PORT OF JUNEAU, ALASKA

BASIS OF DESIGN

CRUISE SHIP DOCK ELECTRIFICATION

STAGE 2 - 35% DESIGN DEVELOPMENT

JULY 21, 2026

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1.0 Introduction

Alaska Electric Light and Power (AEL&P) has contracted H3 Engineering Solutions, Inc. (H3), a professional electrical engineering consulting firm, to prepare and submit preliminary 15% Schematic Design (SD) and 35% Design Development (DD) document packages for the proposed installation of shore power system at the Port of Juneau, AK.

The H3 design team is comprised of two other professional engineering sub-consulting firms. PND Engineers Inc. (PND) is responsible for civil and structural design and Electrical Consultants Inc (ECI) is responsible for the 69kV shore power substation equipment & transmission line extension design.

The project's goal is to design and prepare 35% DD for a new shore power system. This system will be capable of providing dual voltages at 6.6kV and 11kV. This dual voltage connection will be installed at two existing Port of Juneau downtown docks: Alaska Steamship (AS) and Cruise Terminal (CT) docks. Currently these docks are not furnished with any shore power systems.

The 35% DD includes civil, structural, shore power substation, transmission line extension, and shore power electrical distribution system preliminary schematic design drawings, including preliminary site plans, schematics, equipment layouts, calculations, and cost estimate.

The final 35% DD package incorporates the responses to the 15% SD review comments received from AEL&P and City and Borough of Juneau, Docks and Harbors (CBJ).

2.0 Scope of Work

The scope of work to prepare the 35% DD package is summarized as the following:

2.1 Civil & Structural Engineering Design (by PND)

- Data acquisition and analysis
- Site investigation
- Participation in project progress meetings
- Land survey
- Geotechnical investigation
- Design concept development
- Preliminary cost estimate

2.2 69 kV Equipment & Transmission Line Extension Design (by ECI)

- Data acquisition and analysis
- Site investigation
- Participation in project progress meetings
- Electrical transmission lines field routing and centerline identification
- Electrical transmission line conductor and assembly design
- Preliminary cost estimate

2.3 Shore Power Electrical System Design (by H3)

- Data acquisition and analysis
- Site investigation
- Participation in project progress meetings
- Project coordination and management
- Shore power substation design
- Shore power conduit bank routing design
- Shore power cable management and switching system design
- Design concept development
- Preliminary project cost estimate

3.0 Structural & Civil Design

3.1 Structural Design Criteria

3.1.1 Codes and Standards

Publisher	Title	Date/Edition
American Society of Civil Engineers (ASCE)	Seismic Design of Piers and Wharfs (ASCE 61-14)	2014
American Society of Civil Engineers (ASCE)	Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)	2010
American Society of Civil Engineers (ASCE)	Minimum Design Loads for Buildings and Other Structures (ASCE 7-16)	2016
American Society of Civil Engineers (ASCE)	Design of Marine Facilities	3rd/2016
American Institute of Steel Construction (AISC)	Steel Construction Manual, Including Seismic Design Manual	15th/2017
American Welding Society (AWS)	Structural Welding Code (AWS D1.1)	2020
American Concrete Institute (ACI)	Building Code Requirements for Structural Concrete (ACI 318-19)	2014
The Aluminum Association (AA)	Aluminum Design Manual	2020
US Army Corps of Engineers (USACE)	Shore Protection Manual	1984
U.S. Department of Defense (DoD)	Unified Facilities Criteria (UFC)	
International Council Code (ICC)	International Building Code (IBC)	2024

3.2 Loads

3.2.1 Dead Load

- Weight of all materials of construction

3.2.2 Live Load

- Pile Supported Dock = 200 PSF Uniform H-20 Vehicle (AASHTO)
- Gangways/Transition Plates = 60 PSF Uniform

Note: Where live load is used in combination with snow load, the live load shall be reduced by 50 percent due to operational restrictions on all structures with the exception of the 80 Ft gangways and floats.

3.2.3 Snow Load

- Ground Snow Load: P_g = 112 PSF Uniform (Risk Cat. II)
- Exposure Coefficient: C_e = 0.8 (fully Exposed, Exposure D)
- Thermal Coefficient: C_t = 1.2 (Unheated, Open-air Structure)
- Flat Roof Snow Load: P_f = 75.3 PSF Uniform

3.2.4 Wind Load

- IBC 140 MPH 3-second gust, exposure D unless otherwise noted

3.2.5 Seismic

The seismic analysis of this project shall be accessed through the means of an Equivalent Lateral Force Analysis (ELF) based off the following variables.

- Site Class D (Stiff Soil)

  S_S = 0.54g F_A = 1.0 S_{DS} = 0.54g
  S_1 = 0.31g F_V = 1.8 S_{D1} = 0.56g
- Seismic Design Category D (ASCE Hazard Tool)

  Importance Factor: I_e = 1.0
  Response Coefficient: R = 2.0 (Steel Pipe Piles)
  Seismic Response Coefficient: C_s = 0.27

3.3 Existing Conditions

The existing CT and AS Berth Approach Docks consist of glulam stringers supported by steel pile caps on steel pipe piles. The deck itself consists of 4x timber decking and is equipped with a perimeter bull rail and handrail for safety purposes. A transfer bridge and landing connects each approach dock to a 50'x300' concrete pontoon. Steel catwalks connect both the CT and AS concrete pontoons via a gangway on either end.

3.4 Site Information

The site of both the CT and AS approach docks are considered exposure D as they exist in the "South" zone as designated by CBJ, designating that this area receives higher wind loadings. Additionally, a floodplain development permit will be required for this project as both docks exist in a coastal flood zone, as designated by the Federal Emergency Management Agency (FEMA).

3.5 Geotechnical Study

A preliminary geotechnical site investigation has been conducted by PND for three alternative sites considered for the electrical substation on November 20 and 21, 2024, as part of a previous stage of this project (Stage 1). Subsequently, PND has issued the Port of Juneau Shore Power Preliminary Geotechnical Site Investigation Report dated December 18, 2024.

The three locations considered for housing the proposed substation were located at the lower slopes of Mt. Roberts adjacent South Franklin Street and within the site of the historic Alaska-Juneau (AJ) mining operations.

