Salmon Bay Marina Docks A, B, C Closure

Supporting Documentation

Effective September 18, 2025, docks A, B & C at Salmon Bay Marina are scheduled to close to all customers on March 18, 2026. This document set contains supporting engineering documentation on Salmon Bay Marina.

After careful review of escalating safety issues, the Port of Seattle made the decision to terminate all moorage agreements and close docks A, B, and C no later than March 18, 2026. Though the Port has completed routine maintenance over the years, those docks and covered moorage are nearing the end of their usable lifetime, due to issues discovered with the original configuration along with typical structure degradation over time. Fall and winter pose additional safety hazards for customers and Port staff staying under or working around the covered moorage due to the increased frequency and intensity of snow and wind events. After comprehensive engineering review by the Port, with additional guidance of outside engineering firms, Port Engineering and Health and Safety teams have determined that docks A, B, and C can no longer be maintained to an acceptable level of safety and must ultimately be vacated.

The following are reports of conditions and analyses for the facility:

Ultimately, the safety and security of our marina community is our highest priority, and docks A, B, and C can no longer be maintained to an acceptable level of safety and must be vacated.

Accessibility Assistance: Some of these documents contain technical engineering diagrams and may not be fully accessible to screen readers or other assistive technologies. If you have trouble accessing this information, please contact us at salmonbay@portseattle.org or 206-787-3395 to request the content in an alternative, accessible format.

SALMON BAY MARINA: SITE OBSERVATIONS

SITE OBSERVATIONS, LITERATURE REVIEW, AND DISCUSSION

DATE: 8/17/17

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CIVIL

Literature review and site observations at the Salmon Bay Marina

LITERATURE REVIEW

Salmon Bay Marina Topographic Survey Chadwick & Winters, 11-18-13

Salmon Bay Marina Master Use Permit, PND Engineering 6-22-12

OBSERVATIONS

STORMWATER

Based on review of the topographic survey and field inspection, stormwater is collected by various individual catch basins located throughout the site's uplands and then conveyed by pipes (size unknown) discharging through the bulkhead into Salmon Bay. No inspection was made of the conditions of the existing piping system. Several catch basins also tie in to roof drain downspouts (office and warehouse). There are currently no on-site stormwater treatment facilities. No issues were found with the current system.

WATER

Based on review of the topographic survey and field inspection, the marina is serviced from a water main (size unknown) along W. Commodore Way. A water meter is located at the south end of the site which distributes potable water to the office and to C Dock. From C Dock potable water is distributed through individual lines to each dock which can be controlled by manual shut off valves. There is also a stub out line from the meter that can be extended to the warehouse if needed. Inspection of the water meter indicated the system is up to current code. There are no fire hydrants on site but there are dry stand pipes at each dock.

SEWER

Based on review of the topographic survey and field inspection, the marina is serviced by a force main located (size unknown) along W. Commodore Way. There is one sewer line running from the office to a 1600-1800 gallon tank. Since the site is below the force main, the waste from the tank is pumped up to the force main. No detailed condition inspection of the lines or the tank was made, but the system is in good condition according to the owner. There is no sewage system servicing the docks.

GAS

Based on review of the topographic survey and field inspection, gas is serviced to the marina by two lines (sizes unknown) from W. Commodore Way. One line services the office while another line services the warehouse.

DISCUSSION

Based on the observations made during the field review all utilities meet the current use of the facilities. Any improvements to the site (new paving, new buildings, et.) will require upgrade to one or more of the utilities above.

DOCKS AND DIVING

Literature review and site observations at the Salmon Bay Marina

HIGHLIGHTS

Reid Middleton performed an above-water visual inspection of the A, B, and C boathouse pier facilities; D, E, and F floating dock facilities; bulkhead; and parking lot pavement on May 11, 2017. Reid Middleton's subconsultant, Echelon Engineering, performed an underwater inspection (Levels I and II) of representative elements of the same pile-supported pier facilities, pile-guided floating dock facilities, and bulkhead from May 18 to May 22, 2017. The condition assessment was a due diligence inspection in support of the Port of Seattle's possible acquisition of the property. The investigation included above- and below-water inspection of the substructure and piling, deck components, laggings, and wales. Each structure was rated using the condition rating descriptions provided by the ASCE *Manuals and Reports on Engineering Practice, No. 130 (MOP 130): Waterfront Facilities Inspection and Assessment*. Based on these ratings, the approximate remaining service life of each structure was predicted.

- The boathouse piers A, B, and C are over 55 years old. These timber structures supported by timber piles (plumb and batter) have been periodically maintained. The A, B, and C piers are in **Good** condition. The pier structures may have 15 to 20 years of remaining service life, provided the structures are properly maintained on a regular basis.

- The Floating Docks are of varying age. Floating Dock "D" is made up of a series of concrete pontoons secured together with timber wales and anchored by three timber piles. The overall condition of Floating Dock "D" is **Fair**. This dock may have 5 to 10 years of remaining service life, provided the recommended repairs are completed and the structure is properly maintained on a regular basis.

- Floating Dock "E" is of timber construction and anchored by four timber piles, with flotation provided by polystyrene foam-filled tires. The overall condition of Floating Dock "E" is **Fair**. This dock may have 5 to 10 years of remaining service life, provided the recommended repairs are completed and the structure is properly maintained on a regular basis.

- Floating Dock "F" is made up of a series of concrete pontoons secured together with timber wales and anchored by six steel pipe piles. The overall condition of Floating Dock "F" is **Satisfactory**. This dock may have 10 to 15 years of remaining service life, provided the recommended repairs are completed and the structure is properly maintained on a regular basis.

- The bulkhead is a timber structure that is over 40 years old. It was originally constructed with approximately 75 soldier piles, a horizontal wale near the top of the bulkhead, and vertical lagging. The bulkhead has undergone various generations of restorative maintenance, with the installation of 13 steel pipe piles. The overall condition of the bulkhead is **Satisfactory.** The bulkhead may have 15 to 20 years of remaining service life, provided the recommended repair and rehabilitation, including replacement of the damaged piles, is completed and the structure is properly maintained on a regular basis.

- The parking lot pavement has widely spread cracks and potholes, with evidence of differential settlement. Several large potholes have been temporarily repaired with aggregates. The overall

condition of the pavement is **Poor**. The parking lot should be regraded, compacted, and repaved as part of any overall reuse of the facility.

LITERATURE REVIEW

Inspections were performed in accordance with the methods described in the ASCE *Manuals and Reports on Engineering Practice No. 130 (MOP 130): Waterfront Facilities Inspection and Assessment.* The inspection consisted of a 100 percent visual inspection of the above-water structures and a representative sample of the below-water structures to observe and record general conditions and gross measurements. The inspection also included limited degrees of cleaning of the structural elements to better assess general conditions. The inspection results for the components of each structure are presented in this report using condition assessment ratings.

Definitions and descriptions of the ratings contained in this report are based on the MOP 130 and as follows:

Good No visible damage or only minor damage is noted. No repairs are required.

Satisfactory Limited minor to moderate deterioration was observed. No repairs are required.

Fair Primary elements are sound, but minor to moderate defects or deterioration are observed. Repairs are recommended, but the priority of the recommended repairs is low.

Poor Advanced deterioration is observed on widespread portions of the structure. Repairs may need to be executed with moderate urgency.

Serious Advanced deterioration or breakage may have affected the primary structural components significantly. Local failures are possible, and repairs should be carried out on a high-priority basis.

Critical Extremely advanced deterioration or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur, and repairs should be carried out on a high-priority basis.

REFERENCES

- Review Draft Mitigation and Monitoring Plan, Salmon Bay Marina Dredging and Float Improvements, Hart Crowser, October 2014.
- Drawings for Salmon Bay Marina Master Use Permit, PND Engineers, June 2012.
- About Salmon Bay Marina, www.salmonbaymarina.com.
- Salmon Bay Marina Geotechnical Investigation, PND Engineers, December 2012.

OBSERVATIONS

DATA COLLECTION PROCEDURE

This above- and below-water inspection consisted of a 100 percent visual inspection (Level I, general visual inspection) of the structures above water and a representative sample of the below-water members to observe and record general conditions and gross measurements. The inspection also included limited

degrees of cleaning the structural elements to better assess general conditions (Level II, close-up visual inspection). The following methods for data collection and records were used:

- Hammer sounding.
- Surface cleaning (marine growth and fungal decay).
- Direct measurement (dimension).
- Visual documentation with photography representing typical conditions and range of damage/deterioration.

BOATHOUSE PIERS A, B, AND C

The boathouse piers A, B, and C are over 55-year-old timber structures that consist of walkway and finger piers and covered moorages. These piers are supported by creosote-treated timber bearing piles and untreated timber batter piles situated in the deeper water structural sections. The structural piles support the roof over the covered moorages as well as the timber walkways. The boathouse piers have been periodically maintained by replacing damaged structural components. Overall conditions of the A, B, and C boathouse piers are **Good**. The pier structures may have 15 to 20 years of remaining service life, provided the structures are properly maintained on a regular basis. Figures A-1 through A-8 in Appendix A1 show typical conditions of the boathouse piers.

SUBSTRUCTURE – PILE FOUNDATION AND WALKWAY SUPPORT CAP

The plumb and batter piles are in **Good** condition. No evidence of significant deterioration or damage was found. The timber walkway support caps are in generally **Good** condition. A few timber walkway support caps were noted to have sustained minor mechanical and/or fungal damage at their ends. This damage was restricted to less than 5 percent of the member section at bolted connection to support piles. Details of the condition assessment of the piles are provided in Appendix A2.

DECK COMPONENTS

The walkway and finger pier deck structures have no significant observed damage or deterioration. Typically, minor fungal decay on deck components was found at the ends of the boathouse piers. The degree of deterioration due to the fungal decay is less than 10 percent of typical section of deck component. The overall condition rating of the deck components is **Good**.

FLOATING DOCKS D, E, AND F

FLOATING DOCK D

Floating Dock D is composed of a series of concrete pontoons secured together with timber wales and fixed in place by three creosote-treated timber float guide piles. The overall condition of the float is **Fair**. Evidence of significant fungal deterioration was observed in several of the timber wales. Supplemental flotation in the form of plastic barrels was noted under the shoreward portion of the float, from the south end to approximately float guide pile number 1. It is unknown whether the barrels are filled with air or Styrofoam. Several floats showed evidence of crack and spall repair on the deck surface. The float was noted to be sitting visibly level with free board that ranged from a low of 6 inches (deck surface to waterline) to a high of 10 inches. The float guide piles that secure this float were found to be in generally **Satisfactory** condition. Floating Dock D may have 5 to 10 years of remaining service life, provided the recommended repairs are completed and the structure is properly maintained on a regular basis.

FLOATING DOCK E

Floating Dock E is of timber construction, with flotation provided by Styrofoam-filled tires, and is secured in place by four creosote-treated timber float guide piles. The overall condition of the float is **Fair**, but it has a pronounced list, with the east side of the float noted to be significantly higher than the west. Measurements of the freeboard in the area of most visible listing (i.e., near float guide pile number 2) were 19 inches on the east side and 13 inches on the west side. Underwater inspection of the flotation tires in this area showed no evidence of damaged or missing flotation. The float guide piles that secure this float were found to be in **Good** condition. Floating Dock E may have 5 to 10 years of remaining service life, provided the recommended repairs are completed and the structure is properly maintained on a regular basis.

FLOATING DOCK F

Floating Dock F is composed of a series of concrete pontoons secured together with timber wales. The float is anchored by six uncoated steel pipe piles. The overall condition of the float is Satisfactory, with the majority of the length of the float noted to be visibly level with near even freeboard. However, at the northern end, the second to last concrete pontoon was found to have a significant list, with the freeboard on the east side measured at 17 inches and the west side measured at 12 inches. Similarly, the northern-most pontoon freeboard was measured on the east side at 14 inches and on the west side at 9 inches. The float guide piles that secure this float were found to be in generally Good condition, with minor surface corrosion. Floating Dock F may have 10 to 15 years of remaining service life, provided the recommended repairs are completed and the structure is properly maintained on a regular basis.

Figures A-9 through A-13 in Appendix A1 show the existing conditions of the floating dock structures. Details of the condition assessment below water are provided in Appendix A2.

BULKHEAD

The bulkhead was originally constructed using approximately 75 creosote-treated timber soldier piles, a large-dimension horizontal wale near the top of the bulkhead, and vertical creosote-treated timber lagging. The bulkhead has undergone various generations of restorative maintenance, including the installation of 13 steel pipe piles as replacements for timber members that were likely damaged due to fungal decay. The steel piles were found to be in overall Good condition. All 62 of the remaining piles within the bulkhead are creosote-treated timber members. Not all of these piles were inspected, and additional deterioration may be present that was not documented. The overall condition of the piles that were inspected was found to be Fair, with 12 piles (20 percent) found to have sustained heavy fungal/mechanical damage in their upper 2 feet. The damaged piles were found throughout the bulkhead. The overall condition of the timber lagging appears to be Good. No evidence of perforations or openings (other than a few discharge pipes) was noted. No evidence of hydraulic transport of fill materials from behind the bulkhead, such as visible voids or mounds of sediment in front of the bulkhead, was observed. The overall condition of the bulkhead is Satisfactory. The bulkhead may have 15 to 20 years of remaining service life, provided the recommended repair/rehabilitation is completed and the structure is properly maintained on a regular basis. Figures A-14 through A-18 in Appendix A1 show the existing conditions of the bulkhead at various locations. Details of the condition assessment below water are provided in Appendix A2.

PARKING LOT PAVEMENT

Cracks and potholes in the pavement are widely spread over most of the parking lot, with evidence of differential settlement. Several large potholes were temporarily repaired with aggregates. The overall

condition of the pavement is Poor. Filling potholes is a temporary, short-term repair. For long-term service, installation of a new compacted layer of base aggregate materials and replacement of the pavement is recommended. Figures A-19 through A-21 show the current condition of the parking lot pavement. Figure A-22 shows the typical condition of each structure, locations of defects, and overall schematics.

DISCUSSION

Repair and maintenance recommendations are based on findings from this inspection. Waterfront timber structures typically have a design life of 25 years or more, which can be extended with proper routine maintenance and repair.

- The A, B, C boathouse piers have been well maintained and are in **Good** condition. The pier structures may have 15 to 20 years of remaining service life, assuming proper routine maintenance and repair. It is recommended to perform the recurring inspections for the structure every 3 to 4 years. No immediate repair is necessary.

- The overall condition rating for Floating Docks D and E is **Fair**, with 5 to 10 years of remaining service life. The overall condition rating for Floating Dock F is **Satisfactory**, with 10 to 15 years of remaining service life, assuming proper routine maintenance. All three floating docks show evidence of multiple repairs; however, listing docks show evidence of stability problems. It is necessary to repair the docks by addition of flotation and adjustment or replacement of timber walers to relevel the dock surfaces and adjust the pontoons. Another option would be to replace the floats to provide safe operational floating docks with a longer remaining life cycle.

- The overall condition of the bulkhead is **Satisfactory**, with 15 to 20 years of remaining service life, assuming proper routine maintenance and repair/rehabilitation. It is recommended to repair and/or replace the damaged (fungal/mechanical) timber piles. Fiber-Reinforced Plastic (FRP) jacket repair or installation of steel pipe sleeves may be used for repair, depending on the degree and condition of the damage. Replacement if necessary would be with new steel pipe piling.

- The overall condition of the parking lot pavement, with widely-spread cracks and potholes, is **Poor**. For long-term service, complete replacement of the pavement is recommended after installation of a new compacted layer of base aggregate materials.

ELECTRICAL

Literature review and site observations at the Salmon Bay Marina

HIGHLIGHTS

The overall electrical system appears to be in good condition, and the capacity is not overburdened at this time.

LITERATURE REVIEW

The Master Use Plan from 2007 was examined along with client documents.

OBSERVATIONS

Service Entrance

Electrical Service entrance transformer consists of (3) 75~167 KVA single phase transformers mounted and wired for three phase operation. The electrical service entrance is in good condition.

Distribution

Electrical distribution transformers and panels look fair. Their apparent age is roughly 20 to 30 years (perhaps more due to the local conditions). The transformers located on the docks have required substantial seismic and support bracing due to the locations in which they are mounted.

Conduit and Wire

The conduits for power distribution are routed on the lower edge of the docks in some areas. These conduits are schedule 40 or 80 PVC. The PVC conduits are exposed to direct sunlight, which is a strong ultraviolet source. PVC conduit is susceptible to degradation when exposed to UV radiation. The conduits are already showing signs of degradation; they have a “washed out” look to them. Eventually the conduits will become brittle, lose its elasticity, and start to break apart. Conduits routed overhead along the joists and beams are not attached to any structure. This is due to the flexure and movement of the dock; however, it is a code violation for unmounted conduit.

Power Pedestals

The pedestals are in good working condition and serviceable.

Lighting

The light fixtures located under the boat shelters are an issue. The owner stated that they lean a ladder against a purlin or joist for access to the fixtures. This requires a maintenance worker to extend roughly 8 feet over water or a boat. This is a severe safety violation for the Port and as such, will require the light fixtures to be relocated.

DISCUSSION

Service Entrance

The service entrance capacity will need to be expanded by about 600A to 800A in order to accommodate the increase in power usage for commercial fishing vessels. If the three existing transformers located at

the edge of the property are 75KVA units, then the total capacity is 225KVA or 270A. If the three existing transformers are 167KVA, then the total capacity is 500KVA or 600A. In order to correctly determine the remaining capacity, one years' worth of power bill will need to be available or a meter reading performed. Either way, the existing marina probably lacks the power capacity to feed a commercial fishing fleet. Just as an example, Fishermen's Terminal is providing 100A, 3 Phase receptacles for ship dockside power or 400A worth of capacity for an entire dock depending upon the power distribution configuration. Salmon Bay Marina doesn't currently have this capacity. One more item to consider is that Seattle City Light may not currently have power capacity in the local area to feed additional power into Salmon Bay Marina; however, it may be possible to feed power from Fishermen's Terminal Substation #2 if it has capacity. It is possible that the local area power grid has 13.8KV available (FT has 13.8KV), if this is the case, then a change to 13.8kV service entrance may be desirable.

Distribution

The distribution system appears in good condition. The system may have the capacity to handle additional draw, but this will be determined after fully metering the system.

Conduit and Wire

The conduits for power distribution are routed on the lower edge of the docks in some areas. These conduits are schedule 40 or 80 PVC. The PVC conduits are exposed to direct sunlight, which is a strong ultraviolet source. PVC conduit is susceptible to degradation when exposed to UV radiation. The conduits are already showing signs of degradation; they have a "washed out" look to them. Eventually the conduits will become brittle, lose its elasticity, and start to break apart. Conduits routed overhead along the joists and beams are not attached to any structure. This is due to the flexure and movement of the dock; however, it is a code violation for having unmounted conduit.

Power Pedestals

The pedestals are in good working condition and serviceable.

Lighting

The light fixtures located under the boat shelters are an issue. The owner stated that they currently lean a ladder against a purlin or joist for access to the fixtures. This requires a maintenance worker to extend roughly 8 feet over water or a boat. This is a severe safety violation for the Port and as such, will require the light fixtures to be relocated.

MECHANICAL

Literature review and site observations at the Salmon Bay Marina

LITERATURE REVIEW

Salmon Bay Marina Topographic Survey Chadwick & Winters, 11-18-13

Salmon Bay Marina Master Use Permit, PND Engineering 6-22-12

2015 Seattle Fire Code

OBSERVATIONS

DOCK PIPING

Potable water lines were inspected at visible locations and appear to be in good condition. Under-dock piping could not be observed, but is likely to be in similar condition. Check valves were observed at several locations to allow for free drainage and freeze protection.

FIRE WATER STANDPIPES

The fire water piping and connections where inspected were visible and appear to be in working order and good condition. The piping and header system is made from 4-inch steel pipe, meeting the minimum requirements of the Seattle Fire Code. Check valves were observed at several locations to allow for automatic draining of the system.

SEATTLE FIRE CODE COMPLIANCE

The owner provided letters from the Fire Marshal dated July 21, 2014, for the addition of polycarbonate roofing material, and a second letter dated December 3, 2012, that stated the marina was in compliance with Chapter 94 of the Seattle Fire Code at the time of inspection in December of 2012.

Since the facility was found to be in compliance in 2012, it can also be inferred from this statement by the Fire Marshal that the facility, at the time of inspection, met the requirements of the 2005 Covered Moorage Ordinance issued by Seattle Fire Department and Mayor Greg Nichols in 2005. Under the provisions of Chapters 1 and 11 of the current 2015 Seattle Fire Code for existing facilities, modernization of the existing fire protection system would only be required if significant renovation is undertaken or if it is found that there is imminent hazard to life or property.

An updated Fire Code was adopted in 2015 by the City of Seattle. Chapter 94 of the 2015 Seattle Fire Code contains special requirements for covered boat moorage. Paragraph 9405.3 of the Code requires automatic smoke and heat vents be provided in covered boat moorage areas exceeding 2,500 square feet. Paragraph 9405.4 of the Code requires draft curtains to be provided in covered boat moorage areas exceeding 2,500 square feet. The covered areas at Salmon Bay Marina are approximately 8,750 square feet; however, neither heat vents nor draft curtains are present. As stated in the paragraph above, existing facilities are exempt from these requirements. For further assurances, an inspection by, and consultation with the Seattle Fire Department is recommended to confirm continued compliance with the Seattle Fire Code.

Intervening moorage spaces, while not measured, appeared to be adequate, as did the spacing of fire extinguishers throughout the marina. Electrical shutoffs, such as transformers, control panels, and breaker panels, were all labeled and readily accessible, as is required by the Fire Code.

UPLANDS HVAC SYSTEMS

There are two HVAC systems on the property. The first is located within the storage building, and is a unit heater that appeared to be well maintained and in working order. The second is a rooftop unit located in the main office that was in fair to good condition.

DISCUSSION

Based on the observations made during the field review, the mechanical systems meet the needs of the marina as it is currently being operated.

STRUCTURAL

Literature review and site observations at the Salmon Bay Marina

HIGHLIGHTS

Marina structures appear to be in good working order and have been maintained reasonably. No structural observations are expected to threaten operations for the foreseeable future (up to 20 years) given continued proper maintenance.

LITERATURE REVIEW

"SALMON BAY MARINA DREDGING AND FLOAT IMPROVEMENTS" – HART CROWSER, 10/24/2014.

