Production targeted in late 2026/2027



Data from Nova Minerals, 2025

April 2024	Tonnes (millions)	Au (g/T)	Ounces (million)
Korbel (Main+Cathedral)	425	0.3	4.05
RPM (North+South)	51	0.7	1.13
Global MII Resource	**475**	**0.3**	**5.17**

9.9Moz JORC1 &
5.2Moz S-K1300 resource

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DONLIN GOLD - DONLIN

Proposed open-pit gold mine; structurally controlled, intrusion related

[50% Paulson Advisers./50% NovaGold Resources Inc.]

Data from Donlin Gold, 2024

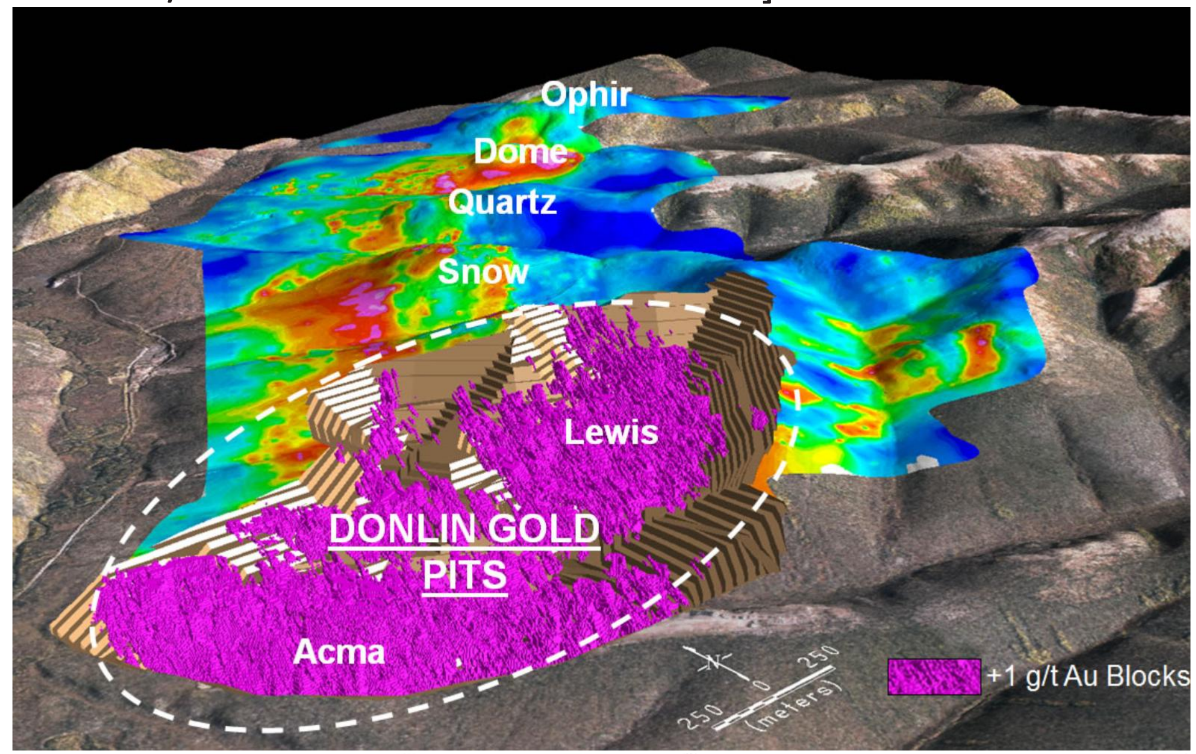
<u>2025 Program</u>

Barrick Mining Corp. completed the divestiture of its 50% interest in the Donlin Gold Project to affiliates of Paulson Advisers LLC and NOVAGOLD Resources Inc. for $1 billion in cash in June.

-Continued litigation in state and federal courts (3 state and 1 federal), won 3 state cases and federal case remanded the agencies to supplement EIS without vacating permits

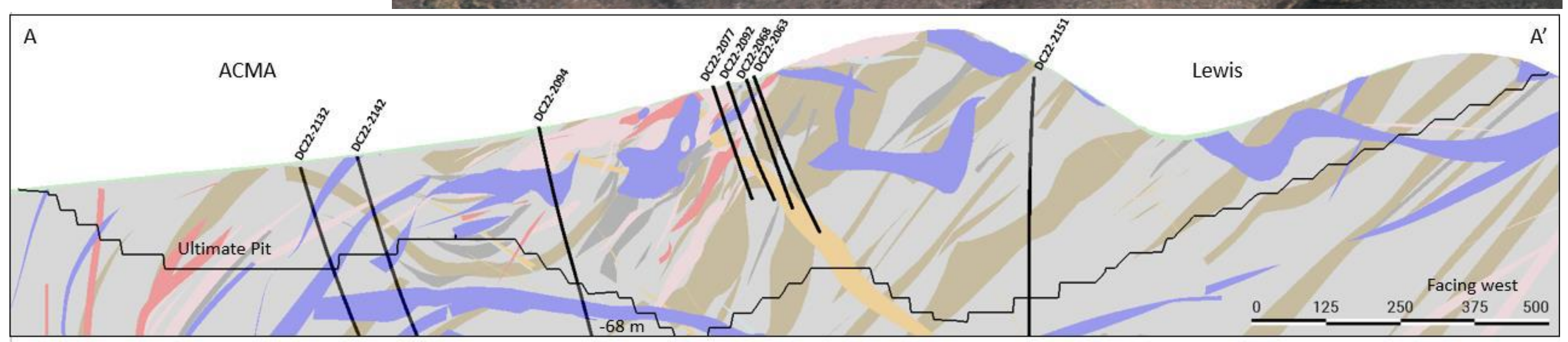
Exploration drilling (15,000 m),Geotechnical + hydrological fieldwork to advance Alaska Dam Safety certificate applications