This preliminary geotechnical report recommends Site No. 2 for the Shore Power Substation location as it "appears to present the most favorable subsurface conditions of the three sites." This report includes recommendations for "Additional test pits to identify the presumable shallow bedrock and overburden characteristics for site development purposes."

3.6 Proposed Substation Site Development

The concept plan described in the Port of Juneau Municipal Shore Power Project (Small Water Port), EPA Clean Ports Program: Zero-Emission Technology Deployment Competition grant application will be further refined.

Upon AEL&P and POJ review and approval of the 15% design and substation site selection preference, the 35% DD will be progressively developed and carried forward to future design phases.

Following the initial concept refinement the design will be progressed to a 35% preliminary level of design completion for all site civil and marine structural improvements.

15% SD civil site plans include the following:

- Substation site entry and driveway access improvements
- Substation civil site development plans, including cross sections, cut & fill sections,
- Grading and drainage
- Site perimeter fencing
- Conduit alignment and profile to existing duct banks

15% preliminary marine structural plans including the following:

- Approach dock modifications/gangway support.
- Aluminum gangway.
- Accommodations on the new docks for the cable management system, trench with cable chain, track element, and IGUS moveable shore power outlet (IMSPO) carriage.
- Steel pipe pile float restraints.
- Catwalks and/or access floats between the dock.

15% cost estimate and material quantity takeoffs will be developed for all civil and structural components listed above as well as specifications' table of contents in CSI format for all site improvements.

3.7 Approach Docks

3.7.1 Materials

3.7.1.1 Structural Steel

Steel shall conform to the following specifications:

Steel Pipe Piles:	ASTM A252, Grade C
Steel Pile Caps:	AISC HP14, ASTM A992
Gangway:	AISC HSSXXX, ASTM A500, Grade C

Dolphin Access Plate:	ASTM AXXX, Grade B
Welding:	70 KSI Electrode Welding

3.7.1.2 Wood Products

Solid Sawn 4x12:	Doug Fir. Select Structural
Glue-Laminated Beams:	24F-V8, Industrial Grade

All timber products shall be pressure treated in accordance with AWPA UC4B.

3.7.2 Structural Overview

The new CT and AS docks will be constructed similar to the existing docks, consisting of DF timber decking supported by timber glulam stringers, supported by steel pile caps on steel pipe piles. The AS shore power dock is to be directly accessible through a vertical lift gate separating it from the existing AS dock. Access to the CT dock will be via modification to the existing gangway from the concrete pontoon. Both docks will be connected via the existing catwalk. A 20'x24' garage will be constructed on each dock to house the cable management system (CMS) positioning device during winter months.

Docks CT and AS will both include a trench along the entire dock to house the IMSPO cable chain, track element, and movable shore power outlet carriage.

3.8 Additional Civil/Structural Discussions

3.8.1 Design Optimization

1. This structure is to be operated primarily as a working dock face, therefore a vehicular bull rail will be installed around its perimeter in lieu of a complete pedestrian handrail, which will avoid interference with operations on the shore power dock.
2. Mooring shall not occur at either dock to reduce potential hazards created by mooring lines.
3. On both the CT and AS approach docks, galvanic anodes are to be field welded at varying elevations along each pile. Anode design life will vary based on a number of factors, including pile diameter and thickness, ranging from 20-40 years.

4.0 69 kV Equipment & Transmission Line Extension

4.1 Overview

The 69 kV electrical equipment will be located in the Shore Power substation and will tap to the existing AEL&P Overhead Transmission Circuit #2 to provide shore power to connected cruise ships berthed in the Port of Juneau. The complete project build will consist of a single transmission line dead-end and three (3) 15/20/25 MVA (69 kV, Delta – 11 kV/6.6 kV, Wye/Wye, Dual Secondary) main power transformers fitted with primary-side automatic on-load tap changers and digital tap controller. The transformers will utilize a conventional open-air design with outdoor power equipment on the Delta connected 69 kV side and with 15 kV rated metal-clad switchgear on the secondary side.

The substation area will include sufficient space allocation and line tap provisions for the third future transformer, similar in size and rating to the two transformers that are being installed initially. This future transformer is intended to serve the Hoonah Totem Dock's future shore power system.

The complete 69 kV design will also include three (3) 69 kV circuit breakers as well as seven (7) 69 kV disconnect switches. Incoming power to the substation will be transmitted via overhead transmission lines, and secondary circuits will run through underground ductbank to their respective metal clad 15 kV shore power switchgear which will include overcurrent protection and circuit switching capabilities.

4.2 Design Criteria

4.2.1 Standards

a. AEL&P and ECI Standards Design criteria will be used.
b. Standards include industry best practice, NESC, NEC, RUS, and IEEE guidelines.
c. AEL&P metering requirements.

4.2.2 Substation Structural Design Criteria

The basis of design will be ASCE 113 and ASCE 7-16, along with ACI 318-14 and AISC Steel Construction Manual, 15th Edition. Tapered tubular steel will be designed, using NESC C2-2023 as the basis for loading. Structure deflection limits will be as defined by ASCE 113. The structural load cases will include extreme wind, concurrent wind and ice, fault current and seismic forces. The project is in the NESC Heavy Loading Zone, and the extreme wind speed at the site is 115 mph (ASCE 7-16). The seismic design category is D and Risk Category III is the basis of design.

4.2.3 Seismic Design – Spectral Response Accelerations & Factors

a. SS: 0.400 g's (ASCE Hazards)
b. S1: 0.222 g's (ASCE Hazards)
c. Site Class: C-Dense Soil
d. ASCE 7-16 Standard

4.2.4 Site Address/Latitude & Longitude

a. Address: TBD
b. Latitude: 58.29°
c. Longitude: 134.39°

4.2.5 Altitude Derating Factor

a. Equipment Insulation (ANSI/IEEE Std. C37.100.1-2018): Ka = 1.00
b. Pollution Level (IEEE Std. C37.100.1-2018): Level I
c. Minimum Creepage Distance (IEE Std. C37.100.1-2018) (mm/kVLL): 16

4.2.6 Environmental

a. Site Elevation: Approximately 185 feet
b. Max Site Design Temperature: To meet or exceed distribution's rating of 32.2 degrees Celsius
c. Min Site Design Temperature: To meet or exceed distribution's rating of -30.0 degrees Celsius
d. Ground Snow Load: 70 psf.