In general, this document discusses a viable design alternative to the current wharf configuration. The report discussion largely focuses on describing the ecological impacts of a dredging and pier reconfiguration. The following are some notes resulting from a topical literature review:

- Light penetration and overwater coverage is known to be an important ecological measure. While proposed alternatives do demonstrate viability for that measure, the report is silent on Americans with Disabilities Act (ADA) requirements, which often require dense walking surfaces and fall in direct conflict with light penetration measurements, which prefer open surfaces.
- Design vessel sizes in the report were not identified.
- Often, floating structures are designed to be as light as possible for buoyancy and freeboard. Strength and durability of the design alternatives (grating, deck, moorage, etc.) were not discussed.

WEBSITE, 12/7/2016

- Remodels (2011) include main office, laundry/shower facility, restrooms, and foyer.
- Marina was painted in 2013.

SITE TOPOGRAPHIC

- While isolines are given, no elevations were found on the topographic survey.

OBSERVATIONS

BOATHOUSES

Boathouses were observed between Dock A and Dock C. The boathouses provide shelter for moored recreational vessels and are generally configured as light- to medium-frame timber construction carrying metal (aluminum and steel) roofs.

In general, the boathouses appear to have been well-maintained, however, it was observed that each of the buildings were constructed using antiquated construction methods. While no evidence of deterioration or failure was evident, the lateral force-resisting system (e.g. forces induced by earthquakes) and vertical tie-down system (e.g. uplift generated by wind) details are likely to be deficient by today's standards. See Figure B-1 for the typical pile-to-roof detail, which does not appear to include any vertical

tie-downs at the roof level. Replacement or upgrade is not required by code at this time, but any major renovation to these structures may trigger a seismic retrofit, which may be prohibitively expensive.

The observed metal roofs were in generally good condition (see Figure B-2). With the exception of a small segment at Dock C, roofs are generally aluminum and have 10+ years of life remaining. While the steel roof is in ‘like new’ condition, it is expected to deteriorate faster than the aluminum roof panels. However, 10+ years is anticipated in these units as well.

Structural timber, e.g. beams, joists, and stringers, appeared to be in good condition (see Figure B-2). Largely, there were no obvious water marks, rot, or signs of obvious distress recorded. In the marine environment, dry rot is of primary concern. Dry rot, however, was not investigated because nondestructive observations only were collected. Drilling small holes into a sample selection of timber piles and beams may provide useful information.

Wall panels, louvers, and backing studs displayed usual amounts of water intrusion for this environment and appear to be in good condition (see Figure B-3). Maintenance (painting), however, is recommended (particularly at louvers).

See Reid Middleton reports for descriptions of dock and submerged structures.

DOCKS D & OUTSIDE STORAGE YARDS

Docks D (several docks called “D”) were in generally poor condition. Steel piles (installed recently) are unprotected and have deteriorated, primarily in the splash zone. Floating concrete docks are experiencing flotation issues, as evidenced by notable listing and cracking.

WAREHOUSE

The warehouse appears to be in generally good condition (see Figure B-4). Framing incorporates timber stringers, supported by steel moment frames. Like the boathouses, connection details may not meet current code and structures may have been constructed outside permitting agency awareness, but no notable distress was observed.

The corrugated metal exterior cladding could use a coat of paint, but appears to be in operational condition. Settlement was noted in the vicinity of the warehouse and elsewhere on the site (see Figure B-5). No distress on account of this settlement was observed in building framing members.

One small water spot was noted, but this may not indicate a roof leak; this water spot was found in an office that happened to be located beneath a mezzanine. See Figure B-6)

MARINA OFFICE

The marine office was observed to be in good condition (see Figure B-7). The roof structure appears to be in good condition, and the interior appears to be regularly maintained. No water intrusion was noted.

GEOTECHNICAL

Literature review and site observations at the Salmon Bay Marina

HIGHLIGHTS

Based on our review of existing information, the primary preliminary geotechnical considerations for the project are summarized below:

- In accordance with the 2015 International Building Code (IBC), the overall site is best classified as Site Class E. The site class under the building could be improved to Site Class D if all of the potentially liquefiable material is removed. Building specific explorations should be completed during final design.

- The site is mantled with 8 to 12 feet of poor fill. Portions of the fill below the groundwater table are susceptible to liquefaction during a large earthquake. However, the potential settlement from liquefaction would be somewhat limited due to the shallow depth of the fill. Lateral spreading of the fill could occur if the bulkhead were to fail during an earthquake. Foundation options for the site include the following:

  - Placing a basement under the building, which would result in removal of the fill;
  - Remove and replace the fill with structural fill;
  - Support the building on a mat foundation which could accommodate some settlement;
  - Support the building on improved ground;
  - Support the building on pile foundations.

- Our study did not include a review of the existing bulkhead. Based on age and construction materials, it is likely that the existing bulkhead would not be able to support the additional lateral load resulting from liquefaction and lateral spreading.

LITERATURE REVIEW

Salmon Bay Marina Topographic Survey, Chadwick & Winters, November 18, 2013.

Salmon Bay Marina Master Use Permit, PND Engineering, June 22, 2012.

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OBSERVATIONS

GeoEngineers did not complete a field inspection. Based on information provided by Reid Middleton, we understand that the land portion of the site is mainly paved with asphalt concrete and has small one-story buildings present, mainly at the southeast corner and near the central western portion of the site. Based on observations by representatives from Reid Middleton, the pavement is in poor condition.

We have not reviewed detailed information of the existing bulkhead but understand that the bulkhead consists of creosoted-treated piles and timber, which in general appear to be in good condition above the water table. The exception is at two locations where the bulkhead was repaired with new PT rods and 12-inch-diameter steep pipe piles.

DISCUSSION

SITE CONDITIONS

Geology

Geologic information for the project area (Yount, et al., 1993) indicates that native surficial soils in the site vicinity consist of modified land (fill) underlain by glacially consolidated Lawton Clay. Lawton Clay typically consists of clay and silt, which accumulated at the base of a huge freshwater lake created by glacial meltwaters. The Lawton Clay deposits have been glacially consolidated and are typically underlain by older glacially consolidated deposits.

Surface Conditions

As described above, the land portion of the site is mainly paved with asphalt concrete and has small one-story buildings present, mainly at the southeast corner and near the central western portion of the site. Based on observations by representatives from Reid Middleton, the pavement is in poor condition. The site is mainly used for parking and support facilities for the marina.

We have not reviewed detailed information of the existing bulkhead but understand that the bulkhead consists of creosoted-treated piles and timber. The exception is at two locations where the bulkhead was repaired with new PT rods and 12-inch-diameter steep pipe piles.

Subsurface Conditions

Based on our review of the existing subsurface information (PND-1 through PND-6), the site is mantled with a variable thickness of fill which is underlain by Lawton Clay and older glacially consolidated deposits. The upper 2 to 2.5 feet of fill typically consists of sand and gravel with some wood debris. The remainder of the fill varies from loose silty sand to soft to very stiff silt with occasional gravel and wood debris. The thickness of the fill varied from about 8 to 12 feet in depth. The fill is underlain by Lawton Clay consisting of stiff to hard silt, clayey silt, silty clay and clay with occasional thin lenses of dense silty sand. Boring PND-6 encountered some gravel layers within the Lawton Clay deposits between a depth of about 25 and 40 feet. Older glacially consolidated soils were encountered below the Lawton Clay deposits in PND-1 and PND-2 at a depth of 62.5 feet, in PND-3 at a depth of about 68 feet, and in PND-6 at a depth of about 70 feet.

Subsurface profiles depicting subsurface conditions are shown on the Cross Sections, Figure C-3 and Figure C-4.

Groundwater Conditions

Groundwater levels were not measured in the boreholes because of the drilling technique (mud rotary). We anticipate that the groundwater is relatively shallow, within the upper 5 to 6 feet across the site, due to the proximity of the site to Salmon Bay. We anticipate shallow groundwater seepage will exist in permeable fill soils above the silt and clay during the wet winter and spring months. Groundwater seepage is expected to fluctuate as a result of season, the water level in the Salmon Bay, precipitation, and other factors.

Earthquake Engineering

Seismicity

In the Puget Sound region, there are two major source-types that contribute to the seismic hazard: the Cascadia Subduction Zone (CSZ) (which can produce large magnitude subduction-interface earthquakes, and deep subduction-intraslab earthquakes), and the shallow crustal faults. The follow sections present brief descriptions of each of the source-types.

Cascadia Subduction Zone

The Puget Sound region is located near the convergent continental boundary known as the CSZ. The CSZ is formed by the subduction of the oceanic Juan de Fuca and Gorda Plates beneath the North American plate and extends from Vancouver Island, Canada, to the Mendocino Escarpment off northern California, United States (Goldfinger et al. 2012). Convergence rates along the plate boundary vary from 30 millimeters per year (mm/y) at the southern end to 45 mm/y at the northern end (McCrory et al. 2012). The interaction between these converging plates results in two potential earthquake mechanisms: (1) interface thrust earthquakes, and (2) intraslab earthquakes associated with the Wadati-Benioff zone.

Interface Earthquakes
CSZ interface earthquakes, also referred to as megathrust earthquakes, result from partial or full rupture of the convergent boundary between the subducting oceanic Juan de Fuca and Gorda Plates and the overriding continental North American Plate. The CSZ is considered to be capable of generating earthquakes up to about Mw 9.0. No earthquakes on the CSZ have been instrumentally recorded; however, paleoseismic evidence and historical records of an orphan-tsunami in Japan suggest the most recent CSZ event occurred in January 1700 (Atwater 2005; Satake et al. 1996). Recurrence intervals for CSZ interface earthquakes are thought to be on the order of 340 years for M8+ events and 500 to 600 years for M9 events (Goldfinger et al. 2012). Paleoseismic evidence suggests that 19 full-rupture earthquakes and 10 partial-rupture earthquakes occurring along the southern portion of the CSZ have occurred over the past 10,000 years (Goldfinger et al. 2012).

Intraslab Earthquakes
Earthquakes associated with the Wadati-Benioff Zone are referred to as intraslab, intraplate, or deep-focus earthquakes. The release of geo-fluids during metamorphism can promote earthquake occurrence by enabling stick-slip frictional sliding, due to an increase in pore pressure that yields a decrease in effective normal stress, in material that would otherwise flow in a stable manner (McCrory et al. 2012). Wadati-Benioff Zone earthquakes primarily occur within three geographic areas: at shallow depths beneath western Vancouver Island and beneath northwestern California, and at intermediate depths beneath Strait of Georgia-Puget Sound (McCrory et al. 2012). In western Washington, intraslab earthquakes are concentrated between depths of 30 to 50 kilometers (km).

The 1949 M6.8 Olympia, 1965 M6.6 Seattle-Tacoma, and 2001 M6.8 Nisqually earthquakes (Ichinose et al. 2004; Ichinose et al. 2006) are considered to have originated from Wadati-Benioff Zone (Wong 2005). The Wadati-Benioff zone is considered to be capable of generating earthquakes up to Mw 8.0 in the 2014 update of the United States National Seismic Hazard Maps (Petersen et al. 2014), and the mean annual rate for M7.2 to M8.0 intraslab earthquakes occurring in western Washington is considered to be about 1,000 years (Petersen et al. 2014). However, Kao et al. (2008) suggests that the maximum size of an intraslab earthquake is limited to about M7 or less. Preston et al. (2003) suggests that although intraslab earthquakes are typically smaller in magnitude than megathrust events, they can potentially be more damaging because they often occur directly beneath population centers and have shorter recurrence intervals, particularly in western Washington; however, there is not broad scientific consensus regarding this assertion.

Shallow Crustal Faults

Oblique subduction of the Juan de Fuca plate results in northeast migration of coastal regions of Washington State. This northeast motion is resisted by older, more stable, continental rocks, thereby resulting in compression of the Puget Lowland region of about 4 mm/y. Compression of the Puget Lowland is expressed as a series of active faults, most notably the Seattle Fault Zone. The Seattle Fault Zone extends approximately 70 km in the east-west direction across the Puget Lowland, and is comprised of south-dipping thrust faults and interpreted north-dipping back thrusts that partly underlie the Seattle metropolitan area. Recent evidence suggests the Seattle Fault Zone is kinematically linked to active faults that border the Olympic Massif including the Saddle Mountain deformation zone (Lamb et al. 2012). Paleoseismic evidence suggests a magnitude 7 earthquake occurred on the Seattle Fault at 900-930 A.D. (Ten Brink et al. 2002).

Per the 2014 United States National Seismic Hazard Map, the recurrence times for the events on the Seattle fault range from 1,000 to 5,000 years (Petersen et al. 2014). The Seattle Fault is capable of producing earthquakes up to about magnitude 7.2. The minimum distance between the project site and the Seattle Fault Zone is approximately 3.5 miles.

2015 IBC Seismic Design Information

The site is located in a seismically active area. Newer structures, designed in accordance with the latest seismic codes and that have proper foundations and structural detailing, have performed well during recent earthquakes. However, modern seismic codes are formulated to provide only life safety protection during a large earthquake. Cosmetic and structural damage are considered acceptable. If better performance during a large earthquake is desirable, it may be necessary to upgrade the design of the structure beyond the current seismic code levels. Site-specific earthquake analyses can be completed during final design, if requested.

We recommend the 2015 International Building Code (IBC) parameters for Site Class, short period spectral response acceleration (SS), 1-second period spectral response acceleration (S1), and Seismic Coefficients FA and FV presented in Table 1.

TABLE 1. 2015 IBC SEISMIC PARAMETERS

2009 IBC Parameter	Recommended Value
Site Class	E
Short Period Spectral Response Acceleration, S_S (percent g)	131
1-Second Period Spectral Response Acceleration, S_1 (percent g)	51
Seismic Coefficient, F_A	0.9
Seismic Coefficient, F_V	2.4

Several borings indicate Site Class D; however, the overall Site Class E designation is used as the borings closest to the bulkhead and boring PND-6 indicates Site Class E. Building specific explorations should be completed during final design in order to adequately determine the site class for the buildings.

Removal of the existing fill and constructing the buildings with basements or on properly compacted structural fill would improve the ground such that the building sites could be classified as Site Class D.

If ground improvement measures, such as stone columns or Geopiers, are used in mitigating soft soils at the site an improvement in the site class might be possible, as stone columns might densify the surrounding soils beneath the building resulting in a denser soil configuration. However, the City of Seattle generally does not allow an improvement in the site class with the use of ground improvement and Site Class E would still be appropriate.

Liquefaction

The fill mantling the site has a potential for liquefaction. Liquefaction is a phenomenon where soils experience a rapid loss of internal strength as pore water pressures increase in response to strong ground shaking. The increased pore water pressure may temporarily meet or exceed soil overburden pressures to produce conditions that allow soil and water to flow, deform, or erupt from the ground

surface. Ground settlement, lateral spreading, and/or sand boils may result from soil liquefaction. Structures, such as buildings, supported on or within liquefied soils may suffer foundation settlement or lateral movement that can be damaging to the buildings. Based on our analyses, the potential exists for liquefaction to occur within portions of the fill encountered in the explorations completed at the site.

The evaluation of liquefaction potential is a complex procedure and is dependent on numerous site parameters, including soil grain size, soil density, site geometry, static stresses, and the design ground acceleration. Typically, the liquefaction potential of a site is evaluated by comparing the cyclic shear stress ratio (the ratio of the cyclic shear stress to the initial effective overburden stress) induced by an earthquake to the cyclic shear stress ratio required to cause liquefaction. Estimation of the cyclic shear stress required to initiate liquefaction and the cyclic shear stress initiated by a design earthquake were completed using the empirical method developed by Seed et al. (1985) as revised at the National Control for Earthquake Engineering Research (NCEER) workshop in 1997 (Youd, et al, 2001). The cyclic shear stress ratio required to cause liquefaction at the site was estimated using empirical procedures based on correlations from the standard penetration tests (SPTs). Estimated ground settlement resulting from earthquake-induced liquefaction was analyzed using an empirical procedure that relates settlement to average SPT N-values. A design earthquake with a magnitude of 7.0 and a peak horizontal acceleration of 0.53g (53 percent of the acceleration due to gravity) was used for our analysis. This analysis also assumes a level ground surface.

The results of our analyses for borings PND-3, PND-4, and PND-6 indicate that the zone of loose fill encountered in the boring has a high potential for liquefaction during a design earthquake event. Our analyses indicate that settlements caused by liquefaction of the saturated loose sand or soft silt fill at this site during a design earthquake could be on the order of 1 to 3 inches. Foundations constructed over the liquefiable soils will be prone to liquefaction induced settlement. Because of the random nature of liquefaction, differential settlements may be on the same order as the total settlements.

The results of our analysis for the remaining three borings (PND-1, PND-2, and PND-5) indicate the site soils have a low potential for liquefaction.

Structures constructed at the site should be evaluated and designed based on the risk and potential magnitude of soil liquefaction. It is possible to design wood-frame structure to accommodate the magnitude of liquefaction induced displacement expected and still perform in a life-safe manner, which is consistent with the IBC philosophy. However, even though the buildings can be designed to perform in a life-safe manner, they may be severely damage. Mitigation of the liquefaction induced settlement would be required to prevent the structures from being damaged.

Lateral Spreading

Lateral spreading occurs when the shear strength of the liquefied soil is incrementally exceeded by the lateral inertial forces induced during an earthquake. The result of lateral spreading is typically horizontal movement of non-liquefied soils located above liquefied soils. Lateral spreading generally develops in areas where sloping ground is present or near a free face, such as a river, waterway, or bulkhead.

If liquefaction were to occur within the fill underlying the site, we anticipate that there would be a moderate potential for lateral spreading to occur within the proposed site building area if the timber bulkhead were to fail. Lateral spreading would be characterized by movement of the soils towards Salmon Bay. Movements near the bulkhead can be excessive and very destructive. During the 1995

earthquake in Kobe, Japan, lateral displacement on the order of 5 to 15 feet occurred resulting in collapse of over 40 miles of waterfront walls and piers.

Lateral spreading associated with liquefaction can be evaluated by performing limit-equilibrium slope stability analyses using liquefied soil strength parameters. In general, the magnitude of lateral spread will decrease with increasing distance from the bulkhead. During final design, the existing timber bulkhead should be evaluated as to whether it meets current seismic design code and can handle the design earthquake and potential lateral spreading loads.

Ground Rupture

Because of the thickness of the Quaternary sediments below the site, which are commonly more than 1,000 feet thick, the potential for surface fault rupture is considered remote.

Foundation Options

Assuming that the Port decides to build a multi-story building at the site, the identified foundation options and general advantages and disadvantages of each are discussed below.

Construct a basement under the building

Advantages:

- Construction of a basement would result in removal of the existing fill and the use of shallow spread foundations to support the building.
- Site Class D would be appropriate for design of the building.

Disadvantages:

- The basement would have to be designed as a "boat" because of the likely high groundwater table at the site.
- Construction of a basement would require shoring and dewatering.

Remove and replace the existing fill under the building footprint

Advantages:

- Allows for the use of shallow spread foundations supported in structural fill to support the building.
- Site Class D would be appropriate for design of the building.

Disadvantages:

- Removal of the existing fill would require shoring and dewatering.
- The zone of fill should extend outward from the building on the north side at a slope of 1H:1V (horizontal:vertical) to provide support if lateral spreading were to occur. Alternatively, the zone of structural fill on the north side could be reinforced.

Support the building on a mat foundation

Advantages:

- Would result in a partial removal of the fill.
- Possibly more economical than ground improvement or pile foundations.

Disadvantages:

- Mat and building would have to be designed to accommodate up to 2 to 3 inches of differential settlement if liquefaction of the fill occurred.

- An analysis of potential static settlement would be required. The mat would likely would have to be designed to accommodate up to 2 to 3 inches of differential settlement due to static settlement of loose zones within the fill.
- Assumes that the bulkhead is upgraded to prevent lateral spreading of the fill if liquefaction occurred.

Support the building on improved ground using stone columns or Geopiers

Stone columns or Geopiers use methods to displace the soil and result in a typical 30- to 40-inch column of stone which extends through poor fill or liquefiable deposits. Because of the likely high water table at the site, the stone columns or Geopiers would need to be constructed using a mandrel which is vibrated into the soils and then rock placed through the mandrel. A drilled method which assumes the hole will stay open should not be considered for this site. For this type of ground improvement, a transfer layer of 2 to 3 feet of gravel or recycled concrete is typically placed between the top of the stone columns and the spread foundations.

Advantages:

- Would likely not require any shoring or dewatering.
- Allows for use of shallow spread foundations after installation of the ground improvement.
- Depending on the design grade selected, could minimize amount of excavation required.
- Could also be used to improve the fill behind the existing bulkheads.
- Depth can easily be varied to accommodate variable fill thicknesses.

Disadvantages:

- Requires a specialty contractor.

Support the building on deep foundations

Advantages:

- Would likely not require any shoring or dewatering.
- Can develop higher capacities within the underlying glacially consolidated deposits.

Disadvantages:

- Augercast piles would likely be the most economical deep foundation support option. Augercast piles will require removal of spoils from the site.
- Most likely the most costly foundation solution.
- Bulkhead will need to be upgraded to prevent lateral spreading, or piles will need to be designed to resist lateral spread loads.

Excavation and Dewatering Considerations

Based on the subsurface soil conditions encountered in the borings completed by others, we expect the soils at the site may be excavated using conventional heavy duty construction equipment. Some wood debris is likely present within portions of the existing fill. It is unknown if any old buried piles might also be present. The fill varies from sand and gravel to silt and clay. The underlying native deposits typically consist of clay and silt, although some deposits of silty sand might also be present.

The groundwater at the site likely reflects the elevation of the water surface in Salmon Bay, which is typically 3 to 6 feet below existing site grades. The site soils are fine-grained, which will limit the use of deep wells. For excavations which extend more than 1 to 2 feet below the water table, dewatering would

likely have to be completed in combination with shoring, such as sheet piles, to reduce the inflow of groundwater into the excavation.

Pavement Considerations

Based on a survey completed by Reid Middleton, the existing pavement appears in poor condition and should be replaced. No base course was recorded on the boring logs completed by others, although the fill underlying the pavement does consist of gravel with sand. The new pavements should consist of asphalt concrete overlying crushed rock base coarse. The upper portion of the existing fill below the new pavement will also need to be recompacted or replaced with structural fill.