-Mine optimization (geologic & resource models)



June 2021	Million Tonnes	Au (g/T)	Ounces (million)
Proven & Probable Reserves	504.8	2.09	33.9
Resources; inclusive of reserves*			
Measured & Indicated*	541.3	2.24	39.0
Inferred	92.2	2.02	5.99
Total	**633.6**	**2.21**	**45.0**

Potential 27-year Mine life, with 1.1 Moz/yr production



Cross-section through ultimate pit, looking west; ACMA-Divide-Lewis deposit areas

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Tectonic Metals LLC - Flat

Structurally controlled, intrusion related gold

[Doyon landowner)

2025 Program

-32 diamond drill holes
(11 Alpha Bowl, 20 Chicken Mountain, 1 Golden Apex)
-93 RC drill holes
(22 Alpha Bowl, 59 Chicken Mountain, 12 Other areas)
-Drone Magnetic survey

CMD25-004 Quartz vein with massive arsenopyrite

Planned 4Q 2025

-3D Inversion of 2025 drone magnetics survey

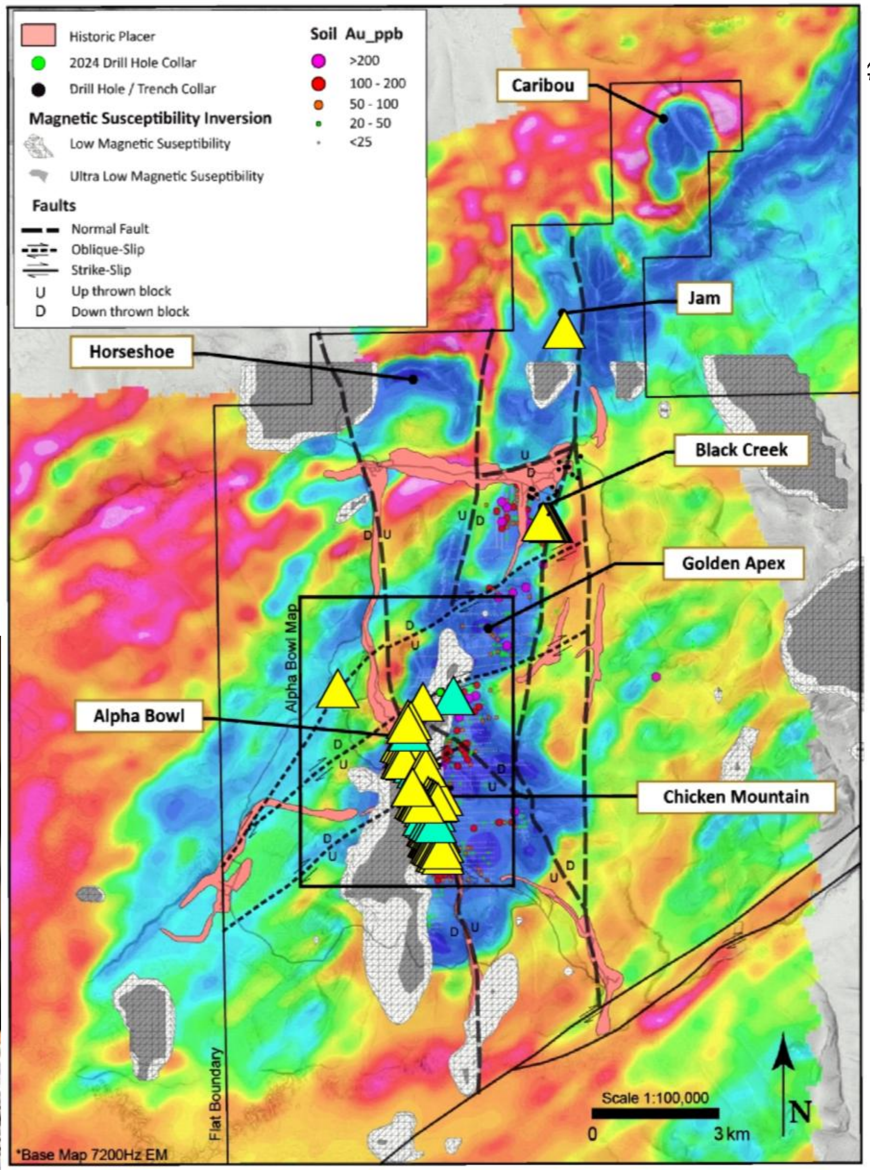
-Geological interpretation and modelling
after receipt of all 2025 geochemistry results

-Internal inaugural Inferred Mineral Resource Estimate

-2" crush column testing using drill core from 2025 Chicken Mountain Metallurgical drilling