4.2.7 Insulation Coordination

a. Substation equipment and bus systems that will operate at a nominal phase-to-phase voltage of 69 kV shall be designed for a Basic Insulation Level (BIL) of 350 kV.
b. Substation equipment and bus systems that will operate at a nominal phase-to-phase voltage of 11 & 6.6 kV shall be designed for a Basic Insulation Level (BIL) of 110 kV.

4.3 Existing Conditions

The nearest power source that can deliver sufficient power for both docks AS and CT is located on the higher slopes of Mt. Roberts above South Franklin Street. This power source is an existing 69 kV AEL&P overhead transmission line on circuits #1 and #2. To accomplish the 69 kV connection to the proposed shore power substation, a new 69 kV overhead tap line (approximately 170 ft long) is proposed to be inserted in the existing line #2 alignment. A rebuild and re-span of existing structures in line #1 and #2 is proposed to accommodate the new tap. Existing poles in the tension sections involved have reached “at replacement” strength values and are due for change out. The new tap line includes new vertical deadend framing with two (2) 1AD 69 kV manual control rod operated disconnect switches installed on a single round wood pole structure. A new vertical double deadend round wood pole is proposed to support the line tap span down a hill side to the new h-frame steel deadend in the station.

The area where the shore power substation will be located is in the vicinity of a historic fuel tank site (indicated as “Site 2” on the “Preliminary Geotechnical Investigation” report dated December 18, 2024). The tanks have since been demolished, and an on-site environmental remediation program was performed within the site. Located just north of the demolished oil tanks is a fill prism of which its original purpose and lateral extent is unknown. The northwest part of this site (beyond the footprint of the removed fuel tanks) currently houses a seasonal vehicle-based tour operation.

There is sufficient space located just south of the vehicle-based tour operation area which will be utilized for the shore power substation.

4.4 Shore Power Substation System Overview

The substation will terminate a single 69 kV overhead transmission line dead-end from AELP’s existing Transmission Circuit #2. A new 69 kV line extension will be installed over a downward slope to connect to the new shore power substation located at Site 2.

Site 2 will be developed to accommodate a new fenced substation with electrical power distribution equipment.

Transmission line power will be distributed between three 69 kV buses, each of which will be protected by a 69 kV circuit breaker.

Line voltage and current will be monitored by three three-phase 69 kV metering units, one on each 69 kV bus between the circuit breakers and the transformer banks.

A 69 kV disconnect switch will be placed on the line side of the circuit breakers to safely isolate equipment for maintenance.

Utility metering equipment will be installed on each of the 69 kV feeders serving each transformer, per AEL&P requirements. AEL&P will provide utility grade meters, one for each 69 kV bus.

Each of the shore power transformers will be equipped with 1MVA, 69kV, 3-phase primary, 11kV & 6.6kV dual secondary windings, automatic on-load tap changer and will connect through to their respective metal-clad switchgear via underground medium voltage power cables.

The substation will also contain a 21ft x 15ft shelter structure housing communication and metering devices.

4.4.1 Steel/Site Work

Build includes three (3) static masts, and single H-Frame dead-end structure that will be a tapered tubular design; all other steel structures will utilize standard shapes.

The pad will be within +/-0.1 ft. of final sub grade elevation. All below grade conduit will be direct burial Schedule 40 PVC. A 4" concrete cover or cap will be included for all ducts underneath locations expected to support heavy equipment.

4.5 System Protection

System protection panels will be in a control enclosure in the station. Relay protection and control will consist of two racks with primary and secondary transformer protection; one rack for owner and utility check metering; one HMI/RTU rack, and server and network racks to be provided by AEL&P. Space will be coordinated to ensure switchgears can accommodate protection equipment.

4.5.1 Rack Line Up Overview

4.5.1.1 69-11/6.6 kV Transformer Protection & Control & Bus Differential Protection

a. Two (2) racks required.
b. Two (2) Control Switches for transformer circuit breaker control
c. Two (2) Control Switches for line switch motor operators
d. Two (2) Transformer Protection and Control Schemes:
    i. SEL-487E (Primary & Secondary) transformer current differential scheme.
    ii. Two (2) Lockout relays for Main Power Transformer protection.

4.5.1.2 Metering

a. One (1) rack required.
b. Two (2) Owner/Utility Revenue Check Meters:
    i. Two (2) ION-8650 revenue and power quality meters.

4.5.1.3 HMI/RTU (Pending AEL&P confirmation)

a. One (1) rack required.
    i. One (1) SEL-2488 Satellite Synchronized Clock
    ii. One (1) CISCO IE-4010 Managed Ethernet Switch
    iii. One (1) ELO HMI Touch Monitor
    iv. One (1) SEL-2440 DPAC
    v. One (1) Corning FPP Fiber Patch Panel
    vi. One (1) SEL-3555 BOP RTAC
    vii. Provisions for one (1) SEL-3555 PPC RTAC

4.5.2 Communication System

4.5.2.1 Relay Communication Requirements: (Pending AEL&P confirmation)

a. Fiber path will be used for transformer monitoring communication. This is currently planned to be a 6 count multi-mode fiber to the MPTs.
b. Relay communication in the substation will be processed via ethernet switches. Where ethernet is not applicable or available, serial communications will be utilized. This connection will provide data for SCADA as well as network access to the relays.
c. SEL Fast Messaging will be the priority protocol used, followed by DNP3.

4.5.2.2 Meter Communication Requirements (Metering Pending Confirmation)

a. Primary meter data will be provided via the primary RTU RTAC.
b. All local meter communications in the substation will be processed via ethernet switches. This connection will provide data for SCADA and network access.

4.5.2.3 Communications Overview (IT, Protection & SCADA)

a. A free-standing HMI rack with one CISCO IE-4010 switch will be used. Hardwired points for control and indication will be provided by protection relays and SEL-2440 I/O module(s) that will communicate with the routers via Ethernet.