APPENDIX A1 – DOCKS AND DIVING FIGURES

Docks & Diving Observations, Salmon Bay Marina

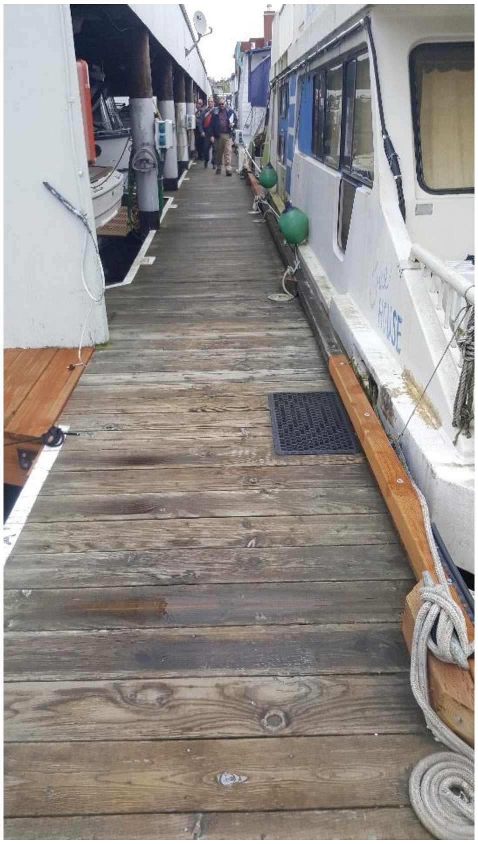

Figure A-1 - Typical Walkway Pier in Boathouse Pier A

Figure A-2 - Typical Finger Pier in Boathouse Pier A

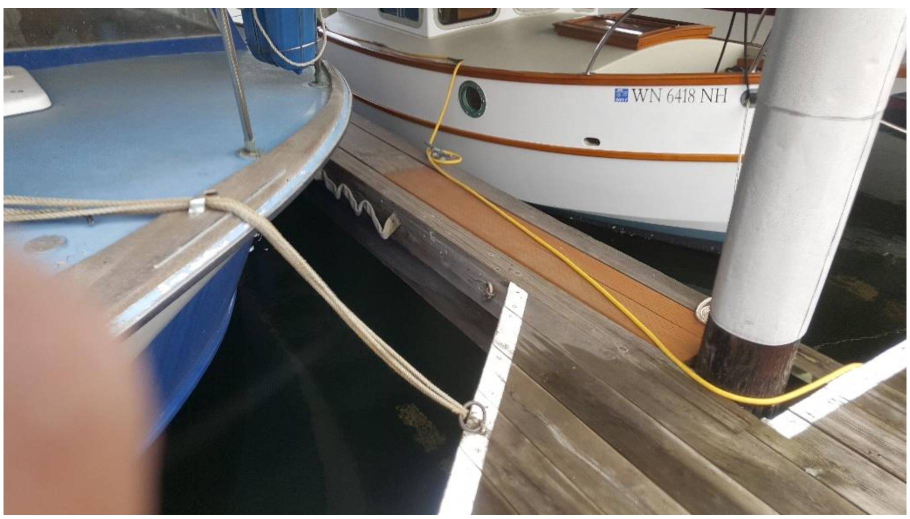

Figure A-3 - Typical Finger Pier in Boathouse Pier A

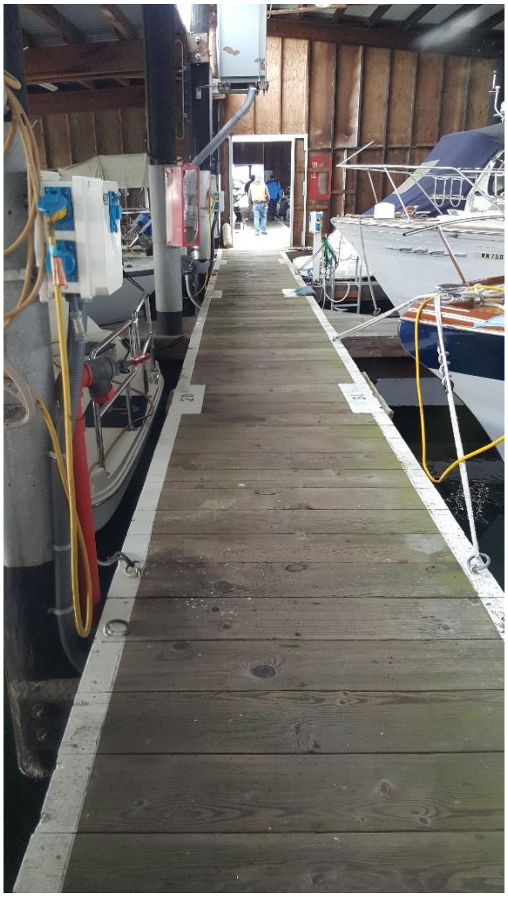

Figure A-4 - Typical Walkway Pier in Boathouse Pier B

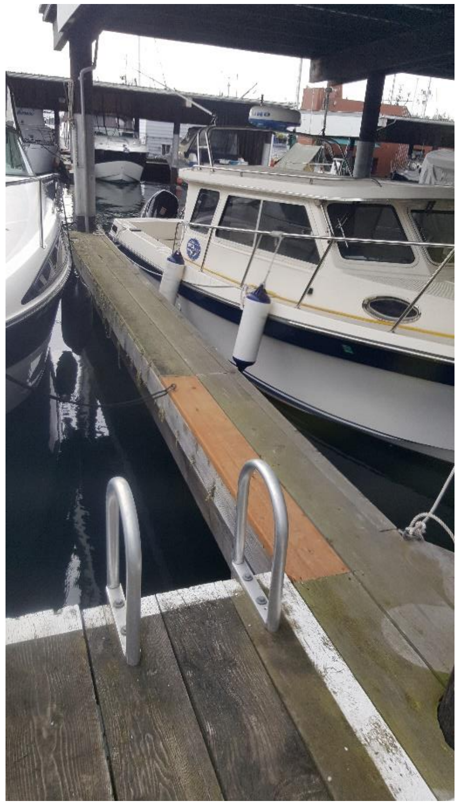

Figure A-5 - Typical Finger Pier Repaired in Boathouse Pier B

Figure A-6 - Boathouse Pier C Entrance

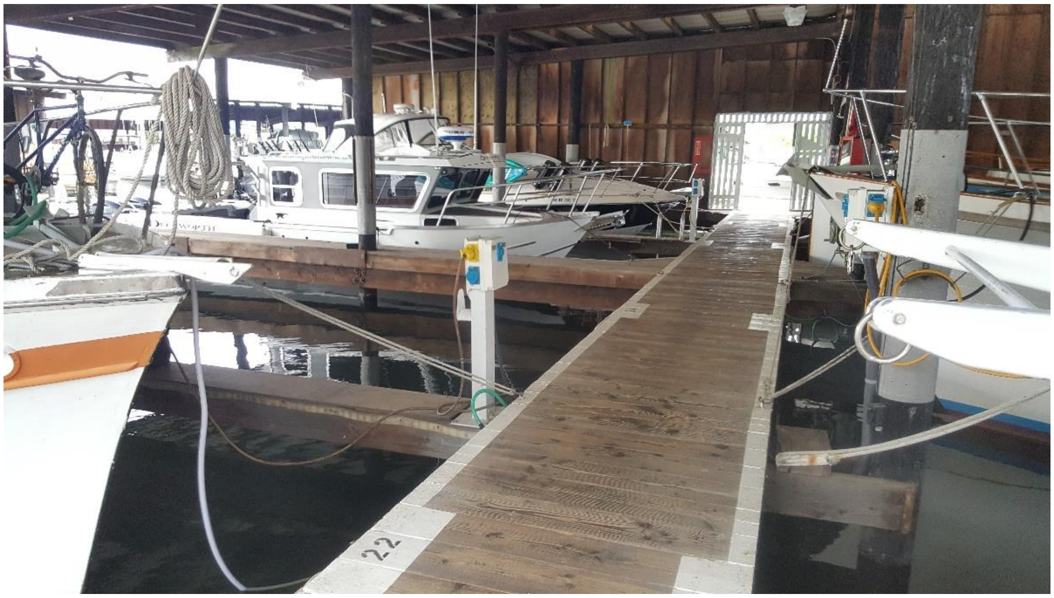

Figure A-7 - Typical Walkway Pier in Boathouse Pier C

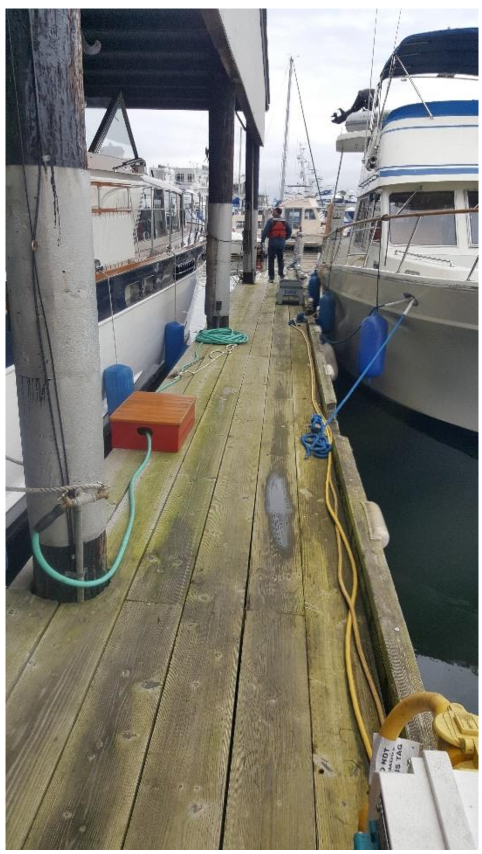

Figure A-8 - Minor Fungal Decay at Boathouse Pier C, North End

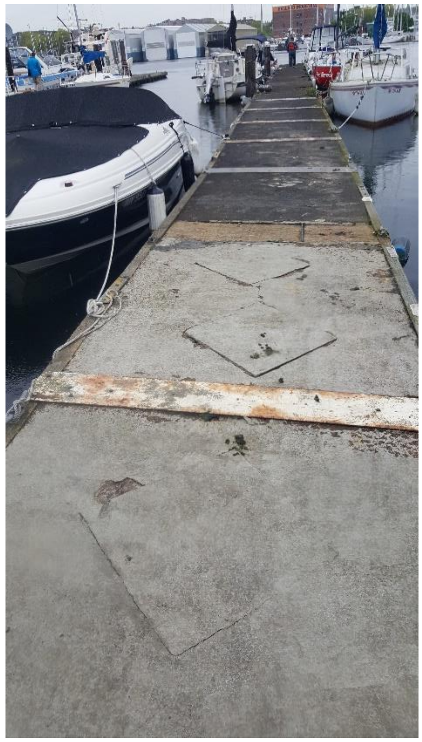

Figure A-9 - Floating Dock D at Entrance

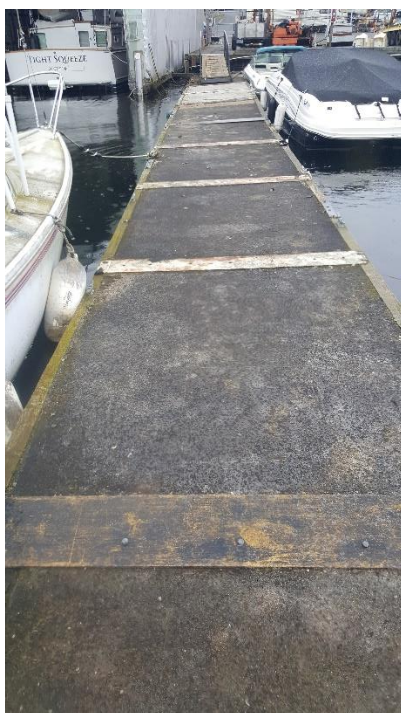

Figure A-10 - Floating Dock D, Looking South

Figure A-11 - Floating Dock E at Entrance

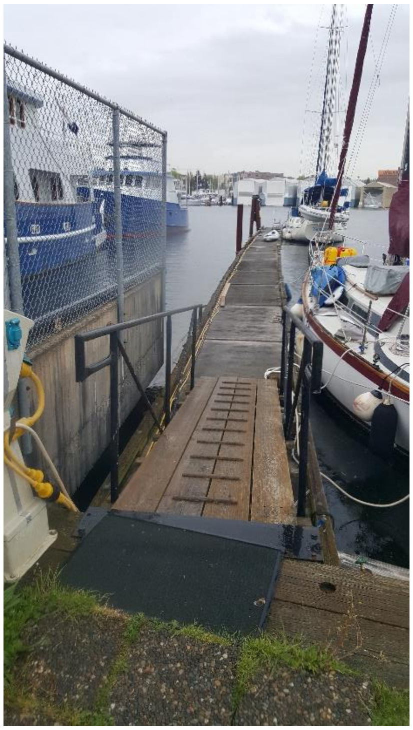

Figure A-12 - Floating Dock F at Entrance

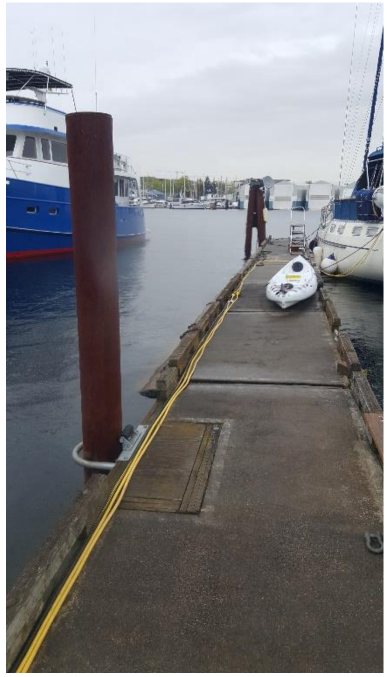

Figure A-13 - Float Guide Piles along Floating Dock F

Figure A-14 - Top of Bulkhead, between Docks A and B

Figure A-15 - Top of Bulkhead, between Docks B and C

Figure A-16 - Bulkhead with New Steel Piles, adjacent to Dock C Entrance

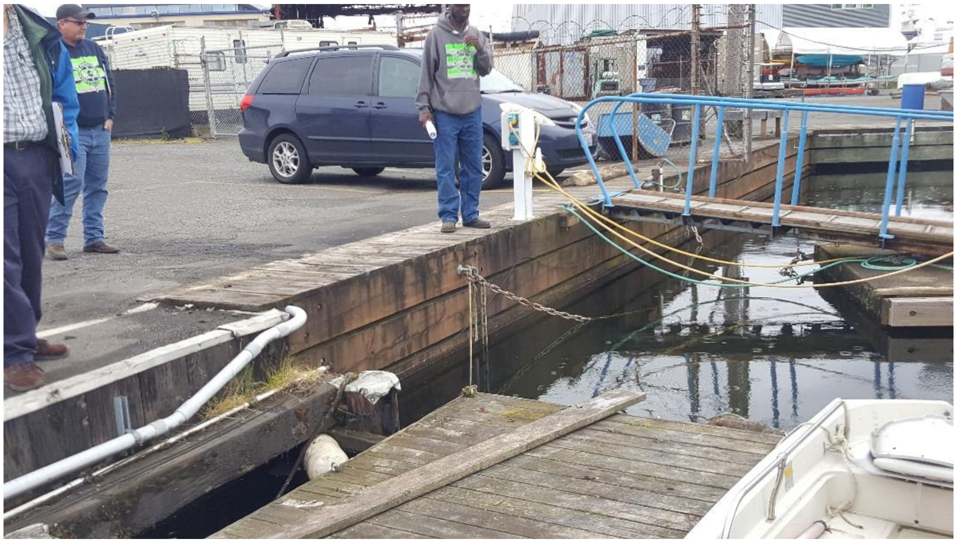

Figure A-17 - Bulkhead adjacent to Dock D

Figure A-18 - Bulkhead between Docks E and F

Figure A-19 - Condition of Pavement in front of Warehouse

Figure A-20 - Condition of Pavement adjacent to Dock B Entrance

Figure A-21 - Condition of Pavement adjacent to Marina Office Building

LEGEND

FIG B-20	PHOTOGRAPH NUMBER, ARROW INDICATES DIRCTION
	EXTENT OF DETERIORATION OR DAMAGE (RECOMMENDED FOR REPAIR)

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Port of Seattle

SITE ADDRESS
SALMON BAY MARINA
2100 W COMMADORE WAY
SEATTLE, WA 98199

ABOVE WATER CONDITION ASSESSMENT PLAN
(FOR DECK SURFACE, BULKHEAD, AND PARKING LOT PAVEMENT)

SALMON BAY MARINA - CONFIDENTIAL

FIGURE A-22

05 / 12 / 2017

APPENDIX A2 – UNDERWATER INSPECTION REPORT, ECHELON ENGINEERING

Underwater Observations, Salmon Bay Marina

ECHELON ENGINEERING, INC.

Civil/Marine Consulting Engineers

Salmon Bay Marina
Due Diligence Effort
Underwater Inspection
Seattle, Washington

Prepared For:

Reid Middleton Inc.
728 134th Street SW, Suite 200
Everett, WA 98204

ATTN: Ms. Shannon Kinsella, PE, PMP, LEED AP
Director Waterfront Engineering
Tel: 425 / 741.3800

Prepared By:

Echelon Engineering, Inc.
21027 61st Avenue West
Lynnwood, WA 98036

ATTN: Ms. Shelley Sommerfeld, PE
President
Tel: 425 / 672.8924

June 2017
17-2517

Echelon Engineering

Civil / Marine
Consulting Engineers

June 2, 2017

Reid Middleton Inc.
728 134th Street SW, Suite 200
Everett, Washington 98204

ATTN: Ms. Shannon Kinsella, P.E.,PMP, LEED AP
Director, Waterfront Engineering

RE: Salmon Bay Marina Due Diligence Effort – Underwater Inspection, Seattle, Washington

Dear Ms. Kinsella:

This letter is submitted as our report to present the findings of our three day due diligence inspection of the various marine structures that make up the Salmon Bay Marina, in Seattle, Washington. The inspection was carried out in support of Reid Middleton's condition assessment and conceptual design of the marina for the Port of Seattle. Specifically the inspection was carried out to provide an overview of the condition of the under-deck and submerged portions of the various bulkheads, boathouses, mooring floats and anchor systems that are within the marina.

INTRODUCTION

The Salmon Bay Marina is located on the south shore of the Lake Washington Ship Canal. The marina consists of multiple structures including a timber bulkhead that extends along the lake shore, three fixed Boathouse Docks identified as Docks A, B, and C, and three mooring floats identified as Floats D, E, and F. All of the structures are accessed from the bulkhead.

The shore bulkhead was originally constructed as a timber soldier pile wall with creosote treated piling and vertical timber lagging. The wall also has a large dimension horizontal wale near the top. The majority of the piles appear to be the original creosote members.

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However, a total of 13 piles have been replaced by newer steel pipe piles. The wale and lagging timbers are also creosote treated. Piles within the Bulkhead have been numbered sequentially from the east.

The boathouses, Docks A, B and C, are constructed on creosote treated piling that support both the fixed timber walkway as well as the overhead roof. In the deeper offshore section of the boathouses, untreated batter piles were found below the water surface to be secured to the vertical piles with a connection that is covered by a concrete filled ballistic nylon form known as a *Seaform* Jacket. Piles within the three structures have been identified by a bent and row grid system with the bents numbered consecutively from the south and the rows numbered from the west.

There are several existing floats and one individual boat house located along the western portion of the property. They are also accessed off from the bulkhead and are located west of Dock C. The investigation included the inspection of the three floats which are identified as Floats D, E, and F from the east, but did not include the individual boathouse or small float located near the angle point in the bulkhead at Pile Nos. 46 and 47. (Refer to the Appendix B drawing for the location of these structures). Floats D and F are constructed with concrete floatation pontoons secured together with timber wales, Float E is constructed with timber framing, decking and has Styrofoam filled tires providing floatation. All three floating docks are secured in place by chains at the south end which secure them to the bulkhead and by float anchor piles along the remaining length of the floats. The float anchor piles on Floats D and E are creosote treated. The float anchor piles in Float F are uncoated steel pipe piles.

Refer to the Appendix B drawing which provides a layout of the marine and the various structures and provides the location and identification of the inspected piles.

SCOPE OF WORK

Echelon conducted the proposed services diligently, with properly qualified personnel and in conformance with the usual standards of similar companies performing similar services under similar circumstances. The three day inspection effort was conducted as a sample Routine Inspection as outlined in the American Association of Civil Engineers (ASCE) publication *Waterfront Facilities Inspection and Assessment* (ASCE Manuals and Reports on Engineering Practice No. 130).

The project was conducted following the multi-tiered inspection protocol endorsed by the American Society of Civil Engineers (ASCE). The project included a three day field effort towards the inspection of the Boathouse piling in Docks A-C from the underside of the walkway decking to the mudline; inspection of the bulkhead piles from the water surface to

the mudline; inspection of the underside of the mooring floats and inspection of the associated anchor piles within Floats D-F, from the water surface to the mudline.

Level I inspection was conducted on all selected members within the sample and provided for visual assessment of the member for its inspected length. Level II inspection was conducted on ~10% of the members within the sampling and consisted of the cleaning of representative or suspect areas ("areas of concern") to facilitate detailed investigation of the member. No Level III inspection was conducted at the request of the client. Echelon Engineering was not tasked with performing an exhaustive evaluation of all members or components. Therefore, variations and discrepancies from the observations stated herein are likely to exist. Echelon makes no warranty or representation regarding the adequacy of members and components which are not expressly set forth herein as inspected.

The results of the investigation are discussed in the Observed Conditions section of this report. Photographs illustrating typical conditions encountered are presented in Appendix A. Appendix B provides a layout of the marina showing the location and identification of the piles included within the sample inspection. The results of the sample inspection are summarized in tabular format in Appendix C. Table 1 presents the condition and details on the inspected piling in the Bulkhead, Table 2 the inspected piling in Docs A-C and Table 3 the inspected float anchor piling in Floats D–F.

QUALIFICATIONS OF INSPECTORS

The investigation was conducted by a crew composed of professional and technical personnel capable and experienced in both the underwater and topside inspection and assessment of structural members. The personnel utilized on this project included the following Echelon Engineering staff:

S.D. Sommerfeld, P.E.	Project Manager/Engineer - Diver Licensed Professional Engineer - WA, AK, Guam 31 Years' Experience in Marine Structures Inspection and Design
E.B. Vegsund, B.Sc.	Marine Specialist/Biologist - Diver B.Sc. in Marine Biology - Emphasis on Marine Biological Studies 41 Years' Experience in Marine Structures Inspection
S.A. Vegsund	Inspection Technician 15 Years' Experience in Marine Structures Inspection
R.G. Provencher	Inspection Technician - Diver 1 Years' Experience in Marine Structures Inspection

RATING SYSTEMS

As is typical with structures in a fresh water environment, the damage to timber members is primarily due to fungal decay or rot. However, other biological agents such as insects and bacteria may contribute to the damage. For the purposes of this report, the term **biological degradation** has been used to describe damage to a member that may be a combination of one or more of these deteriorative agents. This type of damage may be evident as surface erosion or internal section loss. For the inspected members, the combined loss of cross-sectional area (i.e. damage) has been utilized along with engineering judgment to determine the final member rating.