-Preliminary metallurgical test work (bottle rolls) of Alpha Bowl mineralization

CMD25-005 Quartz vein with visible gold



Chicken Mountain-Golden Apex Geology Map
2025 Drill Hole Locations

Pebble Limited Partnership - Pebble

Porphyry Cu-Mo-Au-Ag (Re, Pd) Deposit

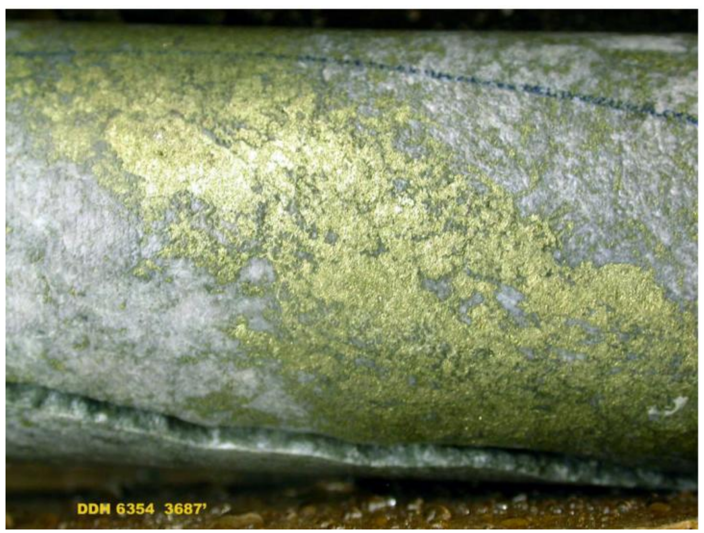
- First- or second-largest porphyry copper deposit in world
- Projected 20-year life-of-mine production: 6.4 billion pounds copper, 7.3 million ounces gold, 300 million pounds molybdenum, 37 million ounces silver, 254 short tons rhenium, and byproduct palladium

2025 events:

- Northern Dynasty Minerals Ltd. announced on December 1 that four national mining and business organizations filed amicus briefs in Alaska Federal Court supporting its challenge to the EPA Section 404(c) veto of the Pebble copper project

Aug 2023	Million Tonnes	Cu Billion pounds	Cu (%)	Au (g/T)	Mo (ppm)	Ag (g/T)
Measured	527	3.35	0.33	0.35	178	1.7
Indicated	5,929	49.6	0.41	0.34	246	1.7
Inferred	4,454	22.7	0.25	0.25	226	1.2
TOTAL	**10,910**	**75.65**	**0.34**	**0.30**	**235**	**1.5**

Oct. 2020: 2.6M kg Re (M&I) and 1.6M kg Re (Inferred)



American Exploration & Mining Association

NMA National Mining Association

The Spirit of Enterprise U.S. Chamber of Commerce

Alaska Miners Association

PEA (Sept. 2021):

-Open-pit mine; ~20-year mine life; 180,000 T/day
-Long-term metal prices: IRR=15.8% & NPV(7%)=US$2.3B; (for values with royalty applied, see 2022 PEA update)
-LOM metal production: 6.4 B lbs. Cu, 7.3 M oz. Au, 300 M lbs. Mo, 37 M oz. Ag, 230,000 kg Re
-Ave. annual production: 320 M lbs. Cu, 363,000 oz. Au, 1.8 M oz. Ag, 15 M lbs. Mo, 12,000 kg Re
-Evaluates expansion scenarios and onsite gold plant

Data from PLP, 2025

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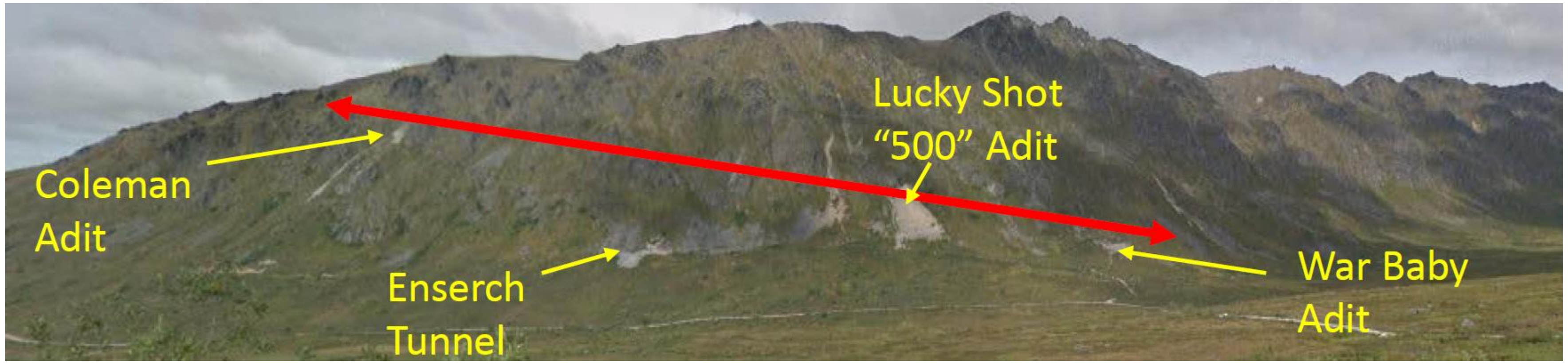
Contango ORE – Lucky Shot

<u>2025-2026 Program:</u>

-planned 59,055-foot (210 hole) underground drift drill program to designed to in-fill the Lucky Shot vein resource to Proven and Probable categories.