4.5.3 Bus Fault Levels (Maximum)

The 69 kV section of the yard is currently designed to a max 25 kA fault current (Circuit Breaker Rating). The existing 69kV system has 3LG fault levels of approximately 1900 amps and 1LG levels of approximately 4080 amps. Design will comply with IEEE Standards.

4.5.4 Grounding System

4.5.4.1 Ground Conductor

Ground grid conductor will be #4/0 AWG soft drawn bare copper conductor installed a minimum of 18 inches below the subgrade surface. The ground grid will extend outside the substation fence by 3 feet.

4.5.4.2 Ground Conductor Connections:

Above grade connections will be compression or bolted type. All below grade connections will be exothermic weld type. Design will comply with IEEE Standards.

4.5.5 Lightning Shielding Design

Tapered steel static masts and the H-frame deadend will be utilized in conjunction with 3/8” EHS cable to provide complete protection of all electrical equipment in the yard. The design shall be consistent with IEEE Standard 998. The fixed angle method will be applied for the 69 kV yard and the 15 kV yard.

4.6 Auxiliary Station Power and AC/DC System

Primary auxiliary station power will come from the station service transformer mounted on the 15 kV underground riser structure. Backup station service will be supplied by a nearby utility distribution transformer (pending confirmation). Station service primary power will be fed through a fused disconnect switch located on the low side switch structure in the yard and run to a non-fused switch located inside the control enclosure before being run into an automatic transfer switch (ATS) and fed into the AC panelboards.

Backup power will be fed through a fused disconnect switch and run to the ATS. The AC station service will be designed to carry the load required by all equipment located within the substation fence.

Auxiliary 125 VDC power systems consist of a single 125 VDC battery with fused disconnect switch, dual battery chargers and battery spill containment. The battery will be in the control enclosure and will be designed to carry the load required by all equipment located within the substation fence. Battery design will comply with IEEE 485-2020 standards.

4.6.1 Yard Lighting:

Yard lights are anticipated to be installed on the static masts/dead end to provide adequate illumination for emergency access and observation of station equipment. Lights will be controlled via a light switch on the wall in the control enclosure. The control enclosure will have internal lighting and outdoor wall packs that can be controlled by light switches in the control enclosure.

4.7 Steel Structures

The static masts and H-frame deadend structures are tapered tubular design; all other steel structures will utilize standard shapes. Material specifications include ASTM A992 for wide flange shapes, ASTM A36 for plates, M and L shapes, ASTM A500, Gr B for HSS shapes, and ASTM F1554 for anchor bolts. Bolted connections will utilize ASTM F3125, Gr A325 high strength bolts, typically installed in a pretensioned condition.

4.8 Foundations

All foundations are anticipated to be drilled pier except for transformers (mat slab foundations). The appropriate foundation design will be selected, based on loading and soil conditions. Concrete will have a compressive strength of 4,500 psi, with appropriate Portland cement type and air entrainment specified for the site conditions. Reinforcing rebar will comply with ASTM A615, Grade 60.

4.9 Oil Spill Containment System:

Transformer oil containments will be an elevated concrete platform with integrated containment pit, grating, and drain.

4.10 Security

Substation perimeter fence will be 2” mesh, 9-gauge galvanized steel, with razor wire and barbed wire support along the top 1 ft. for an overall height of 8 ft.

4.11 Equipment, Cables, and Associated Items

4.11.1 Major 69 kV and 15 kV Equipment (in Shore Power Substation)

a. Twelve (12) 70 kV MCOV Surge Arresters (Nine arresters to be provided with transformer)
b. Nine (9) 7.65 kV MCOV Surge Arresters (To be provided with transformer)
c. Twelve (12) 5.1 kV MCOV Surge Arrestors (To be provided with transformer)
d. Nine (9) 69 kV CVT Metering Units, 350/600:1:1 0.15 WXMYZ Metering Accuracy, 350 kV BIL, with PQ sensing
e. Seven (7) 69 kV Manual Group Operated Air Disconnect Switches, 350 kV BIL, 1200 A
f. Three (3) 69 kV Circuit Breakers, 350 kV BIL, 1200 A, 25 kAIC,

g. Three (3) 15/20/25 MVA 69 kV-11.0 and 6.6 kV Main Power Transformers fitted with ALTC and ALTC Controller
h. Six (6) 15 kV Manual Group Operated Air Disconnect Switches, 110 kV VIL, 2000 A
i. One (1) 15 kV Station Service Transformer (kVA rating TBD)
j. One (1) Lot of Substation Tubular and Standard Shape Steel
k. One (1) Standard Substation SCADA System
l. One (1) 125 VDC Battery Systems, Two Chargers/Spill/Rack (AH rating to be determined)
m. One (1) Lot of Relay, Metering and Communications Equipment

4.11.2 Jumper Conductors and Fittings

For 69 kV connections, single 12721272 kCM AAC conductor (1 per phase) will be used from the high side switches to transformers T1 & T2. All non-current carrying jumpers for VTs shall be #1/0 AAC conductors. Welded lugs and fittings will be used for flexible 15 kV jumpers.

For 15 kV connections, single-conductor 750 kCM copper TRXLP power cable will be used for the tie from the transformer secondaries to the switchgear disconnect switches.

4.11.3 Insulators

Standard strength station post insulators will be used as required by bus analysis.

4.11.4 Control Cable

Control cables per AELP standards will be installed in direct-buried PVC conduits. Yard control, instrumentation, and DC supply cables will be non-shielded. AC supply cables will be non-shielded.

4.11.5 Power Cable

Underground feeder cable sizes are subject to soil thermal resistivity tests.

4.11.6 Junction Boxes

Junction Boxes for CVTs, CTs, VTs, and Yard Lights shall be NEMA 4X rated, stainless steel.

4.12 Other Provisions

4.12.1 Removal

As part of the 69 kV transmission line rebuild of line #1 and #2, various wood pole structures are proposed to be removed and replaced by new douglas fir round wood poles. The existing line ruling spans are proposed to be increased as part of the line rebuild resulting in a net decrease in number of poles on the 69 kV transmission line system.