Throughout the discussion the overall condition of the members is described as good, fair or poor in accordance with the following definitions:

- A member in **good condition** has no damage or has sustained only minor damage.
- A member in **fair condition** has sustained minor to moderate damage, but has no evidence of overstressing.
- A member in **poor condition** has sustained major to severe damage that affects the member's load bearing capacity. This damage may be evident as advanced deterioration, overstressing or breakage.

Piles

The condition of the individual piles is based on the overall damage noted along the length of the member using visual inspection and augmented by the various testing techniques described above. The pile condition has been expressed as a percentage of the remaining cross-sectional area of the member. A breakdown of the rating classifications is as follows:

- **100%** Remaining Cross-sectional Area / Rating Classification
  (No damage or deterioration)
- **90%** Remaining Cross-sectional Area / Rating Classification
  (Minor damage or deterioration; 90-99% remaining area)
- **75%** Remaining Cross-sectional Area / Rating Classification
  (Moderate damage or deterioration; 75-89% remaining area)
- **50%** Remaining Cross-sectional Area / Rating Classification
  (Moderate-Major damage or deterioration; 50-74% remaining area)
- **25%** Remaining Cross-sectional Area / Rating Classification
  (Major damage or deterioration; 25-49% remaining area)
- **0%** Remaining Cross-sectional Area / Rating Classification
  (Destroyed; 0-24% remaining area)

Superstructure

The superstructure caps associated with the selected piles in the sample were subjected to Level I visual examination. Level II examination, including probing, and hammer sounding were conducted at suspect areas along the length of the members as discussed above. Areas of damage were identified and detailed information obtained, including the location and quantification of any specific deterioration encountered. A breakdown of the superstructure rating classifications is as follows:

Undamaged	No significant damage or deterioration (0–4% loss of cross section)
Light Damage	Minor defects, No significant loss of capacity, No observed overstressing (5–24% loss of cross section)
Moderate Damage	Moderate defects, Moderate loss of capacity, No observed overstressing (25-49% loss of cross section)
Heavy Damage	Advanced deterioration, Significant loss of capacity, Possible areas of overstressing, May require additional structural evaluation (50–100% loss of cross section)

OBSERVED CONDITIONS

The field investigation was conducted on May 18, 19, and 22, 2017. Weather conditions at the time of the inspection were seasonably warm with clear skies and calm winds. The lake level was reported by the USACOE Reservoir Control Center to be +21.84 feet (i.e. near high pool). Water depths beneath the marina ranged from approximately 5 feet at the bulkhead to approximately thirty-five feet at the northern end of the boathouses. Underwater visibility ranged from 1 - 10 feet dependent on the water depths and the turbidity caused by the inspectors disturbing the mudline sediments.

Bulkhead

The overall condition of the shoreward bulkhead was found to be fair / good although significant damage was identified in several of the structural components. *Close access to several of the bulkhead piles and members was restricted or not possible due to the presence of the floating docks or vessels moored tight alongside the bulkhead which precluded close access. For this reason additional damage, which may be significant, might be present and might not have been identified by this inspection*. Refer to Appendix

A, Photos 1-14 for general information on the bulkhead and examples of some of the specific deficiencies noted. Refer to Appendix C, Table 1 for the identification of the inspected piles and details on any damage found. The findings of the bulkhead investigation are as follows:

1. The bulkhead was originally constructed with ~75 creosote treated timber soldier piles, a large dimension horizontal wale near the top of the bulkhead, and vertical creosote treated timber lagging. The bulkhead has undergone various generations of restorative maintenance including the installation of 13 steel pipe piles as apparent replacement piles for timber members that were likely damaged due to fungal decay.

2. The 13 steel pipe piles were found to be in good condition. They appear to be relatively new with no evidence of any significant damage or deterioration found. Ten of these piles were noted to be uncoated with only minor surface corrosion and three appear to have a painted galvanized coating that is in good condition.

3. The 62 remaining piles within the bulkhead were found to be creosote treated timber members. The overall condition of these piles was found to be fair with 12 piles, (16% overall) found to have sustained heavy fungal/mechanical damage in their upper ~2 ft. These heavily damaged piles were found throughout the bulkhead.

4. The overall condition of the vertical timber lagging appears to be good. No evidence of perforations or openings, other than one discharge pipe location, was noted. No evidence of hydraulic transport of fill materials from behind the bulkhead, such as visible voids, sink holes or mounds of sediment in front of the bulkhead were observed.

5. The overall condition of the large dimension timber wale near the top of the bulkhead was also observed to be fair to good. No evidence of gross damage or deterioration was noted. In the most recently repaired section of the bulkhead (i.e. the western end between Piles No. 66 – 75) a partial concrete beam has been poured to replace an apparently damaged section of this large dimension timber wale. The concrete beam appears to be in good condition. Refer to Photo No. 14.

Boathouses Dock A, B and C

The overall condition of the underdeck portions of Docks A, B and C was found to be good although significant damage was identified in one of the examined piling. Refer to Appendix A, Photos No. 15 - 22 for general information on the three dock and examples of some of the specific deficiencies found. Refer to Appendix C Table 2 for the identification of the inspected piles and details on any damage found. The findings of the investigation are as follows:

1. The boathouses are constructed with creosote treated timber bearing piles. Untreated timber batter piles were found in the deeper water sections of the structures. The structural piles support the timber walkways that are located above the high water level of the Ship Canal, as well as the roof over the covered moorages.

2. It is estimated that approximately 25% of the piles within the Boathouse Docks A, B and C were included in the investigation. In total 115 piles located within the three structures were inspected. The overall condition of the structural piles inspected was found to be good. Of the 115 piles inspected 112 piles (97.3%) are rated in the undamaged classification; One pile (0.9%) has been rated in the 90% classification; One pile (0.9%) has been rated in the 75% classification; and one pile (0.9% has been rated in the 50% classification. The pile rated in the lower 50% classification was of found to have sustained significant biological damage (i.e. ~30% loss of section) in the wet dry zone, (refer to Photo No. 21).

3. The overall condition of the batter piles was also found to be good. These piles are connected to the vertical piles near the high lake level. The connection is covered with a *Seaform* concrete encasement which encompasses the top of the batter pile and encircles the vertical pile to which it is attached. The concrete at these connections were all found to be intact, and no evidence of deterioration or damage was found in the piles beneath the concrete encasement. One batter pile located on Dock C, Bent 18, Row 5 Batter appears to have been originally secured to the Row 5 vertical pile above the current full pool elevation. As shown in Photo No. 19, the batter pile sustained severe fungal section loss at its top. This seems to indicate that at some point in the Marina's history, all of the original timber batter piling were connected above water to the vertical piling and that due to significant fungal decay at the top connection, the upper damaged portion was removed and the connection was made lower on the vertical pile using the Seaform Jackets. Refer to Photo No. 20.

4. Inspection of the timber walkway pile caps associated with the inspected piling found them to also be in generally good condition. However, several timbers were noted to have sustained minor mechanical and/or fungal damage at their ends. Typically this damage was restricted to less than 5% of the members section at the bolted connection to the support piles. Refer to Photo No. 18. Minor defects were noted on the following members:

   - Dock A Bent 23, W. End – 5% section loss in south timber
     Bent 25, W. End – 2% section loss in north timber
     Bent 25, Row 1 - 5% section loss on bottom of south timber

- Dock C Bent 5, E. End – 5% section loss
  Bent 18, W. End – 5% section loss

Mooring Floats D, E and F

The overall condition of the submerged portions of Floats D, E and F was found to be good although significant damage was identified in several of the structural components. Refer to Appendix A Photos No. 23 - 38 for general information on the three mooring floats and examples of some of the specific deficiencies found. Refer to Appendix C Table 3 for the identification of the inspected piles and details on any damage found. The findings of the investigation are as follows:

1. **Float D** is constructed of a series of concrete pontoons secured together with timber wales. It is chained to the bulkhead and fixed in-place by three creosote treated timber float anchor piles. The overall condition of the float is fair. Evidence of significant fungal deterioration was observed in several of the timber wales. Additionally, supplemental floatation in the form of plastic barrels was noted under the shoreward portion of the float from the south end to approximately Float Anchor Pile No. 1. It is unknown whether the barrels are filled with air or with Styrofoam. The float was noted to be floating essentially level but with variations in free board that ranged from a low of 6 inches (deck surface to waterline) to a high of 10 inches. The float anchor piles which secure this float were found to be in generally fair to good condition. However, two of the piles have sustained minor abrasive section loss in the zone of lake level fluctuation.

2. **Float E** is of timber construction with floatation provided by a double stack of Styrofoam filled vehicle tires. It is also chained to the shoreward bulkhead and is secured in place by four creosote treated timber float anchor piles. The overall condition of the float is fair. Although no evidence of significant mechanical or fungal damage to the framing timbers was observed it appears that some of the floatation tires along the west side have gone missing. The float was noted to have a visibly pronounced list with the east side of the float noted to be significantly higher than the west. Measurements of the freeboard in the area of most visible listing, (i.e. near Float Anchor Pile No. 2), were 19 inches on the east side and 13 inches on the west side. Underwater inspection of the floatation tires in this area revealed only one elevation of tire floats on the west side and the typical two elevations of tires on the east side. Inspection of the float anchor piles which secure this float found them all to be in good condition with no significant damage or deterioration identified.

3. **Float F** is constructed of a series of concrete pontoons secured together with timber wales. The float also has timber cross members located on the bottom of each pontoon. These timbers are secured by long steel bolts. The float is chained to the bulkhead and

fixed in-place by one float anchor pile located at approximately mid-span and a five pile dolphin located at the north end. All six piling are uncoated steel pipe piles. The overall condition of the float is fair to good with the majority of the length of the float noted to be visibly level with near even freeboard. However, at the northern end, the last two concrete pontoons were noted to list significantly to the west. The second to last concrete pontoon was found to have freeboard on the east side measured at 17 inches and the west side measured at 12 inches. Similarly, the northern most pontoon freeboard was measured on the east side at 14 inches and on the west side at 9 inches. Inspection of the float anchor piles which secure this float found them all to be in generally good condition with no significant damage or deterioration and only minor surface corrosion.

SUMMARY

This project, which covered a sampling of the piles and associated superstructure components within the Salmon Bay Marina, found the overall condition of the inspected members to be fair / good. Nevertheless significant damage was identified in a number of the structural components throughout the facility.

Bulkhead

The overall condition of the shoreward bulkhead was found to be fair / good although significant damage was identified in several of the structural components. Of the 75 piling within the Bulkhead, a total of 13 piles were found to have been replaced with newer steel pipe piles. These steel piles were noted to be in good condition. Twelve of the remaining 62 original creosote treated soldier piles were found to have sustained significant damage in their upper approximately 2 feet. We recommend that these piles be evaluated for maintenance or replacement. Inspection found no significant damage to the vertical timber lagging or to the large dimension timber located near the top of the wall was noted. Additionally, no evidence of any loss of fill material from behind the bulkhead was visibly apparent, such as voids, openings in the wall or mounds of material on the mudline adjacent to the bulkhead.

Close access to several of the bulkhead piles and members was restricted or not possible due to the presence of the floating docks or vessels moored tight alongside the bulkhead which precluded close access. For this reason additional damage, <u>which may be significant</u>, might be present and might not have been identified by this inspection.

Boathouses Dock A, B and C

The overall condition of the underdeck portions of Docks A, B and C was found to be good although significant damage was identified in one of the examined piling. Of the 115 structural piles inspected within Boathouse Docks A, B and C, 114 piles (99.1%) were found to be in

overall good condition. Only one pile was noted to have sustained any significant damage which was noted to be fungal decay in the wet/dry zone resulting in an approximate 30% loss of section. Similarly the inspected cap timbers were found to be in generally good condition with only minor mechanical and/or fungal damage found in the ends of a several timbers.

Mooring Floats D, E and F

The overall condition of Mooring Floats D, E and F is fair with the condition of Float F noted to be slightly better than that of Floats D and E. Although the inspected piling and floats were found to be in generally fair to good condition, evidence of differential freeboard was noted on all three floats.

We recommend that the specific members identified to have sustained damage be evaluated for repair or replacement and that periodic routine inspection of the entire facility be carried out to monitor the condition of the marina. Per the American Association of Civil Engineers guidelines, facilities such as this are recommended for re-inspection of the piles and superstructure elements on a three to six year interval. Such inspections will identify specific members that may require maintenance in order to ensure the safe continued operation of the facility during the remaining years of desired service.

It has been a pleasure to have assisted you with this project. Should you have any questions concerning this report, or if we can assist you further in the evaluation of the marina structures, please do not hesitate to contact our office.

Yours Truly,
Echelon Engineering, Inc.

Ms. Shelley D. Sommerfeld, P.E.
President

SDS:jds
Enclosures

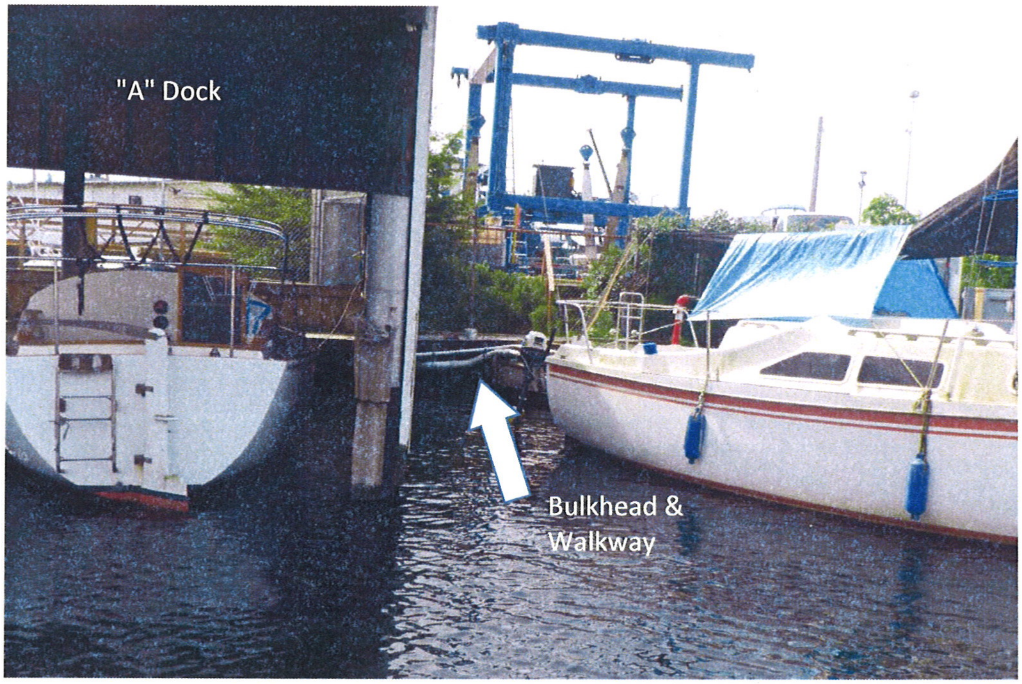


PHOTO No. 1: Salmon Bay Marina, East End of Bulkhead, Looking East – Note the walkway for A Dock which spans over the eastern end of the bulkhead.

PHOTO No. 2: B Dock, Looking South – Note the vessels moored alongside the bulkhead at the south end of B Dock. The piles in this section of Bulkhead between A Dock and B Dock are numbered 1–13 from the east.

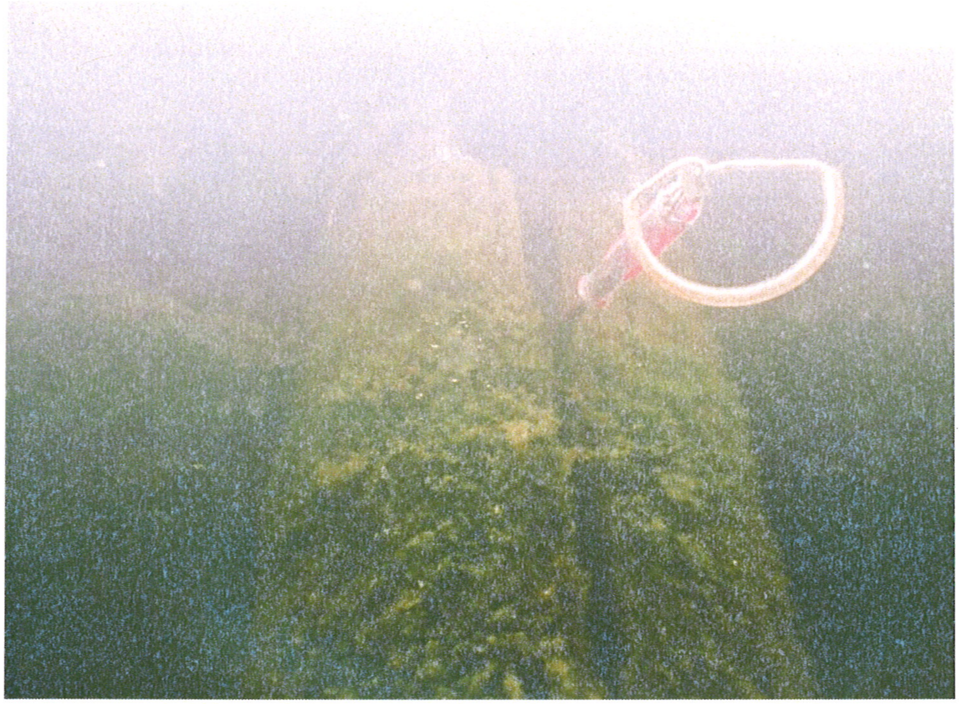


PHOTO No. 3:

Bulkhead Pile No. 3 – Note the screwdriver inserted into a split, near the top of the pile. Level II examination found extensive fungal and mechanical damage in the upper approximate 2 feet of the pile.

PHOTO No. 4: Bulkhead Pile No. 4, Looking West – Note the extensive fungal and mechanical damage in the upper approximate 2 feet of the pile.

PHOTO No. 5: Bulkhead Pile No. 17 – This pile which is located just west of the access walkway to B Dock. Inspection found it to have sustained ~90% loss of section in the upper approximate 2 feet due to fungal decay.

PHOTO No. 6: Bulkhead Pile No. 23, Looking East – Note the diver inspecting this pile which is located near the midpoint between B Dock and C Dock. Level II examination found ~50% fungal and mechanical damage and section loss in the upper approximate 2 feet of the pile.

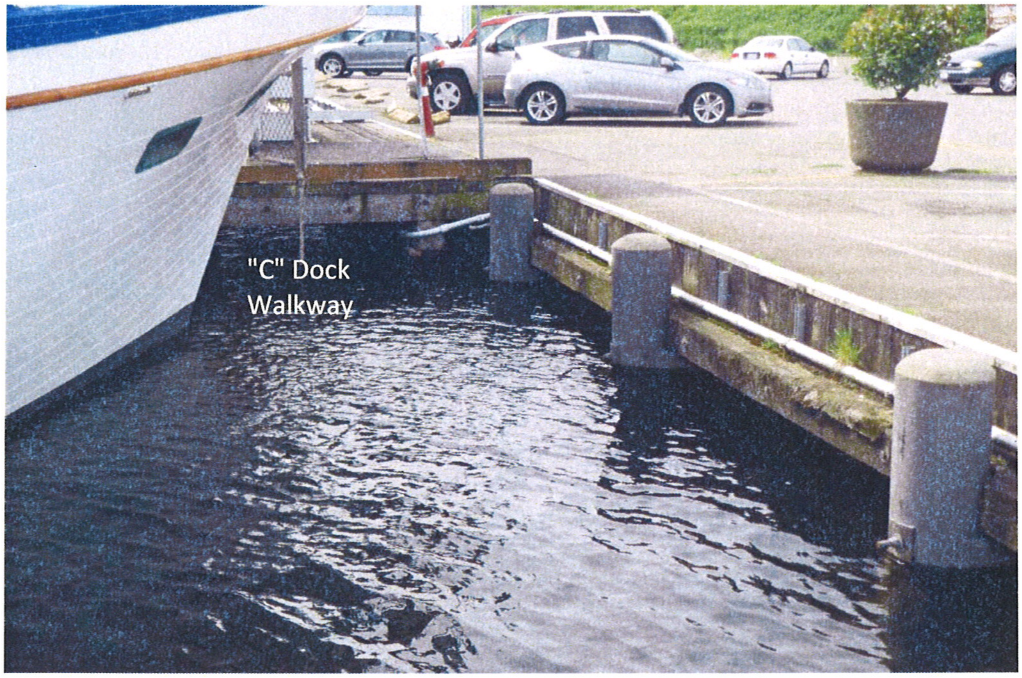


PHOTO No. 7: Bulkhead Piles No. 30–32, Looking East – Note the newer concrete filled steel pipe piles installed to replace older, apparently damage timber piles. The access walkway for C Dock is visible in the background.

PHOTO No. 8: Bulkhead Pile No. 31, Looking West – Note the good condition of the painted steel coating on this steel pile, which was found to be intact with areas of minor surface corrosion. Also note the typical good condition of the creosote treated vertical timber lagging behind the pile.

PHOTO No. 9: Bulkhead Pile No. 31, Looking West – Note the good condition of the painted steel coating on this steel pile at the mudline. Also note the typical good condition of the creosote treated vertical timber lagging.

PHOTO No. 10: Bulkhead Pile No. 40 – Note the construction detail change at Pile No. 40 (arrow) with horizontal wales installed offshore of the original vertical timber lagging (foreground). Access to the inspection of Pile 41–45 was restricted due to the horizontal timbers at this location west of C Dock.

PHOTO No. 11: Bulkhead Piles No. 46-47, Looking South – Note the screwdriver inserted into an area of heavy fungal deterioration (~90% loss) at the top of Pile No. 46. Also note the good condition of Pile No. 47.

PHOTO No. 12: Bulkhead Piles No. 47–56, Looking South – Note the corner at the south end of the bulkhead shown in Photo No. 11, indicated by the arrow. Cursory observation of the floatation beneath the adjacent boathouse (NIS) found that it is supported by unencapsulated Styrofoam that is heavily deteriorated.

PHOTO No. 13: Bulkhead Pile No. 62, Looking South – Note the inspector examining this pile which has sustained ~90% section loss at its top due to fungal decay. Also note the chain around the pile that secures the southern end of Float E.