- Drilling began November 19, 2025
- Feasibility study expected to be completed in 2027
- Target 30,000 to 40,000 oz Au annual production

Orogenic Au-vein system, **Historical Production:** 252,000 Oz Au from 169,000 tons



Data from Contango ORE, 2025

2023	Tonnes (T)	Au (g/T)	Au ounces
Indicated	226,963	14.5	105,600
Inferred	82,058	9.5	25,100
Total	**309,021**	**13.2**	**130,700**

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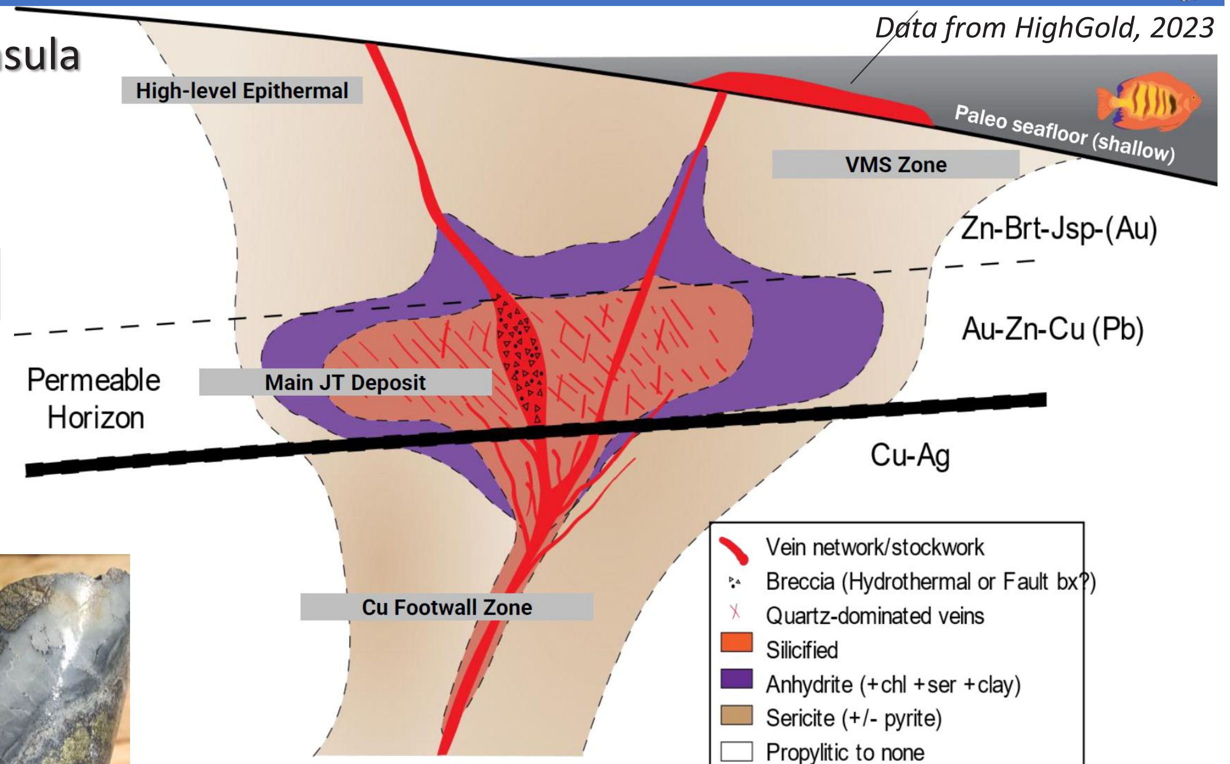
Contango Ore – Johnson Tract

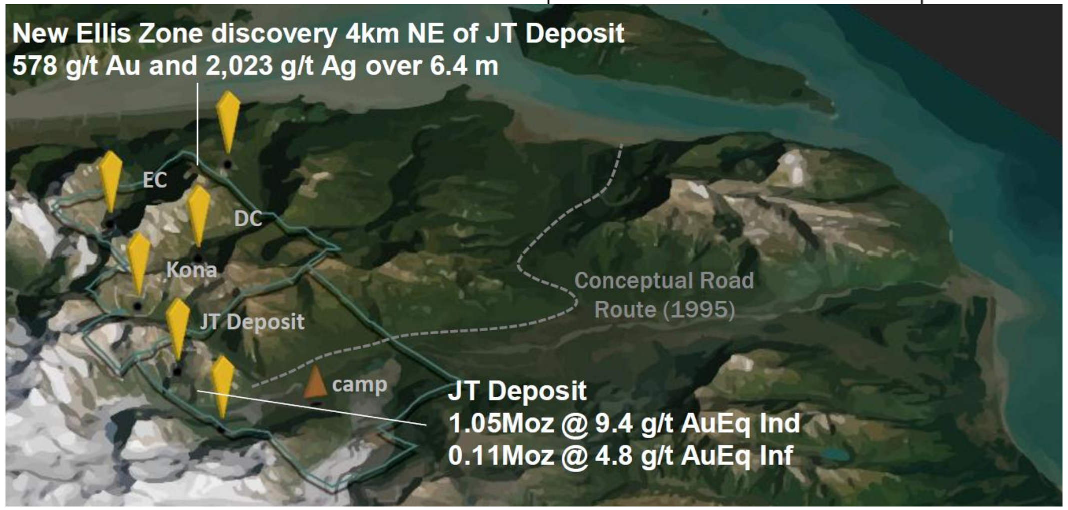
High-grade Au-Cu-Zn-Ag-Pb polymetallic VMS deposit, Alaska Peninsula

JT resource July 12, 2022	Million Tonnes	Au g/T	Ag g/T	Cu (%)	Pb (%)	Zn (%)
Indicated	3.489	5.33	6.0	0.56	0.67	5.21
Inferred	0.706	1.36	9.1	0.59	0.30	4.18
Total	**4.195**	**4.66**	**6.5**	**0.57**	**0.61**	**5.04**