4.12.2 Real Estate

None identified.

4.12.3 Operability/Maintainability

None identified.

4.12.4 Construction

None identified.

4.12.5 Permitting

None identified.

4.12.6 FAA

The FAA's Notice Criteria Tools (NCT) for this project location indicated that filing a 7460-1 and 2 will not be necessary for both the new proposed rebuild and tap of line 1 and 2 or for the proposed substation equipment. A conservative structure/equipment height of 100 feet was reviewed. Shore Power Electrical Distribution System

5.0 Shore Power Electrical Distribution System

5.1 Codes and Standards

- IEC/ISO/IEEE High Voltage Shore Connection (HVSC) International Standard No. 80005-01 and its associated Annex C applicable to cruise vessels and terminals.
- National Electric Code (NEC)

5.2 Existing Conditions

There is no shore power system currently installed at docks AS and CT. The nearest power source that can deliver sufficient power for both docks AS and CT is located on the higher slopes of Mt. Roberts above South Franklin Street. This power source is an existing 69 kV AEL&P overhead transmission line, circuits #1 and #2.

The area where the shore power substation will be located is in the vicinity of a historic fuel tank site. The tanks have since been demolished and an on-site environmental remediation program was performed within the site. Located just north of the demolished oil tanks is a fill prism of unknown purpose and lateral extent. The northwest part of this site, beyond the footprint of the removed fuel tanks, currently houses a seasonal vehicle-based tour operation.

5.3 Shore Power Electrical Distribution System Overview

5.3.1 Shore Power Substation Distribution Equipment

The shore power substation will be designed to have space for three shore power transformers. Two (2) of the transformers will be installed to feed the AS and CT docks. The third space is reserved for a future shore power transformer, medium voltage switchgear, and neutral grounding resistor (NGR) to provide power for a third shore power installation at the Hoonah Totem dock.

A 15 kV rated metal-clad switchgear will be fed from its respective transformer via underground medium voltage power feeders. Each shore power switchgear within the shore power substation will feed their respective 15 kV rated shore power control switchgear located at the AS and CT docks.

Each transformer will have a common neutral bushing that will be connected to a neutral grounding resistor (NGR) with an insulated and isolated neutral conductor, and the NGR will connect to a neutral bus within the metal clad switchgear within the shore power substation. This neutral bus will be connected to the ground bus via a circuit breaker to meet National Electric Code (NEC) system grounding requirements when there is no ship connected. The load side of the NGR will be grounded via an isolated ground triangle minimum 20ft away from the nearest grounded electrode.

The neutral bus within the shore power substation will also be connected directly to the neutral shore power outlet via the dock power control switchgear, located at the dock. This connection will be made with an insulated and isolated neutral conductor.

The shore power substation will have two (2) 15 kV rated switchgears, one for each dock, AS and CT. Each switchgear within the shore power substation will contain four (4) circuit breakers. The first circuit breaker will provide a switched connection from the neutral bus to the ground bus to provide a system ground when no ship is connected. The second circuit breaker will connect to a capacitor bank to provide power factor correction. The third and fourth circuit breakers will connect the 6.6 kV and 11 kV feeders to the dock shore power control switchgear, providing power to the high voltage shore power connection (HVSC) outlets.

The shore power substation switchgear will also include a section housing the communications and auxiliary controls equipment such as human machine interface (HMI), uninterruptable power supply (UPS), emergency push button (EPB), programmable logic controller (PLC), and other telemetry devices as required by the IEC/ISO/IEEE HVSC 80005-01 Annex C standards.

The 15 kV electrical equipment located within the shore power substation will be enclosed in a manufactured E-House enclosure.

5.3.2 Shore Power Routing & Infrastructure

The new shore power underground ductbank will be routed from the shore power substation equipment via the north existing driveway (to be repaved and upgraded as part of this project). The new ductbank will terminate at new manhole SP0, located where the driveway entrance meets South Franklin Street.

This manhole will intercept existing underground conduits to be re-used with new conductors for the shore power system. The new conductors will be routed through these existing underground conduits via existing manholes SP1 and SP2.

Within existing manhole SP2, the conductors will be spliced into outgoing Submarine cable, which will be fed through existing underground conduit stubs below sea level.

In addition to the 11kV and 6.6 kV power conductors, the ductbank will also contain 480 V power and communication fiber optic cables. The 480 V power will be fed from a new local AEL&P service drop located within the Port of Juneau Downtown Area, adjacent to existing AEL&P electrical equipment.

These submarine cables will be terminated at the shore power control switchgear and 480V panelboard located at on docks AS and CT.

5.3.3 Dock Shore Power Control Switchgear and Distribution Equipment

Each dock shore power control switchgear will include two (2) circuit breakers, four (4) digital multi relays (DMR), one (1) fail-safe PLC, one (1) voltage selector switch, and other power control and monitoring devices. The first circuit breaker will be served from a bus tap within the shore power substation switchgear. This circuit breaker will act as the main shore power circuit breaker at the dock, delivering either 6.6 kV or 11 kV as appropriately selected by the voltage selector switch within the dock power control switchgear.

The second circuit breaker serves as a grounding switch to dissipate the capacitance charge by connecting the shore power cables and bussing to the equipment grounding conductor located within the dock shore power control switchgear.

The four (4) digital multi relays (DMR) will monitor and protect each of the four (4) shore power connection outlets and cables. These relays will monitor various protection functions as required by the IEC/ISO/IEEE HVSC 80005-01 Annex C standards. The DMRs shall be capable of two scenario protection settings (11 kV and 6.6 kV) activated based on the selection made by the voltage selector switch.

The fail-safe dock PLC, located within the dock shore power control switchgear will be connected via fiber optic cable to a fail-safe substation PLC, located within the shore power substation switchgear.

Once the voltage is selected by the voltage selector switch at the dock shore power control switchgear, the PLC will automatically and remotely close the appropriate feeder circuit breaker (6.6 kV or 11 kV) and open the unselected feeder breaker. The PLC will also automatically and remotely open two grounding circuit breakers, one at the dock shore power control switchgear and the other at the shore power substation switchgear.