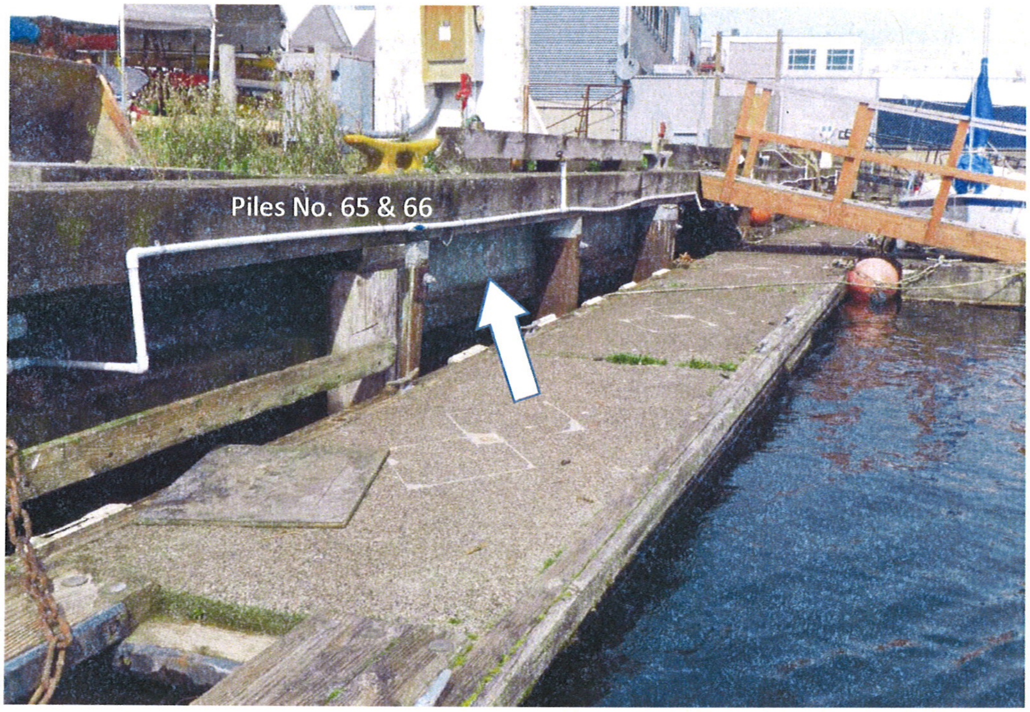


PHOTO No. 14: Bulkhead Piles No. 65–68, Looking West – Note Piles No. 65 (timber) and 66 (steel). Pile No. 66 is the eastern most of 10 recently installed steel pipe piles. Also note arrow indicating the poured in place concrete cap above the vertical timber lagging in this area.

PHOTO No. 15: A Dock, Looking Northeast – Note the typical boathouse construction of the structure using creosote treated piles supporting the roof and the walkways.

PHOTO No. 16: B Dock, Bent 20, Row 3 Vertical and Batter Piles, Looking West – Note the pile supports both the roof and the walkway system. Also note the arrow showing the top of the batter pile secured to the vertical pile with a Seaform concrete encasement.

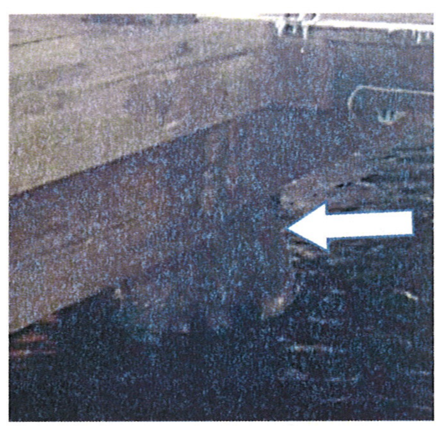


PHOTO No. 17:
C Dock, Bent 20 Row 1 Vertical and Batter Piles, Looking North – Note that both piles have had Seaform concrete encasements installed on their upper approximate four feet. Also note the vegetation growing out of accumulated sediments located on top of the concrete jackets.

PHOTO No. 18: B Dock, Bent 3, South Cap Timber At Row 4, Looking West – Note the minor (~5%) mechanical and fungal section loss identified at the end of this cap timber. The majority of the examined cap timbers were found to be in good condition and undamaged.

PHOTO No. 19: C Dock, Bent 18, Row 5 Vertical Pile, Looking North – Note the severe fungal damage to the top of the original untreated batter pile. Underwater inspection found that this pile which sustained heavy damage above water has been pulled over to the vertical pile underwater and secured using a Seaform concrete encasement.

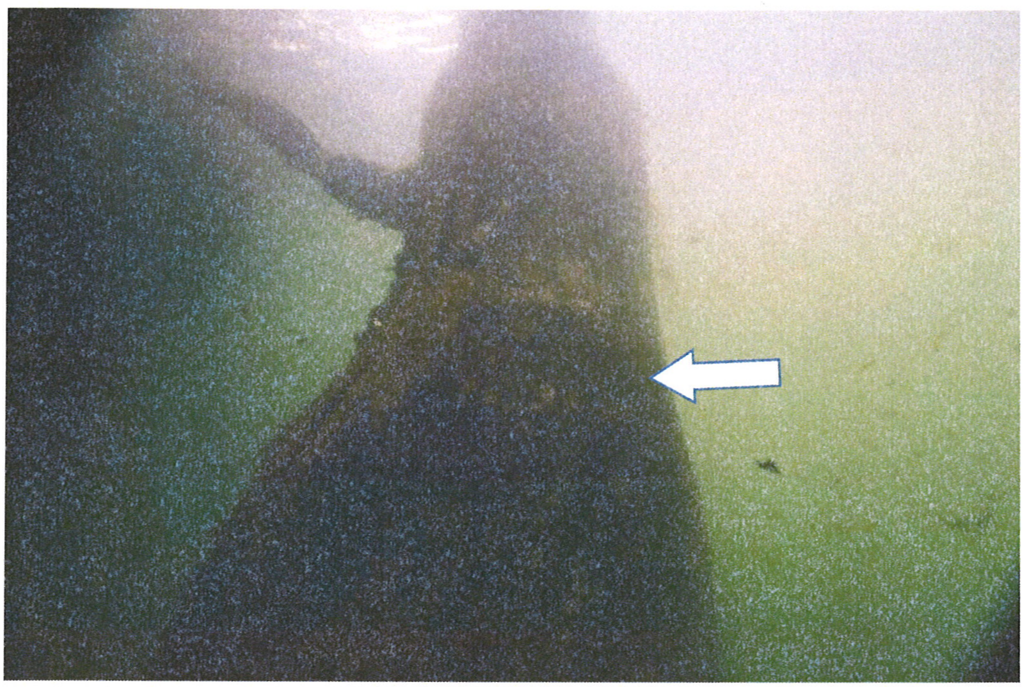


PHOTO No. 20: C Dock, Bent 18, Row 5 Vertical and Batter Piles, Looking Northeast – Note the undamaged lower portion of the original timber batter pile has been secured to the vertical pile using a Seaform concrete encasement. This type of connection was found to be typical throughout the Docks.

PHOTO No. 21: B Dock, West End of North Apron, Looking East – Note the diver inspecting the tall fender pile which protects the corner of the structure. The pile was found to be untreated and to have sustained heavy fungal damage in the wet/dry zone.

PHOTO No. 22: B Dock, East End of North Apron, Looking West – Note the batter pile is not secured to the newer Chemonite treated vertical pile that has been installed as a replacement structural pile in this area.

PHOTO No. 23: Float D, Looking South – Note the float is constructed using concrete pontoons with timber wales and is secured by creosote treated float anchor piles.

PHOTO No. 24: Float D, South End – Note the access ramp that is hinged off of the bulkhead. Also note that the left (east) side of the float has reduced free board when compared to the right (west) side of the float in the area where the ramp lands.

PHOTO No. 25: Float D, South End – Note the south end of the float is secured to Bulkhead Piles No. 56 and 57 with galvanized chain.

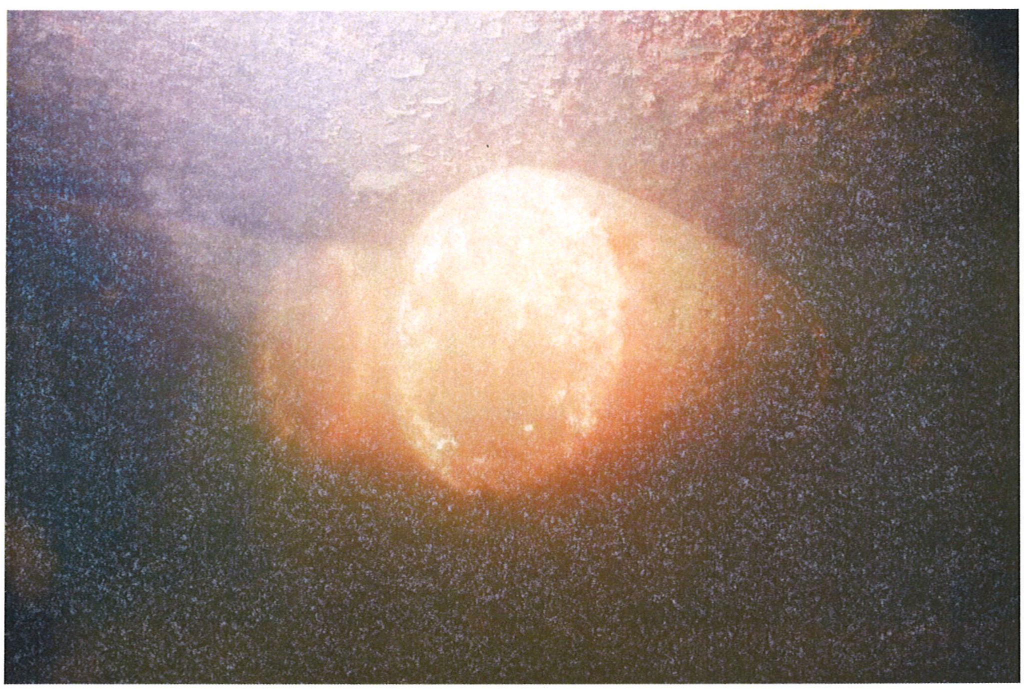


PHOTO No. 26: Float D, Supplemental Floatation Barrels – Several plastic barrels were found beneath the shoreward ~1/3 length of the Float. No strapping or other means of securing the barrels was noted and their buoyancy apparently keeps them in-place.

PHOTO No. 27: Float D, Near Float Anchor Pile No. 1, Looking North – Note the localized areas of deteriorated concrete and the vegetation growing out of sediments trapped between the timber wales (framing members).

PHOTO No. 28: Float D, Northwest Corner - Inspection of the timber wale system noted this area of fungal damage in the timber wale system.

PHOTO No. 29: Float E, North End, Looking South –This float is made up of treated timber framing and Styrofoam-filled tire floatation. The float is secured in-place by creosote treated float anchor piles.

PHOTO No. 30: Float E, South End, Looking West – Note the typical construction using treated timber framing and double stacked Styrofoam filled tires. Also note the float is secured to Bulkhead Piles No. 61 and 62 with galvanized chain.

PHOTO No. 31: Float E, Typical Floatation – Note the floatation provided by Styrofoam filled vehicle tires.

PHOTO No. 32: Float E, Looking North – Note the pronounced list of the float, with the east side of the visibly higher than the west side. Refer to Photo No. 33.

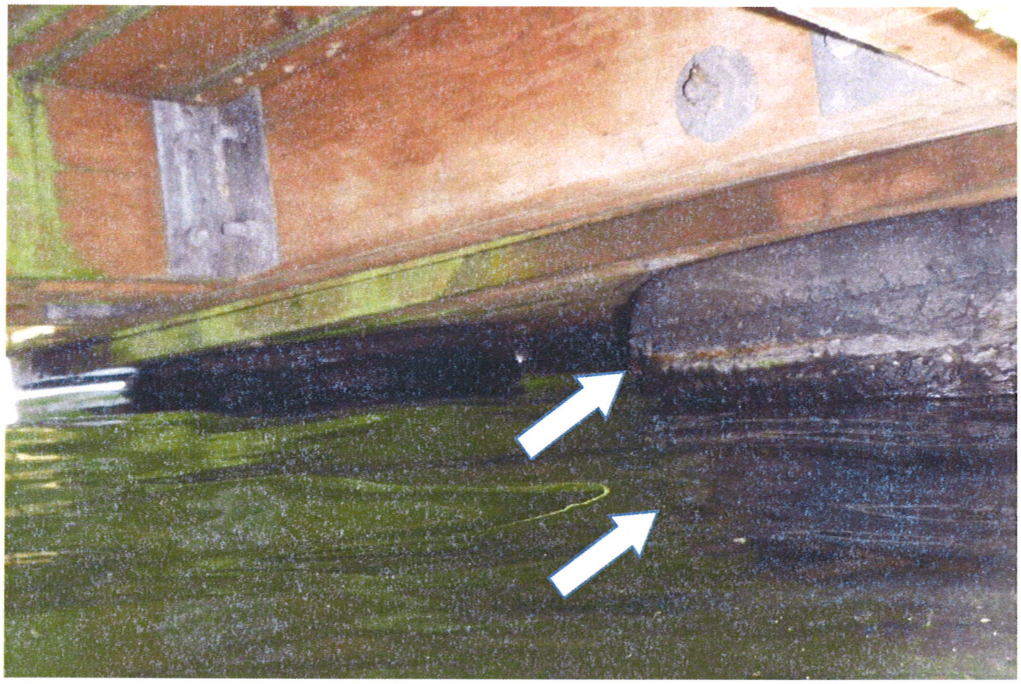


PHOTO No. 33: Float E, Near Float Anchor Pile No. 3, Looking Northwest – Note the pronounced list of the float in this area with the east side siting higher out of the water than the west side. Also note the arrow indicating two, double stacked floatation tires on the east side.

PHOTO No. 34: Float E, Close-up of Photo No. 33 Above – Note there is only one elevation of floatation tires at this low point on the float. The addition of supplemental floatation may correct the differential freeboard, leveling the float in this area.

PHOTO No. 35: Float F, South End, Looking Southwest – Note the float is constructed with concrete pontoons secured together with timber wales. The southern portion of the float was found to be floating level with good freeboard.

PHOTO No. 36: Float F, North End, Looking Northwest – Note the five pile dolphin constructed with steel pipe piles that secures the offshore end of the float. Also note the differential freeboard in the northern-most floatation pontoons.

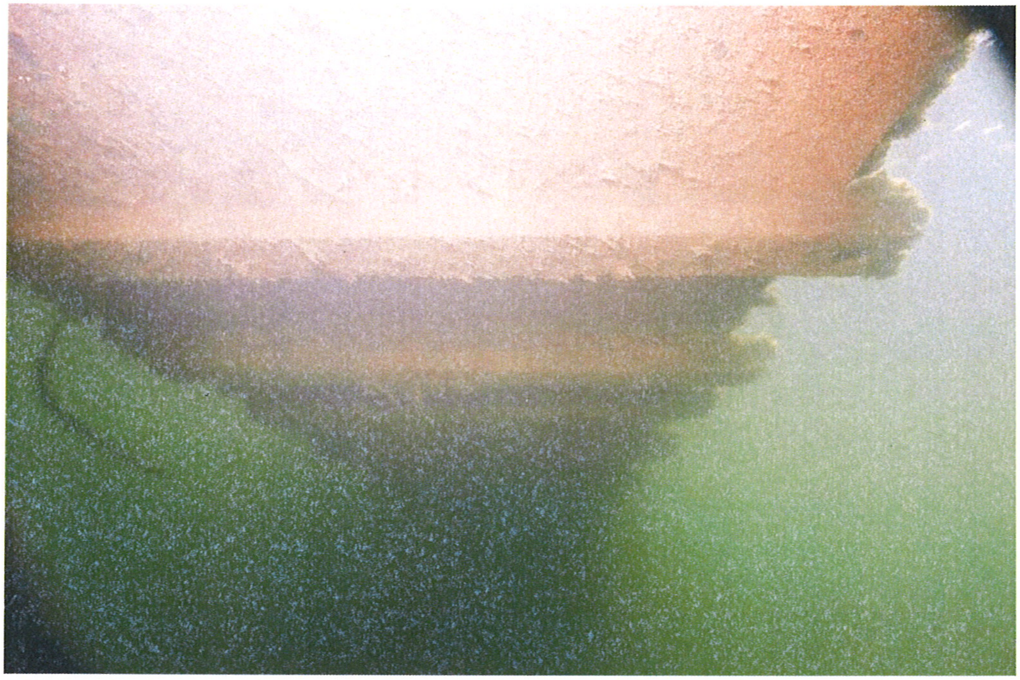


PHOTO No. 37: Float F, Underside of Pontoon, Looking North – Note the good condition of the concrete and the horizontal timbers secured across the bottom of the pontoons.

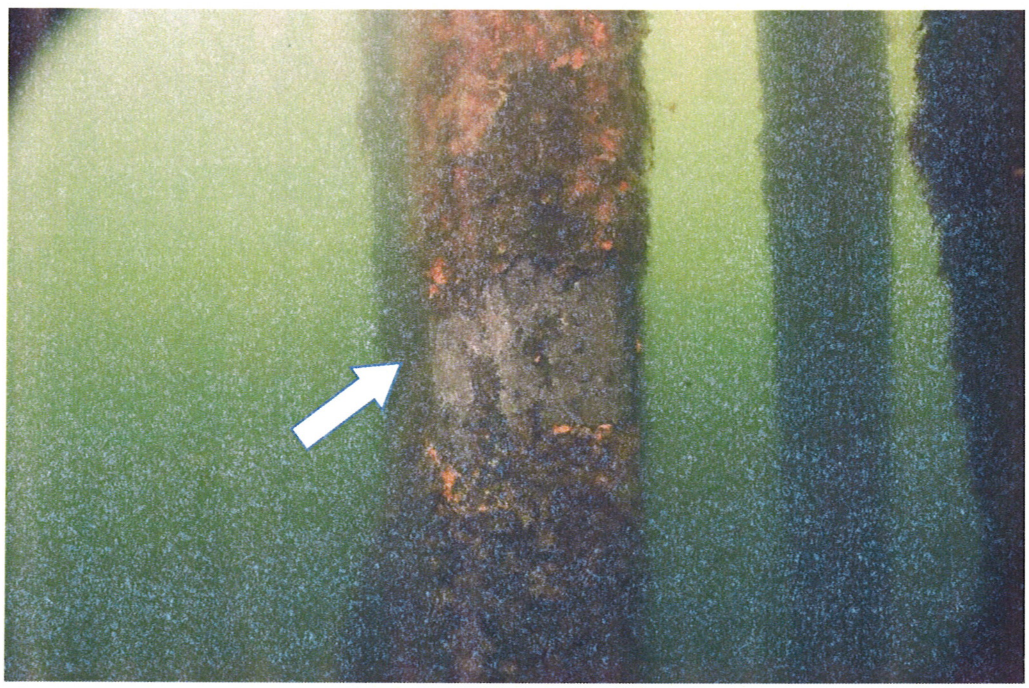
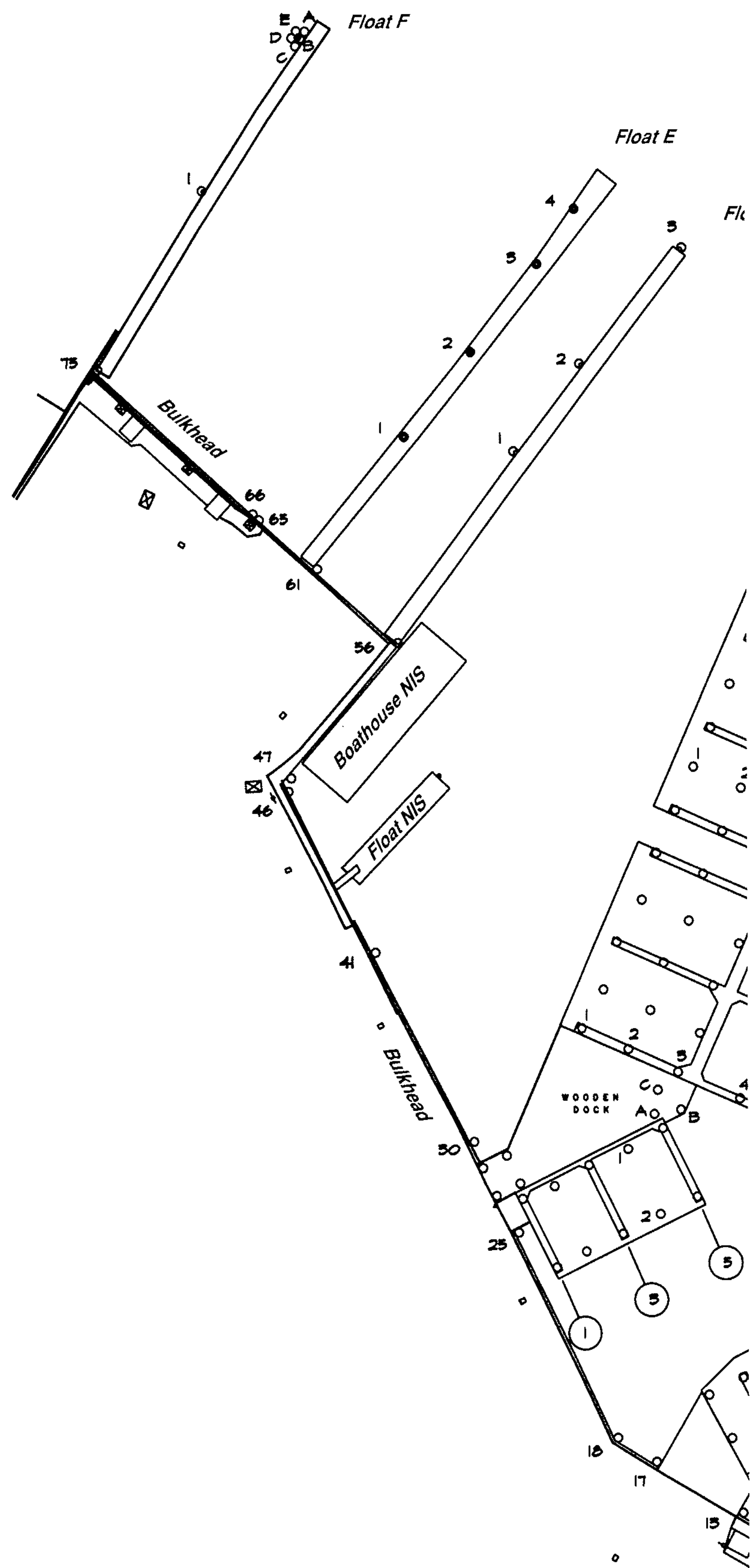


PHOTO No. 38: Float F, Dolphin Pile E Pile – Note the band of Level II cleaning conducted in the submerged zone which removed the corrosion/algae matrix and exposed the underlying steel base metal. Close examination found the steel surface to be smooth and in visibly good condition.



LEGEND

(3) Bent No.