<u>2025 Program:</u>

- Goal: complete permitting in 2 yrs and production in 5 yrs (2029 – Direct Shipping Ore)
- Targeting 100,000 GEO annual production
- Initial Assessment released May 2025 (~PEA)
  - Post Tax NPV5 = $224.5M and 30.2% IRR
  - 7-year LOM with 1.3-year discounted payback period
- Dec 2 put on FAST-41 list
- On CIRI (Native) land within Lake Clark National Park
- Access route easement (20 mi) granted in October



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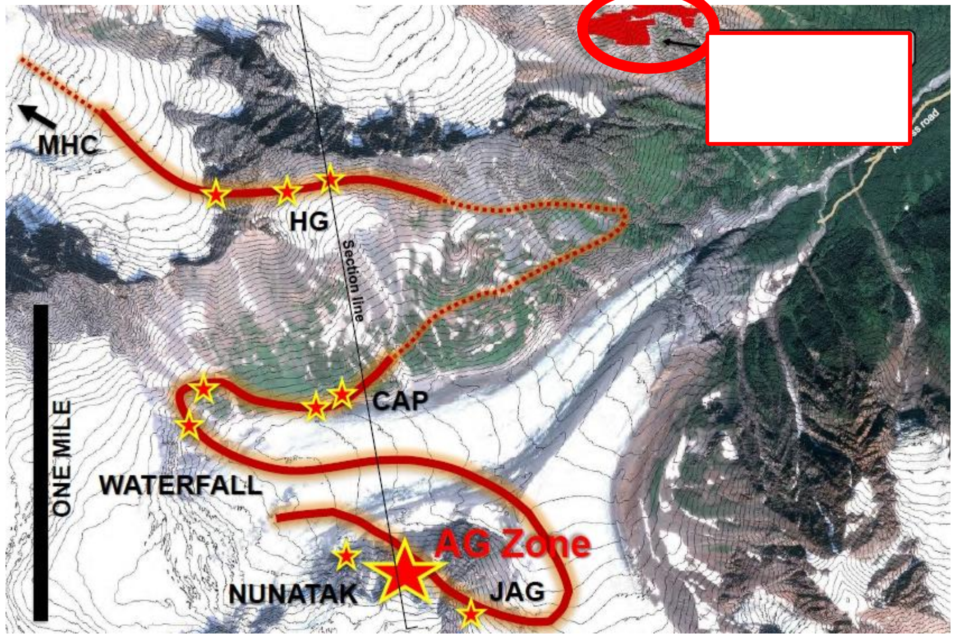
American Pacific Mining/Dowa - Palmer

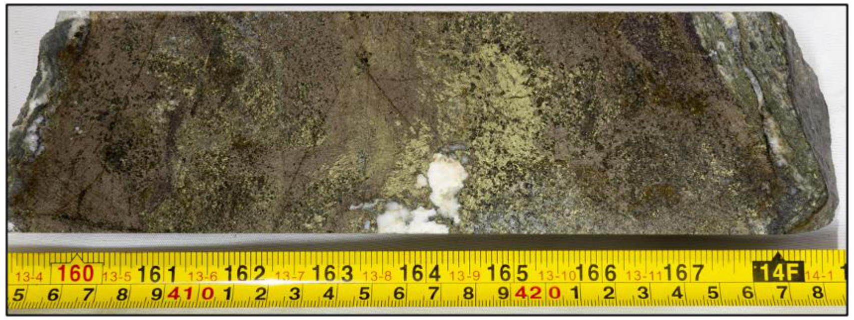
Volcanogenic Massive Sulfide, Southeast Alaska

American Pacific Mining Corp.

Dec. 2018	Million Tonnes	Cu %	Zn %	Ag g/T	Au g/T	Barite %
Indicated	4.677	1.49	5.23	30.8	0.30	23.9
	9.594	0.59	4.95	69.3	0.39	27.7
Total	**14.3**	**0.89**	**5.04**	**56.6**	**0.36**	**26.5**

Vizsla Copper Corp. made deal on November 13 to acquire Palmer project from American Pacific Mining Corp. for $21.4 M