The PLC will also send signals to the shore power substation PLC to govern the ALTC controller, maintaining transformer output voltage at exactly 6.6 kV or 11 kV as selected.

Due to the dual voltage system at the dock shore power control switchgear, an independent and external source of 120V power will be required to provide control power to the power monitoring protection equipment within the auxiliary section of the switchgear. An existing AEL&P transformer with a 480V secondary voltage has been identified to provide a new 480V service entrance switchboard. This service will serve the cable management system (CMS) equipment charging and IGUS movable shore power outlet (IMSPO) carriage. The 480 V panelboard will also serve a 480 V – 208Y/120V transformer and panelboard to serve the dock switchgear power monitoring and control devices.

The two (2) dock shore power switchgears, 480V and 208Y/120V distribution equipment, and two (2) CMS's will be housed within a pre metal building located on the new dock platform.

5.3.3.1 Shore Power Connection Interface & Cable Management System

The new dock platform for both AS and CT docks will contain an IGUS trench-mounted movable shore power connection outlet carriage (IMSPO). This carriage will move along a cable chain-powered track element installed within a trench. This trench will be covered with segmented and removable non-metallic trench covers.

The IGUS IMSPO system will also include a mobile cable management system (CMS). The CMS will be capable of being driven and will be powered by an integrated on-board re-chargeable battery. The battery will be charged via the 480 V panel on the dock located in the garage. During the shore power connection, the CMS will be connected to 480 V outlet located in the IMSPO carriage.

The CMS boom will be able to feed the shore power cables to the shore power hatch located on the vessel at berth.

6.0 Berthing Study

6.1 Overview

H3 has received cruise ship call calendar schedules from years 2025 and 2026 from the CBJ and has converted it into a tabulated format as shown in Table #1 (attached to this report). Table #1 shows ship names, technical information, and dock location where each vessel has been berthed or is scheduled to berth.

Table #1 also shows the overall length, shore power hatch location and orientation (Port Side or Starboard side), shore power hatch distance (relative to the ship's stern), ship's peak electrical load at berth in Megawatts (MW), and its shore power connection voltage.

For the purposes of this Berthing study, the most relevant information is the length and shore power hatch side of the largest vessels. The system is designed to simultaneously connect the two largest vessels berthed at CT and AS docks. Since the two largest vessels are considered for scenario, this system will subsequently be sufficient to accommodate the remaining smaller vessels as well.

Given that both ships at AS and CT are connected to shore power, if the shore power hatch is located on the Starboard Side, then the vessel must be berthed at AS dock. Also given that both ships at AS and CT are connected to shore power, if the shore power hatch is located on the Port Side, then the vessel must be berthed at CT dock. Therefore, the docking configuration will need to be coordinated and revised in future years after the shore power system is installed and ready for use.

Cruise Line	Ship	Length	Hatch Side	Hatch Distance from Stern	2026 Dock
Norwegian Cruise Line Holdings	Norwegian Joy	1094 ft	Starboard Side	193.5 ft	AS
Norwegian Cruise Line Holdings	Norwegian Bliss	1094 ft	Starboard Side	193.5 ft	AS
Norwegian Cruise Line Holdings	Norwegian Encore	1094 ft	Starboard Side	193.5 ft	AS
Royal Caribbean International	Voyager Class	1020.5	Starboard Side	193.6 ft	AS & CT
Holland America Line	Noordam	951 ft	Starboard Side	172.2 ft	CT
Holland America Line	Eurodam	937 ft	Starboard Side	169.9 ft	CT
Holland America Line	Nieuw Amsterdam	936 ft	Starboard Side	169.9 ft	CT
Holland America Line	Westerdam	935 ft	Starboard Side	172.2 ft	CT
Holland America Line	Koningsdam	983 ft	Port Side & Starboard Side	186 ft	AS
Princess Cruises	Emerald Princess	951 ft	Port Side	183.7 ft	CT
Princess Cruises	Star Princess	950 ft	Port Side	187 ft	AS
Holland America Line	Zaandam	780 ft	Unknown	203.4 ft	CT

Table #1 – 2026 Cruise Vessel Information

6.2 Vessel Length, Orientation, Shore Power Hatch, and CMS Reach

6.2.1 Length, Orientation, and Horizontal Location of Shore Power Hatch

Per Table #1, the largest vessels berthing with the shore power hatch located on the Starboard Side of the ship are the three Norwegian Cruise Line vessels: Norwegian Joy, Norwegian Bliss, and Norwegian Encore. Each of these vessels have their shore power hatch located 193.5 ft from stern and will need to be berthed at AS dock, since the shore power hatch is located on the Starboard Side.

Similarly, per Table #1, the largest vessels berthing with the shore power hatch located on the Port Side of the ship is the Holland America Line Koningstam, which is 983 ft long. The shore power hatch on this vessel is located 186 ft from the stern.

Based on the berthing configuration as shown in Figure #1, the vessel on AS dock will have 305ft of available shore power connection range from the stern. For CT dock, the vessel will have 225ft of available shore power connection range from the stern. From all the ships in Table #1, the longest distance of the shore power hatch to the stern is 203.4ft. This is well within both dock's shore power connection ranges.