A Row or Pile Number

○ Timber or Steel Pipe Pile

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TABLE 1
BULKHEAD PILE INSPECTION DATA

BULKHEAD PILE NO.	MEMBER RATING	CONDITION / DAMAGE	
		Elevation* (Referenced to Lake Level)	Details / Remarks
1	100		
2	100		
3	0	Tp / 0'	Split w/ 90% Fungal
4	0	Tp / 0'	90% Mechanical/Fungal
5	100		
6	100		
7	100		
8	100		
9	0	Tp / 0'	90% Fungal
10	0	Tp / 0'	90% Fungal
11	100		
12	100		
13	100		
14	100		
15	0	Tp / 0'	90% Fungal
16	100		
17	0	Tp / 0'	90% Fungal
18	100		
19	100		
20	100		
21	100		
22	100		
23	50	Tp / 0'	50% Fungal
24	100		
25	100		
26	100		
27	100		
28	0	Tp / 0'	90% Fungal
29	100		
30	100		Steel Pipe Pile; Painted Galvanized Coating
31	100		Steel Pipe Pile; Painted Galvanized Coating
32	100		Steel Pipe Pile; Painted Galvanized Coating
33	100		

* Water Surface = 0'

TABLE 1
BULKHEAD PILE INSPECTION DATA

BULKHEAD PILE NO.	MEMBER RATING	CONDITION / DAMAGE	
		Elevation* (Referenced to Lake Level)	Details / Remarks
34	100		
35	100		
36	100		
37	100		
38	100		
39	100		
40	100		
41	100		Limited Access
42	100		Limited Access
43	100		Limited Access
44	--		Not Accessible
45	90	Tp / 0'	2% Mechanical/Fungal; Limited Access
46	0	Tp / 0'	90% Mechanical/Fungal
47	100		
48	100		Limited Access; Sistered Timbers - UD
49	100		
50	100		
51	100		
52	100		
53	100		
54	100		
55	0	Tp / 0'	90% Fungal
56	100		
57	100		
58	100		
59	100		
60	100		
61	100		
62	0	Tp / 0'	90% Fungal
63	25	Tp / 0'	50-75% Fungal; Limited Access
64	100		
65	100		
66	90		Steel Pipe Pile; Uncoated

* Water Surface = 0'

TABLE 1
BULKHEAD PILE INSPECTION DATA

BULKHEAD PILE NO.	MEMBER RATING	CONDITION / DAMAGE	
		Elevation* (Referenced to Lake Level)	Details / Remarks
67	90		Steel Pipe Pile; Uncoated
68	90		Steel Pipe Pile; Uncoated
69	90		Steel Pipe Pile; Uncoated
70	90		Steel Pipe Pile; Uncoated
71	90		Steel Pipe Pile; Uncoated
72	90		Steel Pipe Pile; Uncoated
73	90		Steel Pipe Pile; Uncoated
74	90		Steel Pipe Pile; Uncoated
75	90		Steel Pipe Pile; Uncoated

* Water Surface = 0'

TABLE 2
DOCK PILE INSPECTION DATA

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Bent	Row		Elevation* (Referenced to Lake Level)	Details / Remarks
Dock A				
7	1	100		
	2	100		
	3	100	+1' / -4'	Seaform Jacket - UD
8	1	100		
	2	100		
	3	100	+1' / -4'	Seaform Jacket - UD
9	1	100	+1' / -4'	Seaform Jacket - UD
	2	100	+1' / -4'	Seaform Jacket - UD
11	1	100	+1' / -4'	Seaform Jacket - UD
	2	100	+1' / -4'	Seaform Jacket - UD
13	1	100		
	2	100		
	3	100	+1' / -4'	Seaform Jacket - UD
19	1	100	+0.5' / -4'	Seaform Jacket - UD
	1 E-Br	100		Untreated Pile
			+0.5' / -4'	Seaform Jacket - UD
	2 W-Br	100		
	2	100		Untreated Pile
			+0.5' / -4'	Seaform Jacket - UD
	3	100	+0.5' / -4'	Seaform Jacket - UD
23	1	100		Untreated Pile
			+0.5' / -4'	Seaform Jacket - UD
	1 SE-Br	100		Untreated Pile
			+0.5' / -4'	Seaform Jacket - UD
	2 W-Br	100	+0.5' / -4'	Seaform Jacket - UD
	2	100	+0.5' / -4'	Seaform Jacket - UD
	3	100	+1 / -4'	Seaform Jacket - UD
25	1	100	+0.5' / -4'	Seaform Jacket - UD
	1 E-Br	100		Untreated Pile
			+0.5' / -4'	Seaform Jacket - UD
	2 W-Br	100		Untreated Pile
			+0.5' / -4'	Seaform Jacket - UD

* Water Surface = 0'

TABLE 2
DOCK PILE INSPECTION DATA

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Bent	Row		Elevation* (Referenced to Lake Level)	Details / Remarks
25	2	100	+0.5' / -4'	Seaform Jacket - UD
	3	100	+1' / -4'	Seaform Jacket - UD
33	1	100		
N Apron	A	90		Untreated Pile
			Tp / 0'	1% Biological Degradation
	B	100		
	B SE-Br	100		Untreated Pile
	C	100		Chemonite Pile

* Water Surface = 0'

TABLE 2
DOCK PILE INSPECTION DATA

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Bent	Row		Elevation* (Referenced to Lake Level)	Details / Remarks
Dock B				
3	1	100		
	2	100		
	3	100		
	4	100		
4	1	100		
	2	100		
	3	100		
	4	100		
8	1	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	2	100		
13	1	100		
	2	100		
	3	100		
	4	100		
14	1	100		
	2	100		
	3	100		
	4	100		
20	1	100		
	2	100	+1' / -4'	Seaform Jacket - UD
	2 E-Br	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	3	100	+1' / -4'	Seaform Jacket - UD
	3 W-Br	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	4	100		
21	1	100		
	2	100		
	3	100		
	4	100		

* Water Surface = 0'

TABLE 2
DOCK PILE INSPECTION DATA

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Bent	Row		Elevation* (Referenced to Lake Level)	Details / Remarks
24	1	100		
	2	100		
	3	100		
	4	100		
25	1	100		
	2	100	+1' / -4'	Seaform Jacket - UD
	2 E-Br	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	3 W-Br	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	3	100	+1' / -4'	Seaform Jacket - UD
	4	100		
E Apron	A	100		
	B	100		Chemonite Pile
W Apron	A	50		Untreated Pile
			0' / -2'	30% Biological Degradation
	B	100		Chemonite Pile
	B S-Br	100		Untreated Pile

* Water Surface = 0'
\2517-TBL.xlsx, Dock Piles

TABLE 2
DOCK PILE INSPECTION DATA

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Bent	Row		Elevation* (Referenced to Lake Level)	Details / Remarks
Dock C				
5	1	100		
	2	100		
S Deck	A	100		Untreated Pile
	B	100		Untreated Pile
	C	75	0' / -2'	25% Biological Degradation
4	1	100		
	2	100		
8	1	100		
	2	100		
	3	100		
	4	100		
	5	100		
9	1	100		
	2	100		
	3	100		
	4	100		
	5	100		
14	1	100	+1 / -4'	Seaform Jacket - UD
	1 E-Br	100		Untreated Pile
			+1 / -4'	Seaform Jacket - UD
	2	100		
	3	100		
	4	100		
	5 W-Br	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	5	100	+1 / -4'	Seaform Jacket - UD
17	1	100		
	2	100		
	3	100		
	4	100		
	5	100		

* Water Surface = 0'

TABLE 2
DOCK PILE INSPECTION DATA

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Bent	Row		Elevation* (Referenced to Lake Level)	Details / Remarks
18	1	100	+1' / -4'	Seaform Jacket - UD
	1 E-Br	100		Untreated Pile
			+1' / -4'	Seaform Jacket - UD
	2	100		
	3	100		
	4	100		
	5 W-Br	100	-3' / -6'	Seaform Jacket - UD
	5	100	-3' / -6'	Seaform Jacket - UD
E Apron	A	100		
	B	100		
	B S-Br	100		

* Water Surface = 0'

TABLE 3
FLOAT ANCHOR PILES

PILE LOCATION		MEMBER RATING	CONDITION / DAMAGE	
Float	Pile No.		Elevation* (Referenced to Lake Level)	Details / Remarks
D	1	90	0'	<5% Abrasion
	2	100		
	3	90	0'	<5% Abrasion
E	1	100		
	2	100		
	3	100		
	4	100		
F	1	90	Tp / MDL	Steel Pipe Pile; Uncoated w/ Minor Surface Corrosion
	2-A	90	Tp / MDL	Steel Pipe Pile; Uncoated w/ Minor Surface Corrosion
	2-B	90	Tp / MDL	Steel Pipe Pile; Uncoated w/ Minor Surface Corrosion
	2-C	90	Tp / MDL	Steel Pipe Pile; Uncoated w/ Minor Surface Corrosion
	2-D	90	Tp / MDL	Steel Pipe Pile; Uncoated w/ Minor Surface Corrosion
	2-E	90	Tp / MDL	Steel Pipe Pile; Uncoated w/ Minor Surface Corrosion

* Water Surface = 0'

APPENDIX B - STRUCTURAL

Structural Observations, Salmon Bay Marina

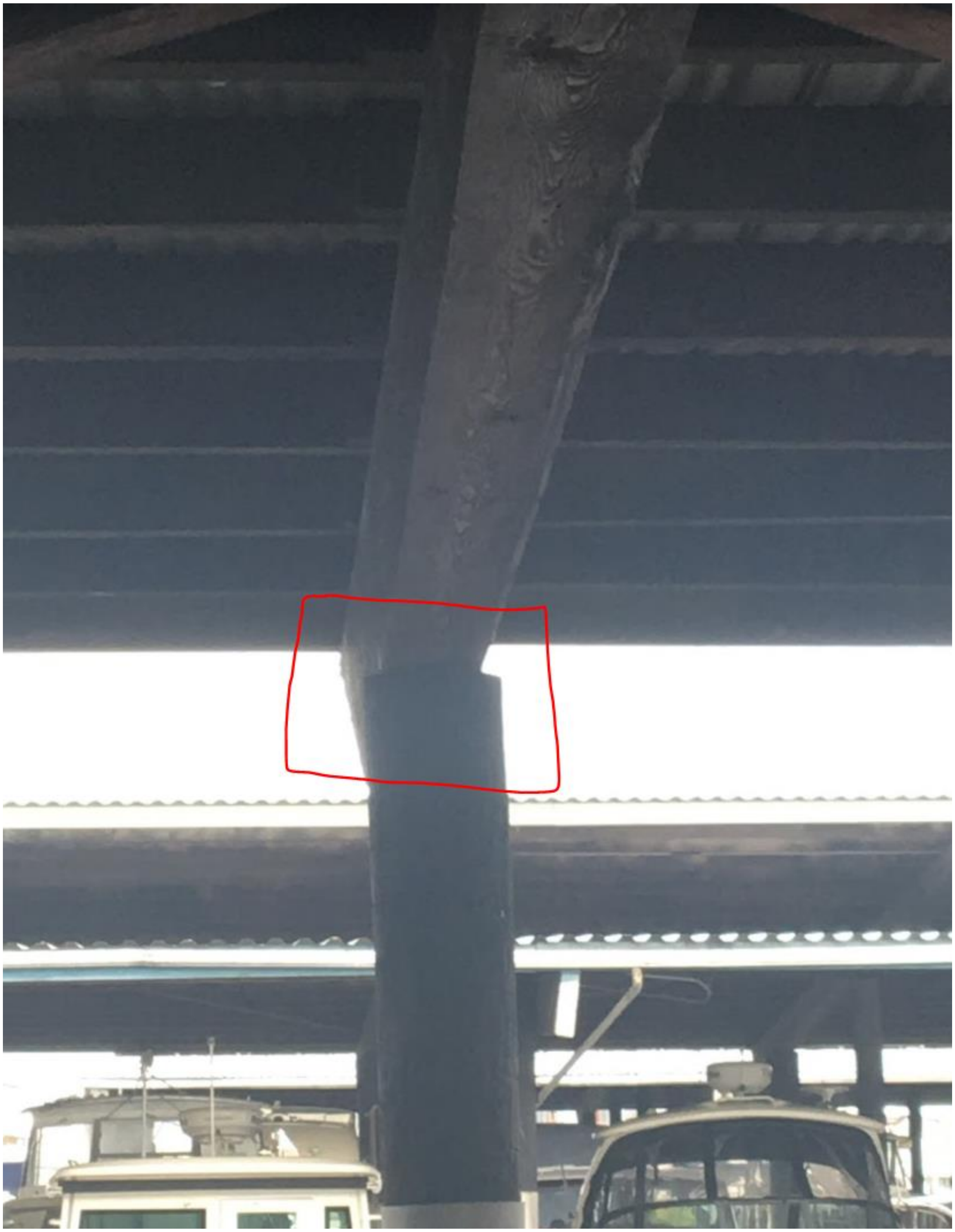


Figure B-1 - Pile-to-Roof Connection. Note: no vertical tie-downs exist at the roof level.

Figure B-2 - Typical Framing Scheme

Figure B-3 - Exterior Boathouse Cladding

Figure B-4 - Warehouse Typical Framing

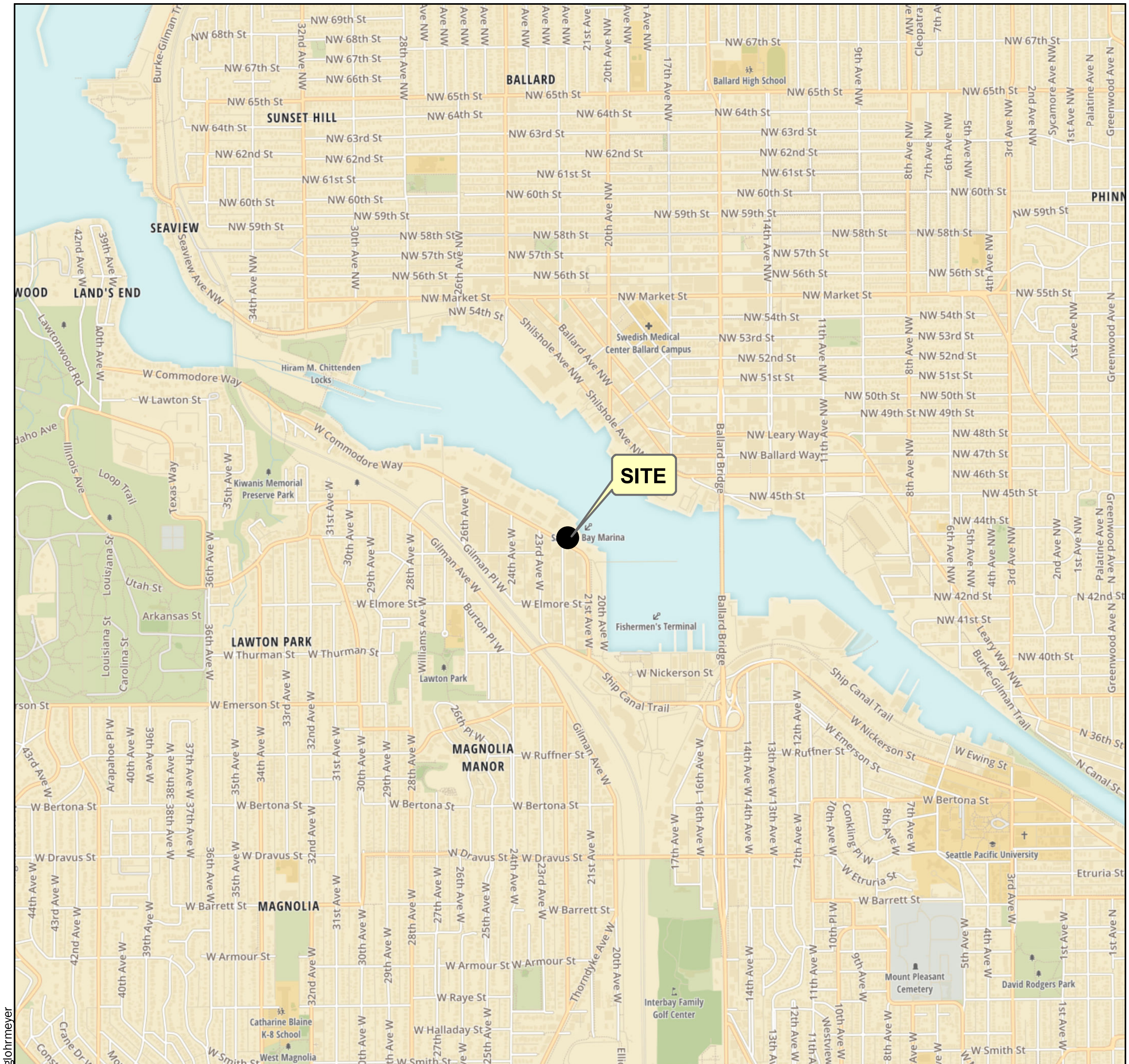
Figure B-5 - Settlement at Warehouse

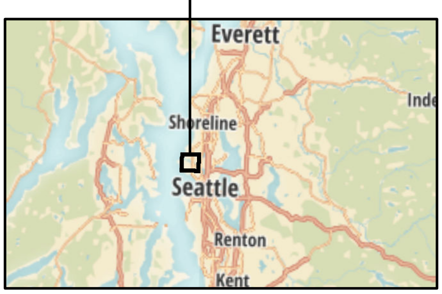
Figure B-6 - Localized Water Spot beneath Mezzanine in Warehouse

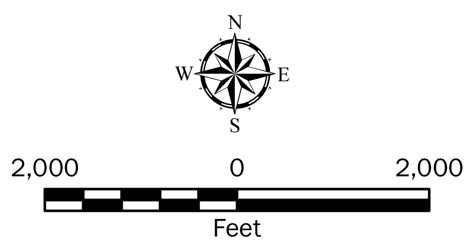
Figure B-7 - Marina Office

APPENDIX C – GEOTECHNICAL

Geotechnical Observations, Salmon Bay Marina







Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

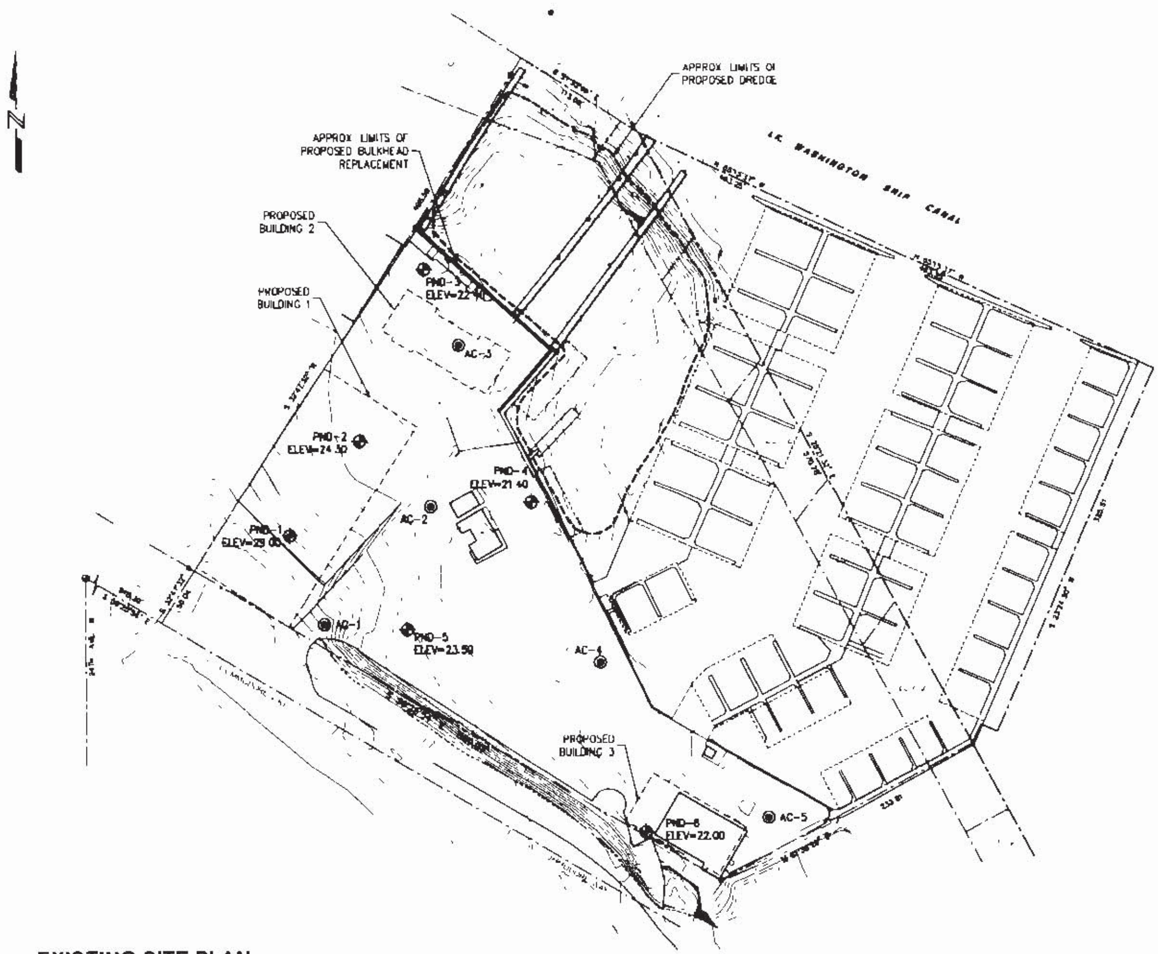
P:\0\0303128\GIS\030312800_F1_VicinityMap.mxd Date Exported: 06/02/17 by glohrmeyer

Vicinity Map

Port of Seattle - Salmon Bay Marina Due Diligence
Seattle, Washington

GEOENGINEERS

Figure 1



LEGEND

- BOREHOLE ELEV=##.##
- ASPHALT CORE

EXISTING SITE PLAN

0 20 50 100 150 FT

12/6/12
Projects\2010 Project Files\104101.01 - Salmon Bay Marina\Task 2 Geotech-Project Folders\G Geotechnical\2012 Geotechnical Investigation\DRAFT - Borelogs\Borehole Locations\104101.02-BOREHOLE LOCATIONS.dwg

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REVISIONS

REV	DATE	DESCRIPTION

PROJECT: SALMON BAY MARINA GEOTECHNICAL INVESTIGATION

TITLE: BOREHOLE LOCATIONS

DESIGNED BY	BH	PROJECT NO.	104101.01	SHEET NO. 1 OF 1
DRAWN BY	DRH	DATE	JULY 2012	
CHECKED BY		SCALE	NOTED	

APPENDIX B

Borehole Logs

SOILS CLASSIFICATION, CONSISTENCY AND SYMBOLS

CLASSIFICATION

Identification and classification of the soil is accomplished in general accordance with the ASTM version of the Unified Soil Classification System (USCS) as presented in ASTM Standard D2487. The standard is a qualitative method of classifying soil into the following major divisions (1) coarse grained, (2) fine grained, and (3) highly organic soils. Classification is performed on the soils passing the 75 mm (3 inch) sieve and if possible the amount of oversize material (> 75 mm particles) is noted on the soil logs. This is not always possible for drilled test holes because the oversize particles are typically too large to be captured in the sampling equipment. Oversize materials greater than 300 mm (12 inches) are termed boulders, while materials between 75 mm and 300 mm are termed cobbles. Coarse grained soils are those having 50% or more of the non-oversize soil retained on the No. 200 sieve (0.075 mm); if a greater percentage of the coarse grains is retained on the No. 4 (4.76 mm) sieve the coarse grained soil is classified as gravel, otherwise it is classified as sand. Fine grained soils are those having more than 50% of the non-oversize material passing the No. 200 sieve; these may be classified as silt or clay depending their Atterberg liquid and plastic limits or observations of field consistency. Refer to the most recent version of ASTM D2487 for a complete discussion of the classification method.