Data from American Pacific Mining Corp., 2025

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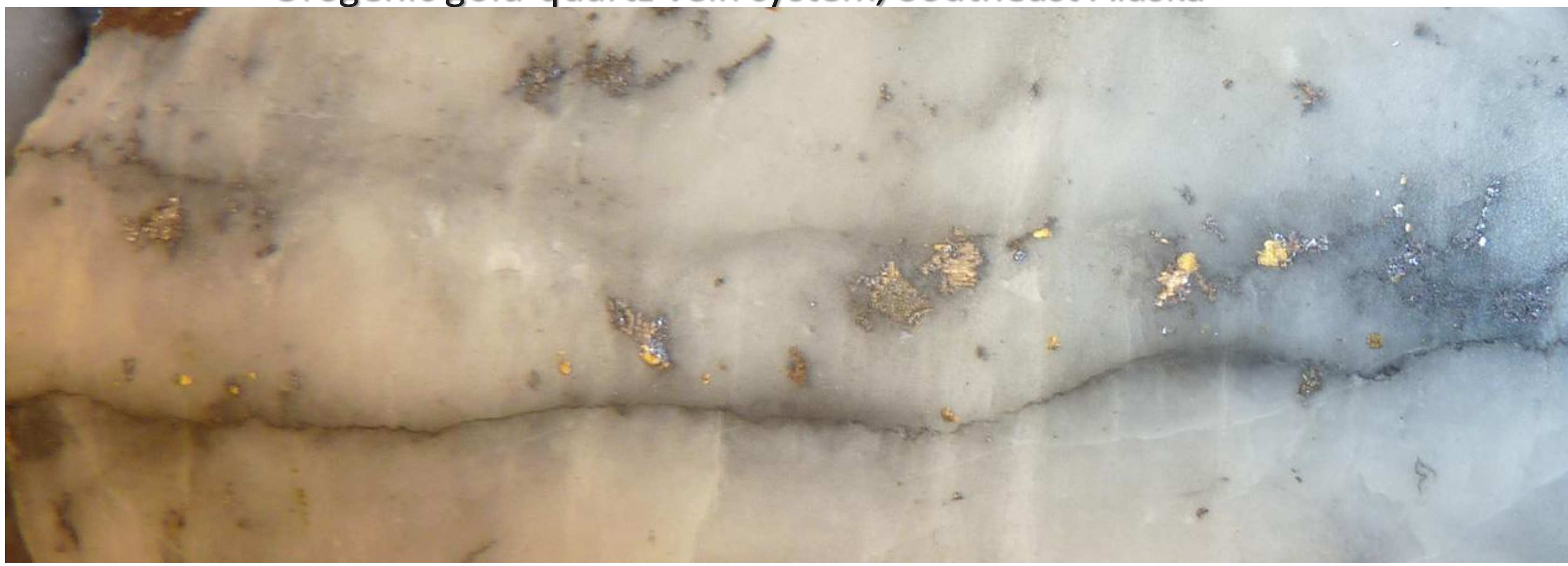
GRANDE PORTAGE RESOURCES – NEW AMALGA

Orogenic gold-quartz vein system, Southeast Alaska



Quartz vein with **asp**, py, gl, spl, and VG

Renamed Project New Amalga *formerly Herbert Gold)

<u>2025 Program :</u>

- Baseline environmental study work
- Currently developing a 43-101 Preliminary Economic Assessment (PEA), expected completion late Q1 2026 for proposed underground mine
- applying for road easement with Alaska DNR for initial portion of project access road over state land

June 2024 Resources	Tonnes (T)	Au (g/T)	Au ounces	Ag (g/T)	Ag ounces
Measured	-	-	-		
Indicated	**4,726,000**	9.47	1,438,500	5.86	891,600
Inferred	**1,813,000**	8.85	515,700	7.33	390,600
Total	**6,539,000**		**1,954,200**		**1,282,200**

Data from Grande Portage Resources., 2025

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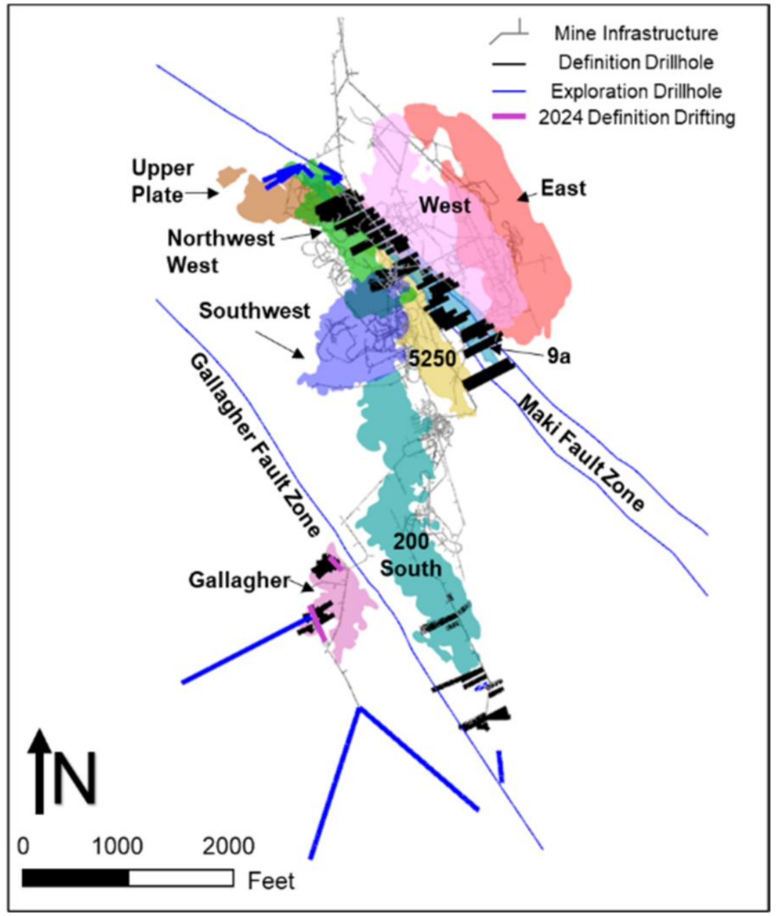
Positive Results at 9a, West, 200 South, East, Gallagher, and Cliff Creek Zones