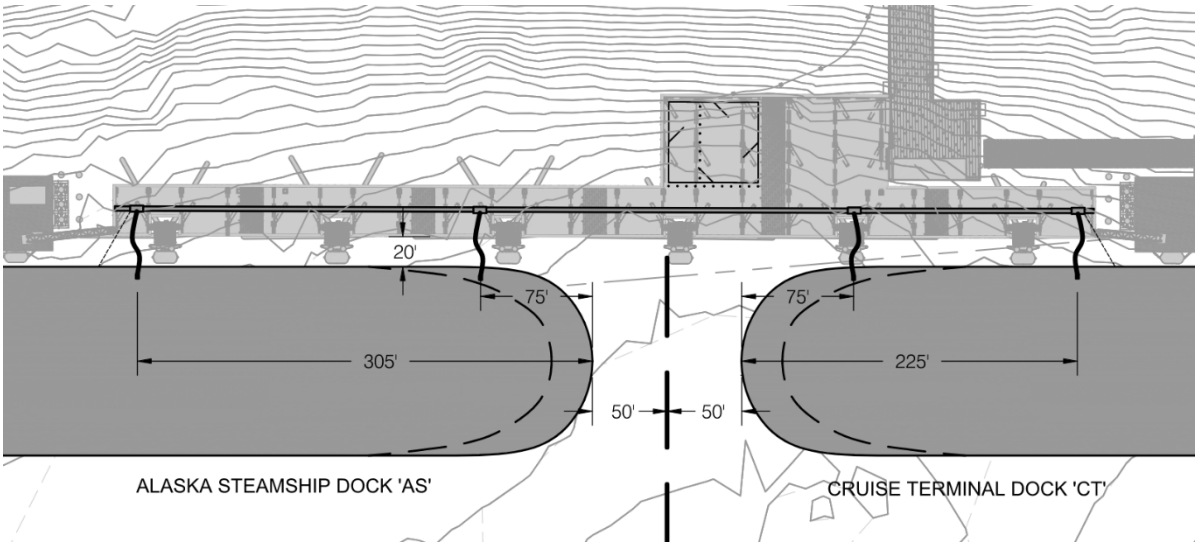


Figure #1 - Berthing Site Plan

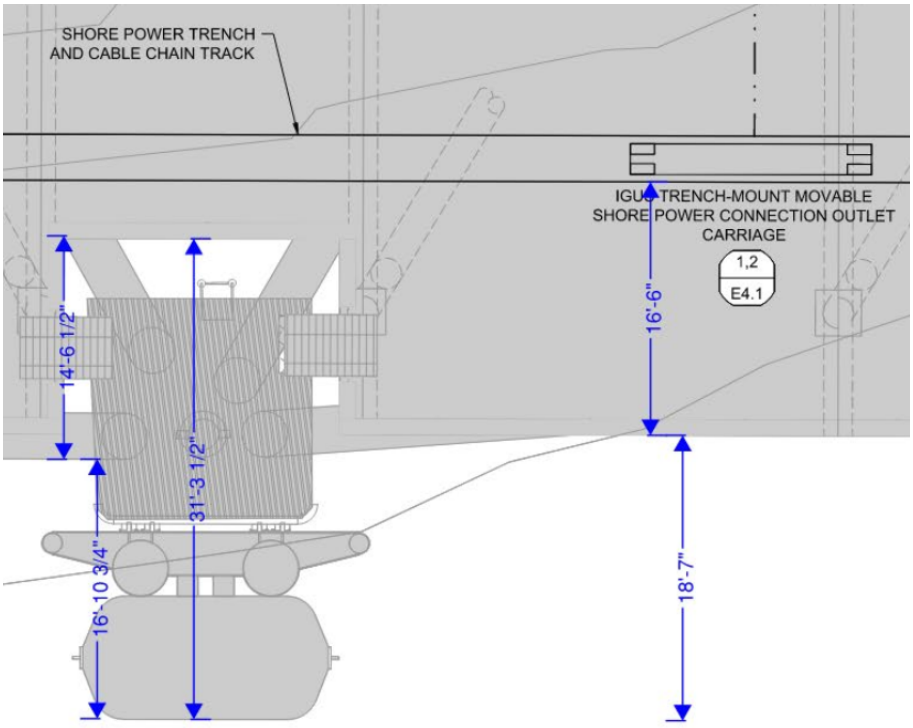


Figure #2 - Enlarged Dock Site Plan

6.2.2 Shore Power Hatch Height, E-Chain Trench Location, and CMS Reach

To connect the cruise vessels to shore power, the CMS will first connect to the shore power outlets on the moveable carriage, which is recessed within the deck and which travels along the electrified chain (E-Chain) trench. This trench will be located 16.5ft from the edge of the deck, and the CMS will be parked directly above the carriage. The boom of the CMS will be hanging over the edge of the deck, with the ability to lower or raise the shore power outlets and cables into the shore power hatch on side of the vessel, which is located 20ft away from the edge of the deck.

The shore power hatch height on cruise vessels ranges from 7.21ft above the water line to 13.21 ft above the water line. Also, per Figure 4 (NOAA Tidal Datums), the minimum tide level is -5.7ft below the mean lower low water (MLLW) level, and the maximum tide level above MLLW is +25.1ft. With the deck elevation at 28ft above MLLW, the shore power outlet cables on the CMS must be able to reach the lowest shore power hatch location of 26.5ft below the deck up to the highest shore power hatch location of 10.31ft above the deck. The cable length will also require an additional 11.48ft of cable within the vessel to connect to the vessel's shore power switchboard.