SOIL CONSISTENCY - CRITERIA

Soil consistency as defined below and determined by normal field and laboratory methods applies only to non-frozen material. For these materials, the influence of such factors as soil structure, i.e. Fissure systems, shinkage cracks, slickensides, etc., must be taken into consideration in making any correlation with the consistency values listed below. In permafrost zones, the consistency and strength of frozen soils may vary significantly and unexplainably with ice content, thermal regime and soil type.

Standard Penetration Test (Blows/ft)
Relative to Denstiy/Consistency

N60	Density	Relative Density
0-4	Very Loose	0-15%
4-10	Loose	15-35%
10-30	Medium	35-65%
30-50	Dense	65-85%
> 50	Very Dense	>85%

N60	Consistency	Undrained Shear Strength psf
< 2	Very Soft	< 250
2 - 4	Soft	250 - 500
4 - 8	Medium	500 - 1000
8 - 15	Stiff	1000 - 2000
15 - 30	Very Stiff	2000 - 4000
> 30	Hard	> 4000

Ref: Terzaghi, Peck, and Mesri Soil Mechanics in Engineering Practice, 3rd Edition, pg 60-63
ASTM D1586 Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils
ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (USCS)

SAMPLER TYPE SYMBOLS

A	Auger Sample	Pb	Pitcher Barrel	St	1.4" Split Spoon w/ 47# Hammer
Bs	Bulk (grab) Sample	Sl	2.5" Split Spoon w/ 140# Hammer	Sx	2.0" Split Spoon w/ 47# Hammer
Cs	Core Barrel w/ Single Tube	Sm	2.5" Split Spoon w/ 300# Hammer	Sz	1.4 Split Spoon w/ 340# Hammer
Cd	Core Barrel w/ Double Tube	Sh	2.5" Split Spoon w/ 340# Hammer	Ts	Shelby Tube
Ct	Core Barrel w/ Triple Tube	Sp	2.5" Split Spoon, Pushed	Tm	Modified 2.5 O.D. Shelby Tube
Hl	2.5" Split Spoon w/ Air Hammer	Ss	1.4" Split Spoon w/ 140# Hammer		
Hs	1.4" Split Spoon w/ Air Hammer				

Note: Split Spoon size refers to sampler inside diameter.

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Drawn PND
Checked PND
Project No 104101.02
Date Dec 2012

STANDARD BOREHOLE LOG DETAILS

BOREHOLE LOGS | FIGURE B-1

Depth (Feet)	Water Table	GRAPHIC SYMBOL	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per Foot)*	GRAPH: ■ BLOW COUNT (BPF)* 20 40 60 80; ● POCKET PEN (TSF) 1 2 3 4; ▲ VANE SHEAR (TSF) 2 4 6 8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation Additional Information	Elevation (Feet)
0			0' - 0.30' A.C. PAVEMENT							Begin drilling 10/24/03 8:00 a.m.	24.43
	▽		POORLY-GRADED GRAVEL W/ SILT AND SAND (GP-GM) Gray, Moist, Dense, Subangular	1	Ss		30	20-20-25 (45)	■	2' to 3' - Hard, loud drilling (Cobbles/Boulder encountered)	
2											22.43
1 2		3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1	Depth	Depth (in feet) below the ground surface.
2	Water Level	Groundwater level recorded while drilling. Depths and times are recorded in comments column.
3	Graphic Log	Graphic depiction of materials encountered.
4	Soil Description	Description of materials encountered, including USCS soil descriptions.
5	Sample Number	Sample identification number.
6	Sample Type	Type of soil sample collected at depth interval depicted; symbols explained on Fig. B-01.
7	Sample Location	Location soil sample taken
8	Sample Recovery	Percentage of sample recovered.
9	Sample Blows	Number of blows to advance driven sampler each 6-inch interval using sampler type specified with a 30-inch drop. Blows per foot given in parentheses.
10	Graphs	Graphic log depicting blow counts per foot with a specified split spoon, Pocket Penetration and Vane Shear tests depicted where taken on fine grained soils.
11	Comments	Comments or observations on drilling/sampling by driller or PND field personnel.
12	Elevation	Elevation (in feet) with respect to Mean Lower Low Water (MLLW) or other datum where specified.

GENERAL NOTES

1. Field descriptions may have been modified to reflect laboratory test results.
2. Descriptions on these boring logs apply only at the specific locations at the time the borings were drilled. They are not warranted to be representative of subsurface conditions at other locations or times.
3. Split spoon blow counts shown are uncorrected raw data. Various hammer sizes and split spoon sizes were used and have not been corrected to a Standard Penetration Test (SPT). Blow counts may vary substantially between SPT and these methods.

P N D ENGINEERS, INC.	Designed PND Drawn PND Checked PND Project No 104101.02 Date Dec 2012	STANDARD BOREHOLE LOG DETAILS BOREHOLE LOGS — FIGURE B-2

Soil Legend

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	Well-graded gravels, gravel sand mixtures, little or no fines
		(LITTLE OR NO FINES)		GP	Poorly graded gravels, gravel sand mixtures, little or no fines
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO 4 SIEVE (4.75mm)	GRAVELS WITH FINES		GM	Silty gravels, gravel-sand-silt mixtures
		(APPRECIABLE AMOUNT OF FINES)		GC	Clayey gravels, gravel sand clay mixtures
	SAND AND SANDY SOILS	CLEAN SANDS		SW	Well graded sands, gravely sands, little or no fines
MORE THAN 50% RETAINED ON NO 200 SIEVE (0.075mm)		(LITTLE OR NO FINES)		SP	Poorly graded sands, gravelly sands, little or no fines
	MORE THAN 50% OF COARSE FRACTION PASSING NO 4 SIEVE (4.75mm)	SANDS WITH FINES		SM	Silty sands, sand silt mixtures
		(APPRECIABLE AMOUNT OF FINES)		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sand clays, silty clays, lean clays
				OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	Inorganic silts, micaceous or diatomceous fine sandy or silty soils, elastic silts
MORE THAN 50% PASSING NO. 200 SIEVE (0.075mm)				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS				PT	Peat and other highly organic soils

NOTE. Multiple symbols are used to indicate borderline or dual soil classifications

Stratigraphic Contact

Distinct contact between soil strata or geologic units

Gradual change between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Laboratory / Field Tests List of Abbreviations

%F	Percent Fines	HA	Hydrometer Analysis	PP	Pocket Penetrometer
AL	Atterberg Limits	LMA	Limited Mechanical Analysis	SA	Sieve Analysis
CP	Laboratory Compaction test	MC	Moisture Content	TV	Torvane
CO	Consolidation test	MD	Moisture content and Dry density	TX	Triaxial Shear
DP	Depth "Peat" Probe	OC	Organic Content	UC	Unconfined Compression
DS	Direct Shear	PM	Permeability or Hydraulic Conductivity	VS	Vane Shear

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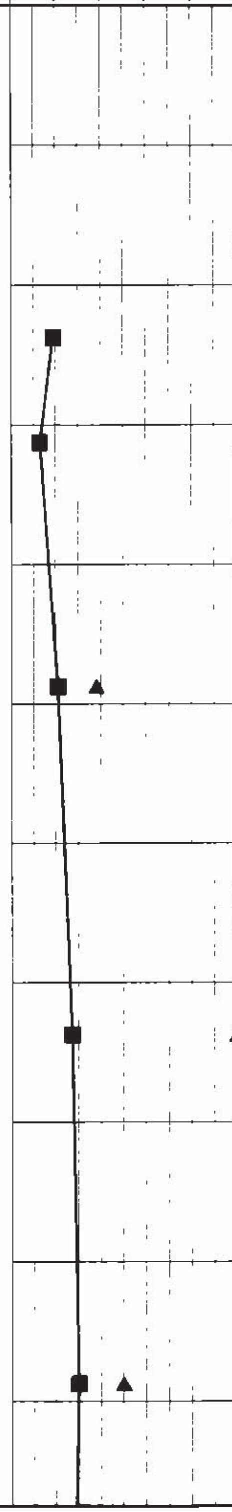
Checked: PND
Project No: 104101.02
Date: Dec 2012

STANDARD BOREHOLE LOG DETAILS

BOREHOLE LOGS | FIGURE B-3

SOIL DESCRIPTION			SAMPLES					GRAPH	COMMENTS	
Depth (feet)	Water Table	Graphic Symbol	Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	■ BLOW COUNT ■ 20 40 60 80; ● POCKET PEN (tsf) ● 1 2 3 4; ▲ VANE SHEAR (tsf) ▲ 0.2 0.4 0.6 0.8	Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
0.0			ACP, 3 inches							Start: 5/22/2012 9:37:00 AM	29.0
			GRAVEL WITH SAND (GP). (Fill)							Concrete debris encountered approx. 1-1.5 ft. depth Driller advanced slowly with 500 psi down pressure.	
			SILT (ML) brown mottled with orange, moist, very stiff, with occasional gravel. (Fill)								
2.5											26.5
5.0				1	Ss		0	9-12-7 (19)			24.0
			SANDY SILT (ML) gray mottled with orange, moist, stiff. (Fill)	2	Ss		67	3-5-8 (13)			
7.5											21.5
			SILTY SAND (SM) gray, moist, medium dense								
10.0				3	Ss		67	10-10-11 (21)		VS = 0.38 tsf MC=20%; SA	19.0
12.5			SILT (ML) gray, moist, very stiff, with occasional fine sand								16.5
15.0				4	Ss		100	6-12-15 (27)		VS = 1.13 tsf	14.0
17.5											11.5
20.0				5	Ss		100	9-15-15 (30)		VS = 0.50 tsf	9.0



Groundwater level not noted during drilling due to mud rotary wash Northing: 244676 Easting: 1258132

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Logged By CW
Data Entry CW/CMK
Checked CMK
Project No 104101.02
Date 12/13/12

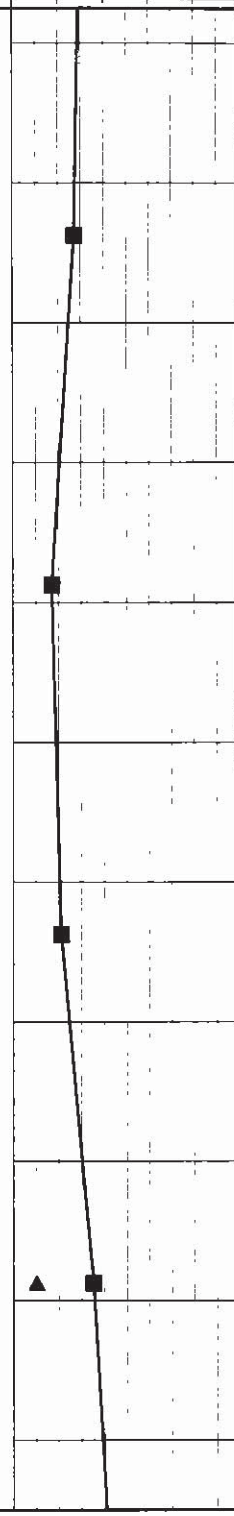
SALMON BAY MARINA
Seattle, Washington

PND - 1

FIGURE B-4.1

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
22.5			SILT (ML) gray, moist, very stiff with occasional fine sand							6.5
25.0				6	Ss		100	8-13-14 (27)	MC=26%; AL	4.0
27.5										1.5
30.0				7	Ss		100	5-7-10 (17)		-1.0
32.5										-3.5
35.0				8	Ss		100	6-9-12 (21)	Sand noted in bottom 3 in. of sample.	-6.0
			CLAYEY SAND (SC) gray, moist, dense							
37.5										-8.5
40.0				9	Ss		100	13-14-21 (35)	VS = 0.10 tsf	-11.0
42.5			CLAY (CL) gray, moist, hard							-13.5

GRAPH: BLOW COUNT 20 40 60 80; POCKET PEN (tsf) 1 2 3 4; VANE SHEAR (tsf) 0.2 0.4 0.6 0.8



Groundwater level not noted during drilling due to mud rotary wash Northing: 244676 Easting: 1258132

PND ENGINEERS, INC	Logged By: CW Data Entry: CW/CMK Checked: CMK Project No: 104101.02 Date: 12/13/12	SALMON BAY MARINA Seattle, Washington
		PND - 1 / FIGURE B-4.2

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT 20 40 60 80; POCKET PEN (tsf) 1 2 3 4; VANE SHEAR (tsf) 0.2 0.4 0.6 0.8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			CLAY (CL) gray, moist, hard								
				10	Ss		100	6-15-29 (44)			
45.0			CLAYEY SAND (SC) gray, moist, dense								-16.0
47.5			CLAY (CL) gray, moist, very stiff								-18.5
				11	Ss		100	5-9-11 (20)			
50.0											-21.0
52.5											-23.5
				12	Ss		100	8-12-14 (26)			
55.0											-26.0
57.5										Driller noted gravel layer at 57.5 ft., approx. 1 in. thick.	-28.5
				13	Ss		100	6-12-17 (29)			
60.0											-31.0
62.5			CLAY (CL) gray, moist, hard, (Glacially Consolidated)							Driller noted gravel at 63 ft	-33.5

Groundwater level not noted during drilling due to mud rotary wash Northing: 244676 Easting: 1258132

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SALMON BAY MARINA
Seattle, Washington

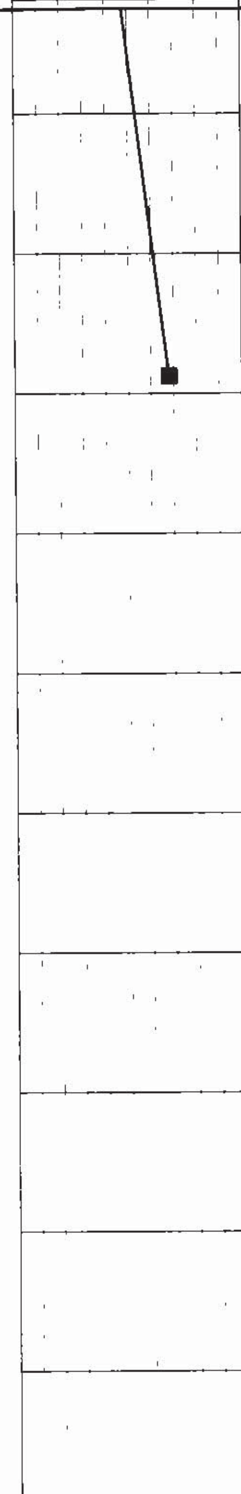
PND - 1

FIGURE B-4.3

BOREHOLE LOG SALMON BAY GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	COMMENTS Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
65.0			CLAY (CL) gray, moist, hard (Glacially Consolidated)							-36.0
67.5										-38.5
70.0				14	Ss		100	27-34-34 (68)	Terminated at: 70.5 ft. 5/22/2012 3:00:00 PM	-41.0
72.5										-43.5
75.0										-46.0
77.5										-48.5
80.0										-51.0
82.5										-53.5
85.0										-56.0

GRAPH



Groundwater level not noted during drilling due to mud rotary wash. Northing: 244676 Easting: 1258132

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Checked: CMK
Project No: 104101.02
Date: 12/13/12

SALMON BAY MARINA
Seattle, Washington

PND - 1

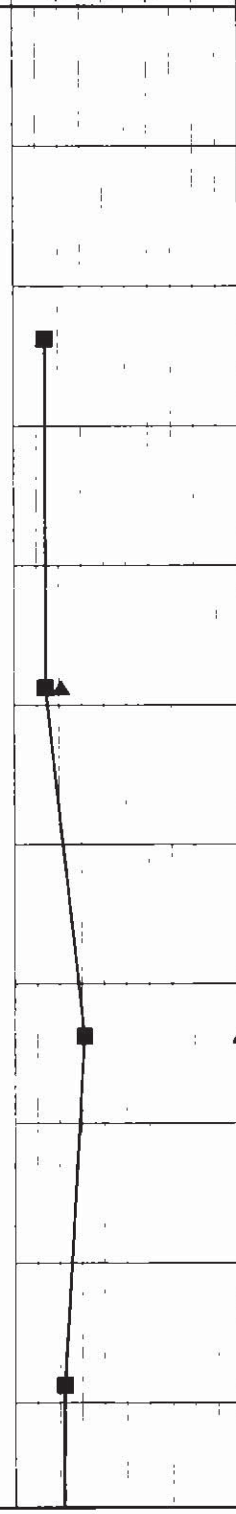
FIGURE B-4.4

Depth (feet)	Soil Description (Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information)	Elevation (feet)
0.0	ACP, 3 inches	24.3
	GRAVEL WITH SAND (GP). (Fill)	
2.5	CLAY (CL) brown mottled with orange, moist, stiff, with occasional gravel. (Fill)	21.8
5.0		19.3
7.5	CLAY (CL/ML) gray, moist, stiff to hard	16.8
10.0		14.3
12.5		11.8
15.0		9.3
17.5	SILT (ML/CL) gray, moist, very stiff	6.8
20.0		4.3

Samples: Number	Type	Recovery (%)	Penetration Blows per 6/Inch (per foot)	Comments
				Start 5/24/2012 8:00:00 AM
				Driller noted 2 ft of gravel then transition to fine grained material.
1	Ss	100	4-7-7 (14)	
2	Ss	95	3-6-8 (14)	VS = 0.21 tsf MC=27%, AL
3	Ss	100	8-14-17 (31)	VS = 1.00 tsf
4	Ss	100	6-10-12 (22)	

Comments: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information

GRAPH



Groundwater level not noted during drilling due to mud rotary wash. Northing: 244753 Easting: 1258189

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Project No: 104101.02
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SALMON BAY MARINA
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PND - 2

FIGURE B-5.1

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT (20 40 60 80) / POCKET PEN (tsf) (1 2 3 4) / VANE SHEAR (tsf) (0.2 0.4 0.6 0.8)	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			SILT (ML-CL) gray, moist, very stiff								
22.5											1.8
25.0				5	Ss		100	5-10-11 (21)		3/4 in. gravel sized particle at top of sample.	-0.7
27.5											-3.2
30.0				6	Ss		100	6-8-11 (19)		MC=27%, AL	-5.7
32.5			SILT WITH SAND (ML) gray, moist, very stiff								-8.2
35.0			SILTY SAND (SM) gray, moist, dense	7	Ss		100	6-10-21 (31)		MC=23%, SA	-10.7
37.5			CLAY (CL-ML) gray, moist, very stiff to hard								-13.2
40.0				8	Ss		100	6-10-11 (21)			-15.7
42.5											-18.2

Groundwater level not noted during drilling due to mud rotary wash. Northing: 244753 Easting: 1258189

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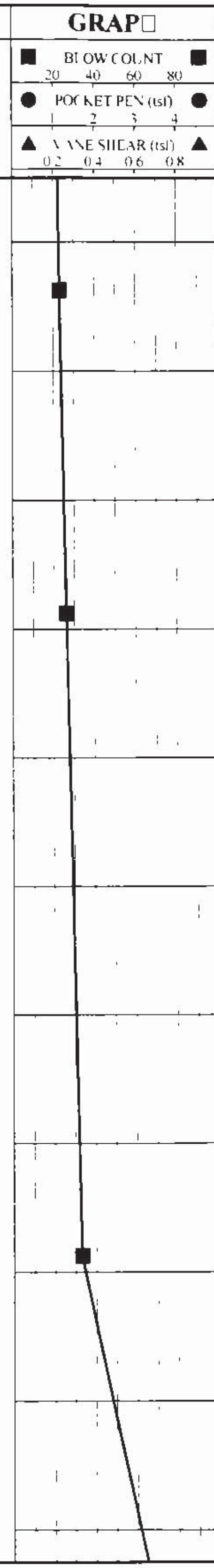
Seattle, Washington

PND - 2

FIGURE B-5.2

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			CLAY (CL/ML) gray, moist, very stiff to hard								
45.0				9	Ss		100	6-10-13 (23)			-20.7
47.5											-23.2
50.0				10	Ss		100	8-11-15 (26)			-25.7
52.5											-28.2
55.0											-30.7
57.5											-33.2
60.0				11	Ss		100	7-13-20 (33)			-35.7
62.5			SILTY SAND WITH GRAVEL (SM) gray, moist, very dense. (Glacially Consolidated)							Driller noted transition to sand with gravel layer at 62.5 ft.	-38.2



Groundwater level not noted during drilling due to mud rotary wash Northing: 244753 Easting: 1258189

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PND - 2

FIGURE B-5.3

BOREHOLE LOG SALMON BAY GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT 20 40 60 80 / POCKET PEN (tsf) 1 2 3 4 / VANE SHEAR (tsf) 0.2 0.4 0.6 0.8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
65.0			SILTY SAND WITH GRAVEL (SM) gray, moist, very dense (Glacially Consolidated)								-40.7
67.5											-43.2
70.0				12	Ss		28	46-47-66 (113)		Terminated at 70.5 ft. 5/24/2012 11:13:00 AM	-45.7
72.5											-48.2
75.0											-50.7
77.5											-53.2
80.0											-55.7
82.5											-58.2
85.0											-60.7

Groundwater level not noted during drilling due to mud rotary wash Northing 244753 Easting: 1258189