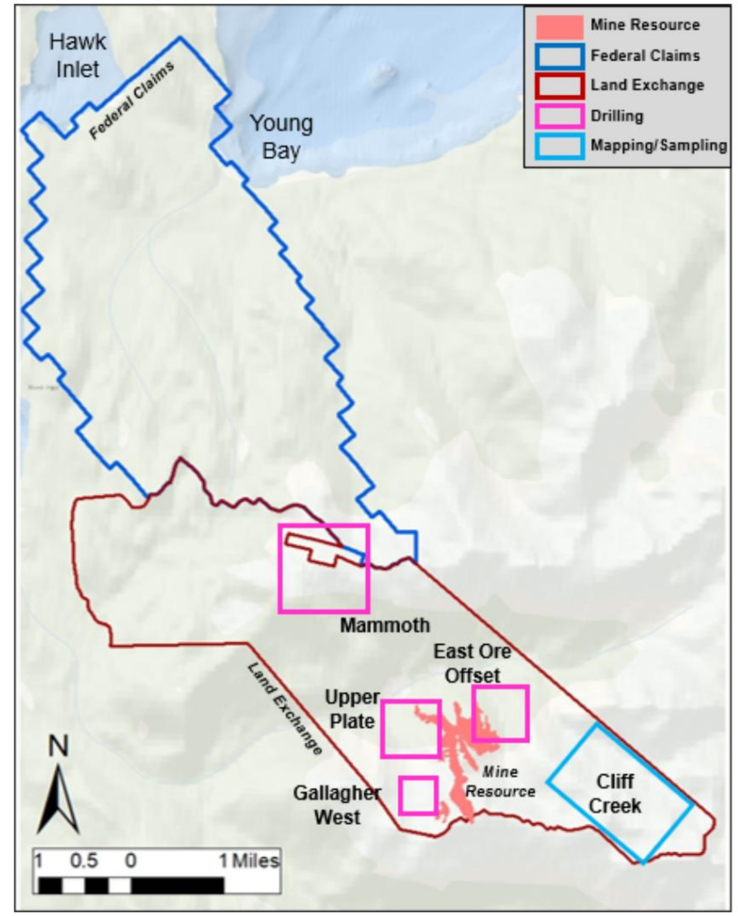
2024 Exploration Drilling - $9M Budget

- Underground drilling focused on resource conversion and exploration to extend mineralization of known resources in 6 zones.
- Two helicopter-supported surface exploration drills are focused on expanding the Upper Plate Zone to the west of current resources and drill testing the Mammoth, Gallagher West, and East Ore Offset targets.
- Assay highlights include (reported widths are estimates of true width):
  - **NWW Zone: 32.0 oz/ton silver, 0.18 oz/ton gold, 14.2% zinc, and 5.0% lead over 19.3 feet**
  - **200 South Zone: 15.7 oz/ton silver, 0.02 oz/ton gold, 2.0% zinc, and 1.0% lead over 26.9 feet**
  - **West Zone: 72.7 oz/ton silver, 0.23 oz/ton gold, 9.6% zinc, and 5.2% lead over 26.9 feet**