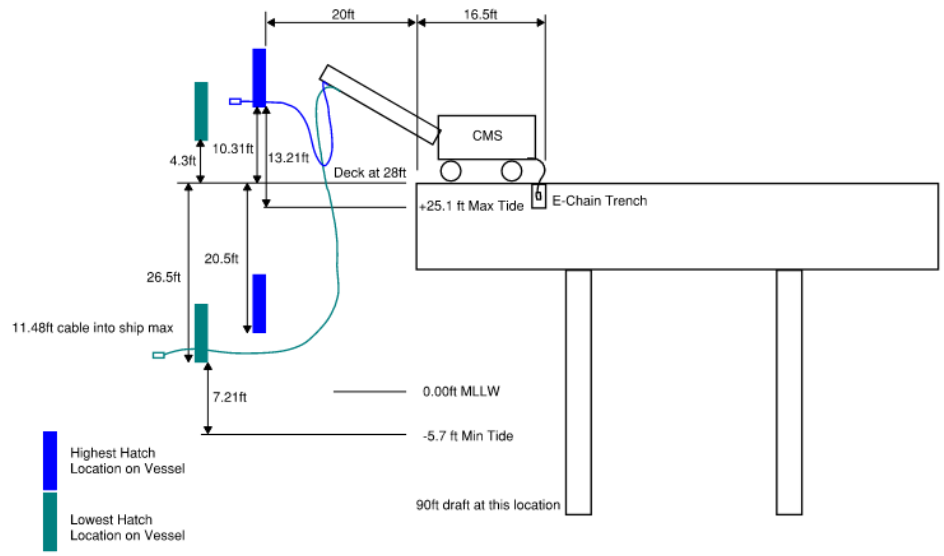
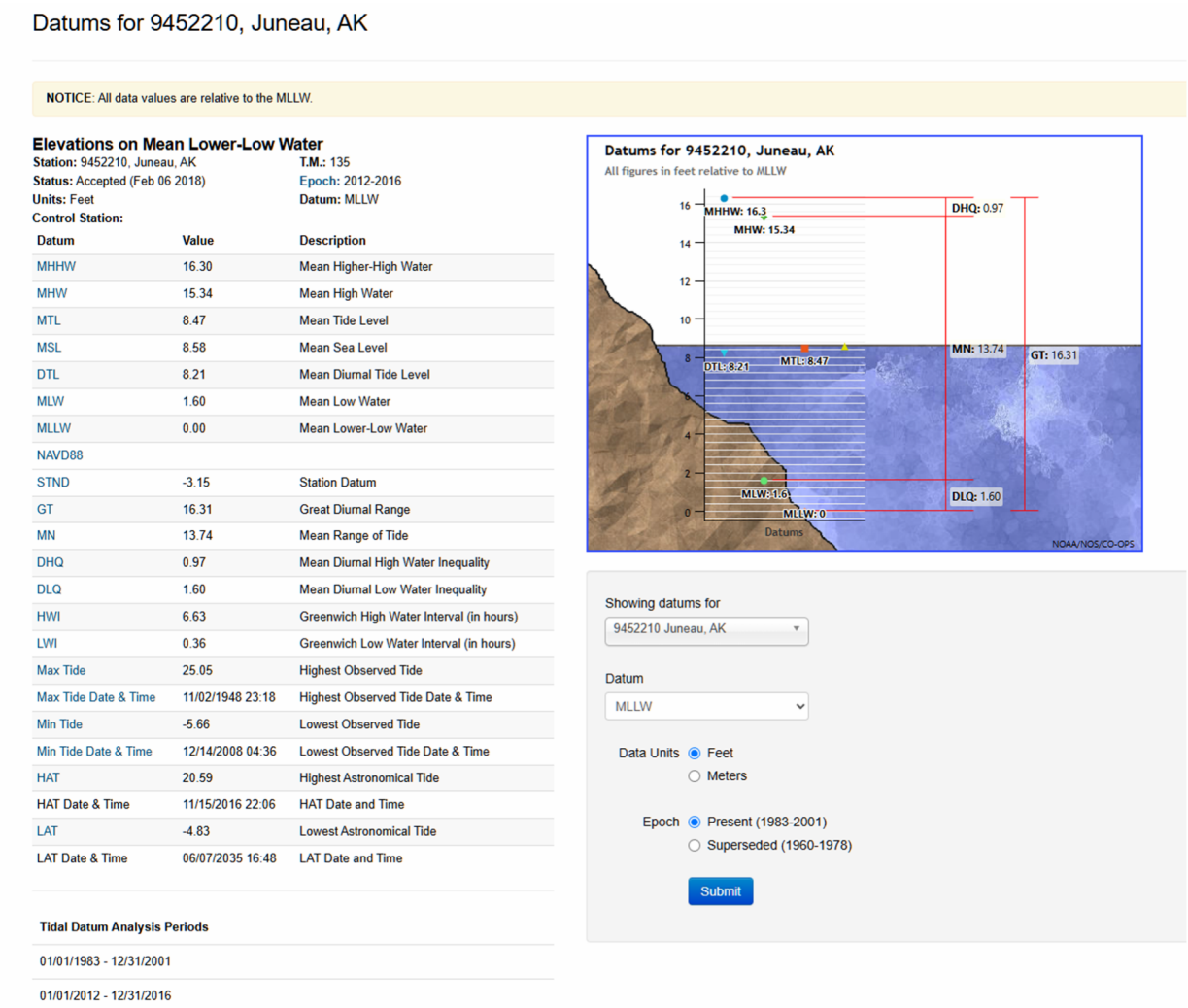


Figure #3 - CMS Cable Reach and Tidal Elevations



Datums for 9452210, Juneau, AK

NOTICE: All data values are relative to the MLLW.

Elevations on Mean Lower-Low Water

Station: 9452210, Juneau, AK
Status: Accepted (Feb 06 2018)
Units: Feet
Control Station:
T.M.: 135
Epoch: 2012-2016
Datum: MLLW

Datum	Value	Description
MHHW	16.30	Mean Higher-High Water
MHW	15.34	Mean High Water
MTL	8.47	Mean Tide Level
MSL	8.58	Mean Sea Level
DTL	8.21	Mean Diurnal Tide Level
MLW	1.60	Mean Low Water
MLLW	0.00	Mean Lower-Low Water
NAVD88		
STND	-3.15	Station Datum
GT	16.31	Great Diurnal Range
MN	13.74	Mean Range of Tide
DHQ	0.97	Mean Diurnal High Water Inequality
DLQ	1.60	Mean Diurnal Low Water Inequality
HWI	6.63	Greenwich High Water Interval (in hours)
LWI	0.36	Greenwich Low Water Interval (in hours)
Max Tide	25.05	Highest Observed Tide
Max Tide Date & Time	11/02/1948 23:18	Highest Observed Tide Date & Time
Min Tide	-5.66	Lowest Observed Tide
Min Tide Date & Time	12/14/2008 04:36	Lowest Observed Tide Date & Time
HAT	20.59	Highest Astronomical Tide
HAT Date & Time	11/15/2016 22:06	HAT Date and Time
LAT	-4.83	Lowest Astronomical Tide
LAT Date & Time	06/07/2035 16:48	LAT Date and Time

Tidal Datum Analysis Periods

01/01/1983 - 12/31/2001

01/01/2012 - 12/31/2016

Showing datums for
9452210 Juneau, AK

Datum
MLLW

Data Units ◉ Feet ○ Meters

Epoch ◉ Present (1983-2001) ○ Superseded (1960-1978)

Submit

Figure #4 – NOAA Tidal Datums for Juneau, AK