2024 Underground



2024 Surface



<u>Drilling Program ($9M 2025 Exploration Budget):</u>

- 2 helicopter-supported surface drills and 4 underground drills

Data from Hecla Mining, 2025

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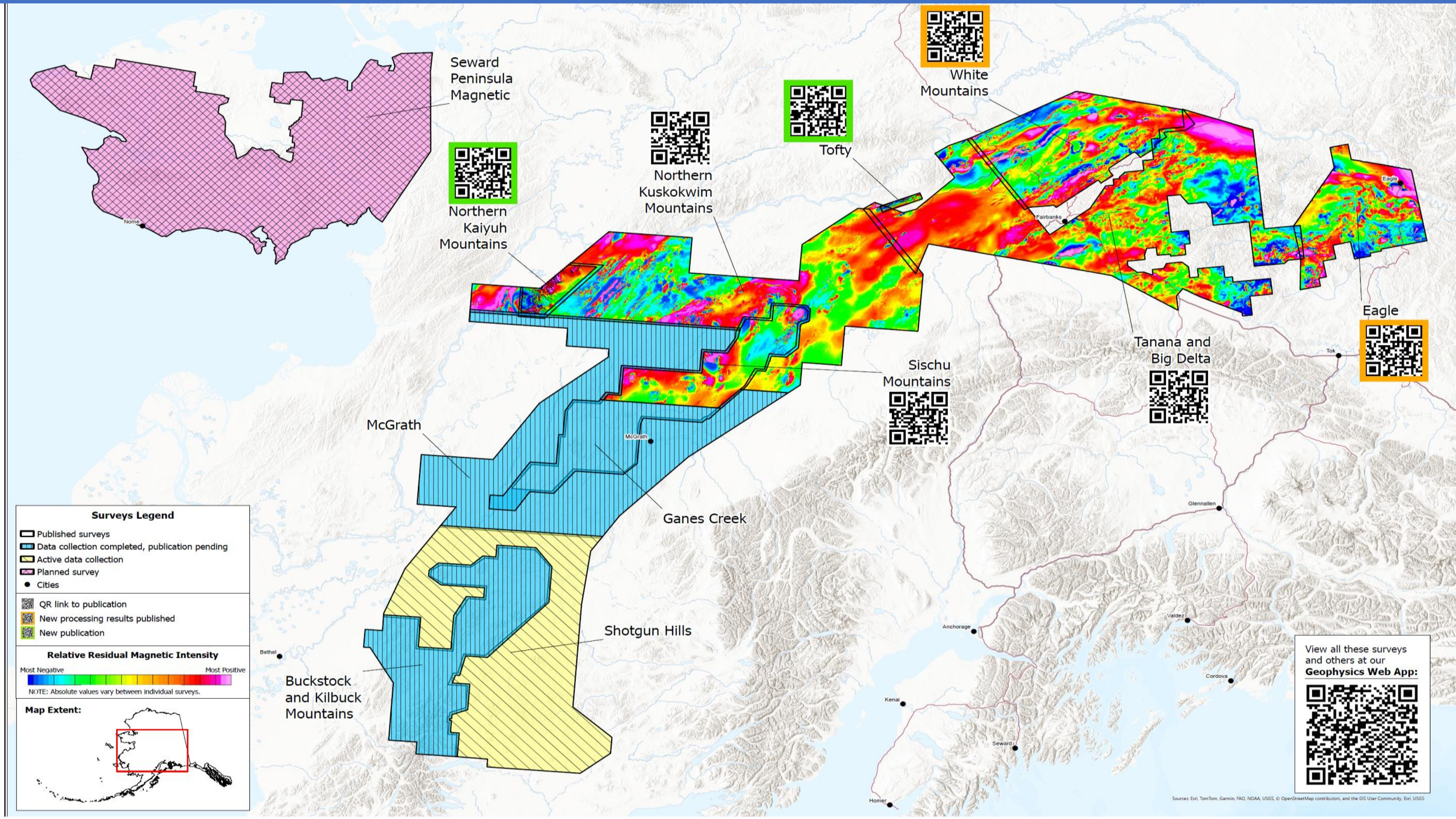
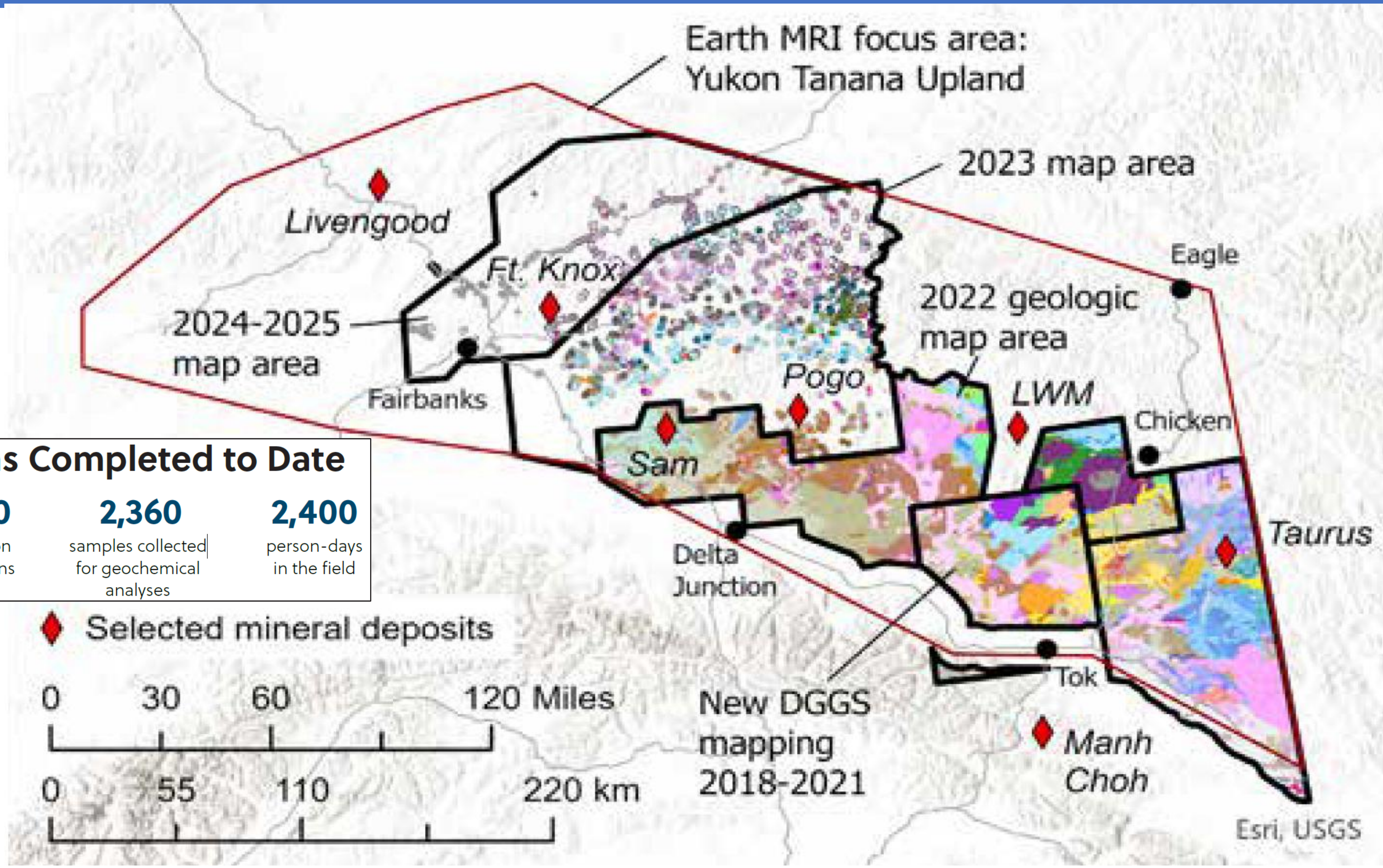
Recent Airborne Geophysical Surveys (DGGS & USGS EarthMRI)



Alaska Geological Survey Mineral Geologic Mapping since 2018 w/ Earth MRI (USGS) funding



Tasks DGGS has Completed to Date

16,900	15,100	2,360	2,400
square miles mapped in the Yukon Tanana Uplands	field station observations collected	samples collected for geochemical analyses	person-days in the field

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