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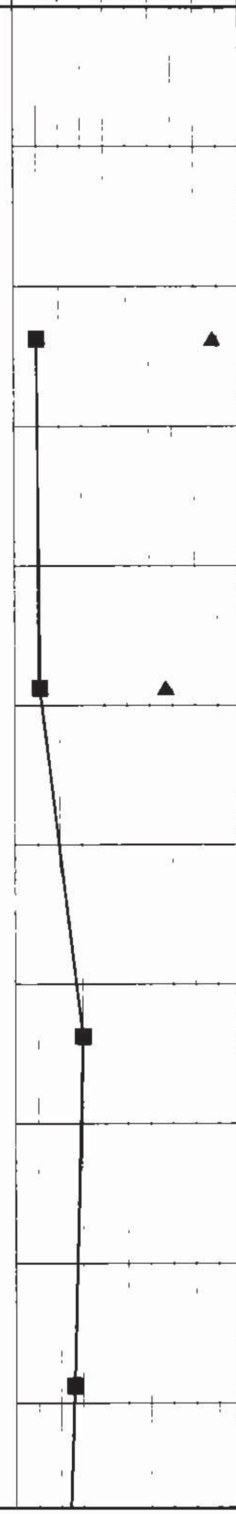
SALMON BAY MARINA
Seattle, Washington

PND - 2

FIGURE B-5.4

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH	COMMENTS Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
0.0			ACP, 2 inches							Start: 5/23/2012 10:55:00 AM	22.4
			GRAVEL (GP) wood debris noted (Fill)								
2.5			SANDY SILT (ML) gray mottled with orange, moist, stiff, (Fill)								19.9
5.0				1	Ss		84	2-4-6 (10)		VS = 0.88 tsf MC=20%, SA	17.4
7.5			CLAY (CL/ML) gray mottled with orange, moist, stiff, with occasional fine sand. (Fill)								14.9
10.0				2	Ss		89	4-5-6 (11)		VS = 0.67 tsf	12.4
12.5			CLAY (CL ML) gray, moist, very stiff								9.9
15.0				3	Ss		100	6-13-17 (30)			7.4
17.5											4.9
20.0				4	Ss		100	7-10-16 (26)			2.4

GRAPH legend: ■ BLOW COUNT ■ 20 40 60 80; ● POCKET PEN (tsf) ● 1 2 3 4; ▲ VANE SHEAR (tsf) ▲ 0.2 0.4 0.6 0.8



Groundwater level not noted during drilling due to mud rotary wash Northing: 244896 Easting: 1258242

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SALMON BAY MARINA
Seattle, Washington

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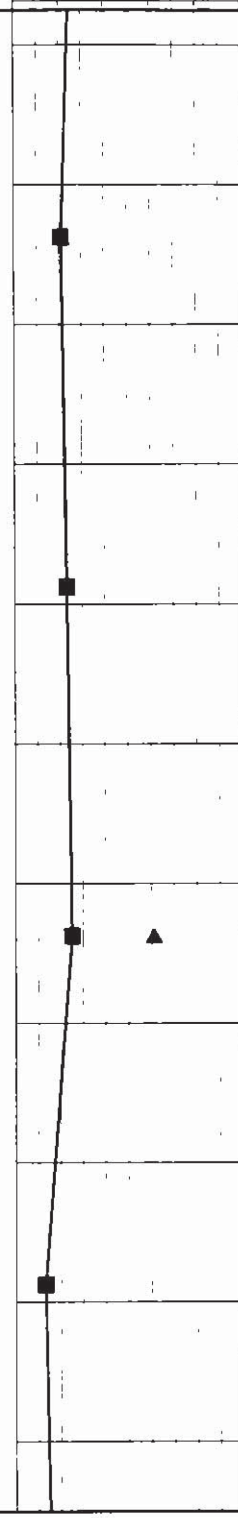
FIGURE B-6.1

BOREHOLE LOG SALMON BAY GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT 20 40 60 80; POCKET PEN (tsf) 1 2 3 4; VANE SHEAR (tsf) 0.2 0.4 0.6 0.8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			CLAY (CL/ML) gray, moist, very stiff								
22.5											-0.1
25.0				5	Ss		100	7-10-11 (21)			-2.6
27.5											-5.1
30.0				6	Ss		100	6-10-13 (23)			-7.6
32.5											-10.1
35.0			Occasional fine sand	7	Ss			11-13-12 (25)		VS = 0.61 tsf Percent recovery not recorded.	-12.6
37.5			CLAY (CL/ML) gray, moist, stiff to very stiff								-15.1
40.0				8	Ss		100	4-6-7 (13)			-17.6
42.5											-20.1



Groundwater level not noted during drilling due to mud rotary wash Northing: 244896 Easting: 1258242

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SALMON BAY MARINA
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PND - 3

FIGURE B-6.2

BOREHOLE LOG SALMON BAY GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT 20 40 60 80; POCKET PEN (tsf) 1 2 3 4; VANE SHEAR (tsf) 0.2 0.4 0.6 0.8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			CLAY (CL/ML) gray, moist, stiff to very stiff								
45.0				9	Ss		100	4-7-9 (16)			-22.6
47.5											-25.1
50.0				10	Ss		100	5-8-9 (17)			-27.6
52.5										Driller noted gravel at 53 ft.	-30.1
			CLAY WITH GRAVEL (CL) gray, moist, very stiff								
55.0											-32.6
57.5											-35.1
			CLAY (CL/ML) gray, moist, very stiff								
60.0				11	Ss		100	7-10-12 (22)			-37.6
62.5											-40.1

Groundwater level not noted during drilling due to mud rotary wash Northing: 244896 Easting: 1258242

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Project No 104101.02
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SALMON BAY MARINA
Seattle, Washington

PND - 3

FIGURE B-6.3

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT 20 40 60 80; POCKET PEN (tsf) 1 2 3 4; VANE SHEAR (tsf) 0.2 0.4 0.6 0.8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
65.0			CLAY (CL ML) gray, moist, very stiff								-42.6
67.5											-45.1
70.0			CLAYEY SAND (SC) gray, moist, dense, clay layers noted within sample up to 1 inch thick	12	Ss		100	15-21-22 (43)		Driller noted change in material at approx. 69.5 ft VS = 0.73 tsf	-47.6
72.5											-50.1
75.0											-52.6
77.5											-55.1
80.0			CLAY (CL) gray, moist, hard	13	Ss		0	16-24-30 (54)		Driller noted transition back to fine grained material at approx. 78 ft. Sampler ball seal may have been clogged causing loss of material during recovery Terminated at: 80.5 ft. 5/23/2012 2:52:00 PM	-57.6
82.5											-60.1
85.0											-62.6

Groundwater level not noted during drilling due to mud rotary wash Northing: 244896 Easting: 1258242

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Project No 104101.02
Date 12/13/12

SALMON BAY MARINA
Seattle, Washington

PND - 3

FIGURE B-6.4

Depth (feet)	Soil Description (Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information)	Number	Type	Recovery (%)	Penetration Blows per 6/Inch (per foot)	Comments (Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information)	Elevation (feet)
0.0	ACP, 3 inches					Start: 5 23 2012 8:20:00 AM	21.4
	SAND WITH GRAVEL (SP) wood debris noted (Fill)						
2.5	SILTY SAND (SM) brown, wet, very loose, wood debris noted (Fill)						18.9
5.0		1	Ss	100	1-0-1 (1)	MC=44%, SA	16.4
7.5							13.9
10.0	SILT (ML/CL) brown mottled with orange, moist, soft to medium stiff	2	Ss	100	2-2-2 (4)	VS = 0.73 tsf VS on bottom 1 2 of sample	11.4
12.5	CLAY (CL ML) gray, moist, very stiff						8.9
15.0		3	Ss	100	4-8-11 (19)	VS = 0.71 tsf	6.4
17.5							3.9
20.0		4	Ss	100	6-12-15 (27)		1.4

Graph legend: BLOW COUNT (20, 40, 60, 80); POCKET PEN (tsf) (1, 2, 3, 4); VANE SHEAR (tsf) (0.2, 0.4, 0.6, 0.8)

Groundwater level not noted during drilling due to mud rotary wash. Northing: 244702 Easting: 1258330

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Data Entry: CW/CMK
Checked: CMK
Project No: 104101 02
Date: 12/13/12

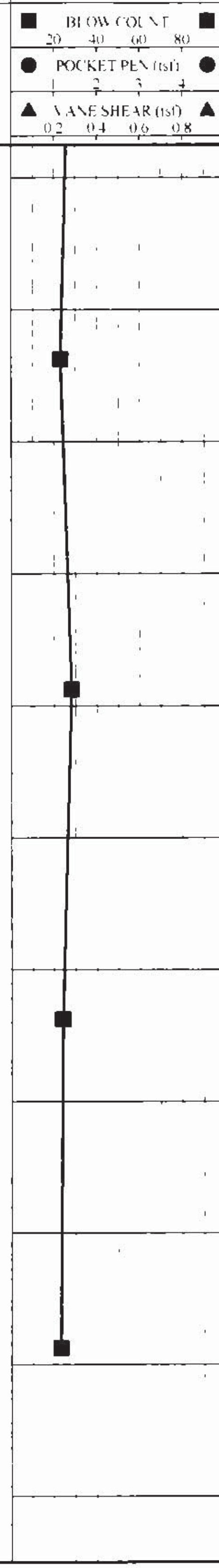
SALMON BAY MARINA
Seattle, Washington

PND - 4

FIGURE B-7.1

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			CLAY (CL/ML) gray, moist, very stiff							
22.5										-1.1
25.0				5	Ss		100	5-10-13 (23)		-3.6
27.5										-6.1
30.0				6	Ss		100	7-14-14 (28)		-8.6
32.5										-11.1
35.0				7	Ss			7-10-14 (24)	Percent recovery not recorded	-13.6
37.5										-16.1
40.0				8	Ss			7-10-13 (23)	Percent recovery not recorded Terminated at: 40.5 ft. 5/23/2012 9:40:00 AM	-18.6
42.5										-21.1

GRAPH



Groundwater level not noted during drilling due to mud rotary wash. Northing: 244702 Easting: 1258330

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Data Entry: CW/CMK
Checked: CMK
Project No: 104101.02
Date: 12/13/12

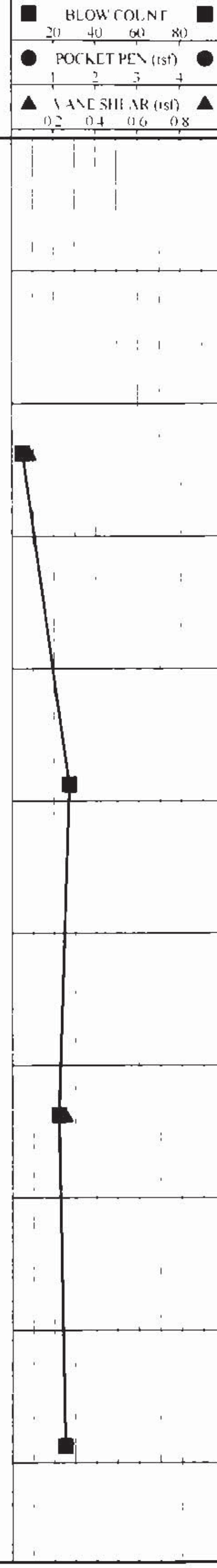
SALMON BAY MARINA
Seattle, Washington

PND - 4

FIGURE B-7.2

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6 Inch (per foot)	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
0.0			ACP, 1.5 inches						Start: 5/24/2012 1:05:00 PM	23.5
			GRAVEL WITH SAND (GP) brown, moist (Fill)							
2.5			CLAYEY SAND (SC) brown mottled with orange, moist, loose (Fill)							21.0
5.0				1	Ss		89	1-3-2 (5)	VS = 0.08 tsf	18.5
7.5			CLAY (CL/ML) gray, very stiff							16.0
10.0				2	Ss		95	5-10-17 (27)	Too stiff for VS	13.5
12.5										11.0
15.0			Occasional sand	3	Ss		100	6-9-13 (22)	VS = 0.25 tsf	8.5
17.5										6.0
20.0				4	Ss		100	6-12-13 (25)	Too stiff for VS	3.5
									Terminated at: 20.5 ft. 5/24/2012 1:40:00 PM	

GRAPH



Groundwater level not noted during drilling due to mud rotary wash. Northing: 244599 Easting: 1258228

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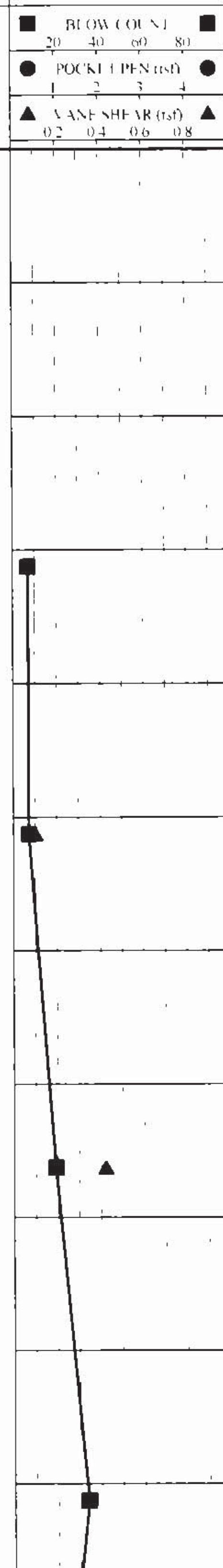
Date	12/13/12

SALMON BAY MARINA
Seattle, Washington

PND - 5

FIGURE B-8

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
0.0			ACP							Start: 5/21/2012 8:35:00 AM	22.0
			SILT (ML) brown, wet, soft, with trace organics. (Fill)							ACP thickness not recorded	
2.5										Very easy drilling to 5.5'	19.5
5.0											17.0
			SILTY SAND (SM) gray, moist, loose, fine sand. (Fill)	1	Ss		95	0-3-4 (7)			
7.5			CLAY (CL/ML) brown mottled with orange, moist, medium stiff, with occasional gravel. (Fill)							Wood debris at 8'	14.5
10.0			SANDY SILT (ML) gray mottled with orange, moist, loose, with occasional gravel. (Fill)	2	Ss		78	4-3-4 (7)		VS = 0.10 tsf	12.0
			SILT (ML/CL) gray, moist, very stiff to hard, with occasional sand								
12.5											9.5
15.0				3	Ss		100	5-8-11 (19)		VS = 0.42 tsf MC=32%, AL	7.0
17.5											4.5
20.0				4	Ss		67	6-17-17 (34)			2.0



Groundwater level not noted during drilling due to mud rotary wash Northing: 244433 Easting: 1258422

P N D ENGINEERS, INC.

Logged By: CW
Data Entry: CW/CMK
Checked: CMK
Project No: 104101.02
Date: 12/13/12

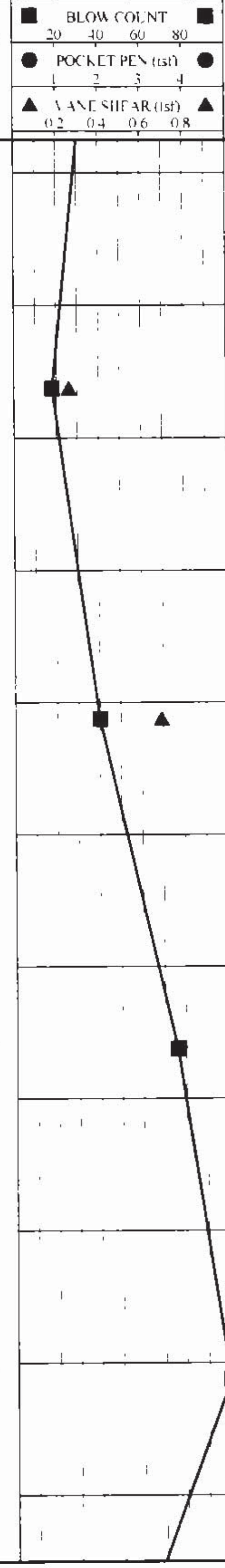
SALMON BAY MARINA
Seattle, Washington

PND - 6

FIGURE B-9.1

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			SILT (ML/CL) gray, moist, very stiff to hard, with occasional sand							
22.5										-0.5
25.0				5	Ss		95	11-9-9 (18)	VS = 0.26 tsf	-3.0
27.5			Gravel layer, 3 inches							-5.5
30.0				6	Ss		78	6-15-25 (40)	VS = 0.69 tsf	-8.0
32.5			Gravel							-10.5
35.0			Gravel layer, 1 inch	7	Ss		45	12-40-36 (76)		-13.0
			Gravel layer, 1 inch							
37.5										-15.5
40.0				8	Ss		100	35-99-85 (100+)		-18.0
42.5										-20.5

GRAPH



Groundwater level not noted during drilling due to mud rotary wash. Northing: 244433 Easting: 1258422

PND ENGINEERS, INC

Logged By	CW
Data Entry	CW/CMK
Checked	CMK
Project No	104101.02
Date	12/13/12

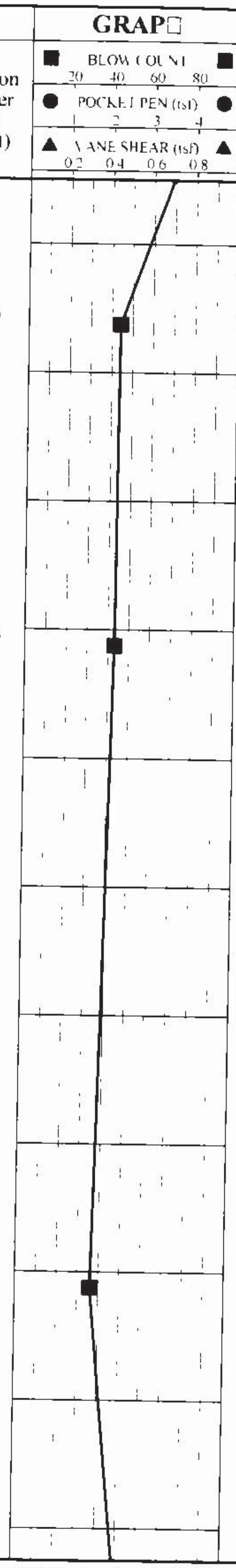
SALMON BAY MARINA
Seattle, Washington

PND - 6

FIGURE B-9.2

BOREHOLE LOG SALMON BAY.GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			FAT CLAY (CH) gray, moist, hard								
45.0				9	Ss		100	7-18-26 (44)		MC=26%; AL	-23.0
47.5			CLAY (CL/ML) gray, moist, hard, interbeded sand layers								-25.5
50.0				10	Ss		56	12-20-23 (43)		Recovery indicated soil pushed into sampler between rock (Gravel) Difficult drilling from 50-60 feet	-28.0
52.5											-30.5
55.0											-33.0
57.5											-35.5
60.0				11	Ss		100	10-17-19 (36)			-38.0
62.5											-40.5



Groundwater level not noted during drilling due to mud rotary wash Northing: 244433 Easting: 1258422

PND ENGINEERS, INC.

Logged By	CW
Data Entry	CW/CMK
Checked	CMK
Project No	104101.02
Date	12/13/12

SALMON BAY MARINA
Seattle, Washington

PND - 6

FIGURE B-9.3

BOREHOLE LOG SALMON BAY GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH: BLOW COUNT 20 40 60 80 / POCKET PEN (tsf) 1 2 3 4 / VANE SHEAR (tsf) 0.2 0.4 0.6 0.8	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
65.0			CLAY (CL/ML) gray, moist, hard, interbedded sand layers								-43.0
67.5											-45.5
70.0			SILTY SAND (SM) gray, moist, very dense, with occasional gravel	12	Ss		100	8-29-36 (65)			-48.0
72.5										Driller noted transition to sandy material	-50.5
75.0											-53.0
77.5											-55.5
80.0				13	Ss		100	33-49-52 (100+)		MC=21%; SA	-58.0
82.5			CLAY (CL) gray, moist, hard							Driller noted transition to clay.	-60.5
85.0											-63.0

Groundwater level not noted during drilling due to mud rotary wash. Northing: 244433 Easting: 1258422

P N D
ENGINEERS, INC.

Logged By	CW
Data Entry	CW/CMK
Checked	CMK
Project No	104101.02
Date	12/13/12

SALMON BAY MARINA
Seattle, Washington

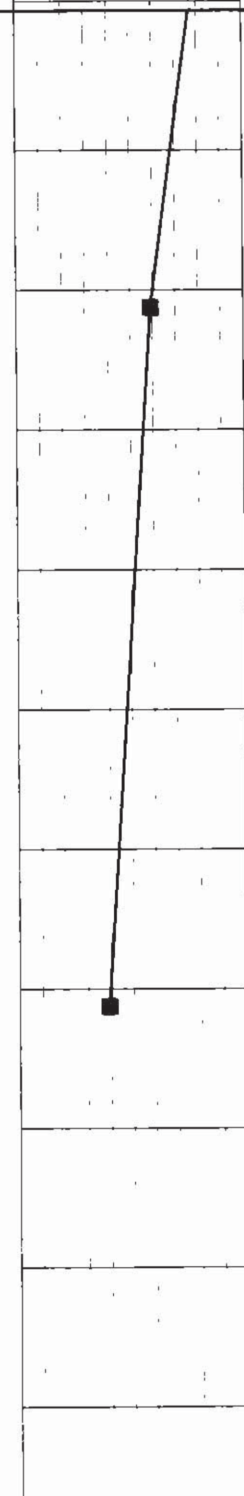
PND - 6

FIGURE B-9.4

BOREHOLE LOG SALMON BAY GPJ ©2012

Depth (feet)	Water Table	Graphic Symbol	SOIL DESCRIPTION: Soil Name, Color, Moisture Condition, Relative Density, Soil Structure, Mineralogy, Other Information	SAMPLES: Number	Type	Location	Recovery (%)	Penetration Blows per 6/Inch (per foot)	GRAPH	COMMENTS: Casing Depth, Drilling Rate, Fluid Loss, Drill Pressure, Tests, Instrumentation, Additional Information	Elevation (feet)
			CLAY (CL) gray, moist, hard								
87.5											-65.5
90.0				14	Ss		100	14-23-36 (59)			-68.0
92.5											-70.5
95.0											-73.0
97.5											-75.5
100.0				15	Ss		100	12-16-23 (39)			-78.0
										Terminated at: 101.0 ft. 5/21/2012 4:32:00 PM	
102.5											-80.5
105.0											-83.0
107.5											-85.5

GRAPH legend: ■ BLOW COUNT ■ 20 40 60 80; ● POCKET PEN (tsf) ● 1 2 3 4; ▲ VANE SHEAR (tsf) ▲ 0.2 0.4 0.6 0.8



Groundwater level not noted during drilling due to mud rotary wash. Northing: 244433 Easting: 1258422

P N D ENGINEERS, INC

Logged By	CW
Data Entry	CW/CMK
Checked	CMK
Project No	104101.02
Date	12/13/12

SALMON BAY MARINA
Seattle, Washington

PND - 6

FIGURE B-9.5

BOREHOLE LOG SALMON BAY GPJ ©2012

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Base provided by Reid Middleton, Dated 5/12/2017

Projection: WA State Plane, North Zone, NAD83, US Foot

Site Plan

Port of Seattle - Salmon Bay Marina Due Diligence
Seattle, Washington

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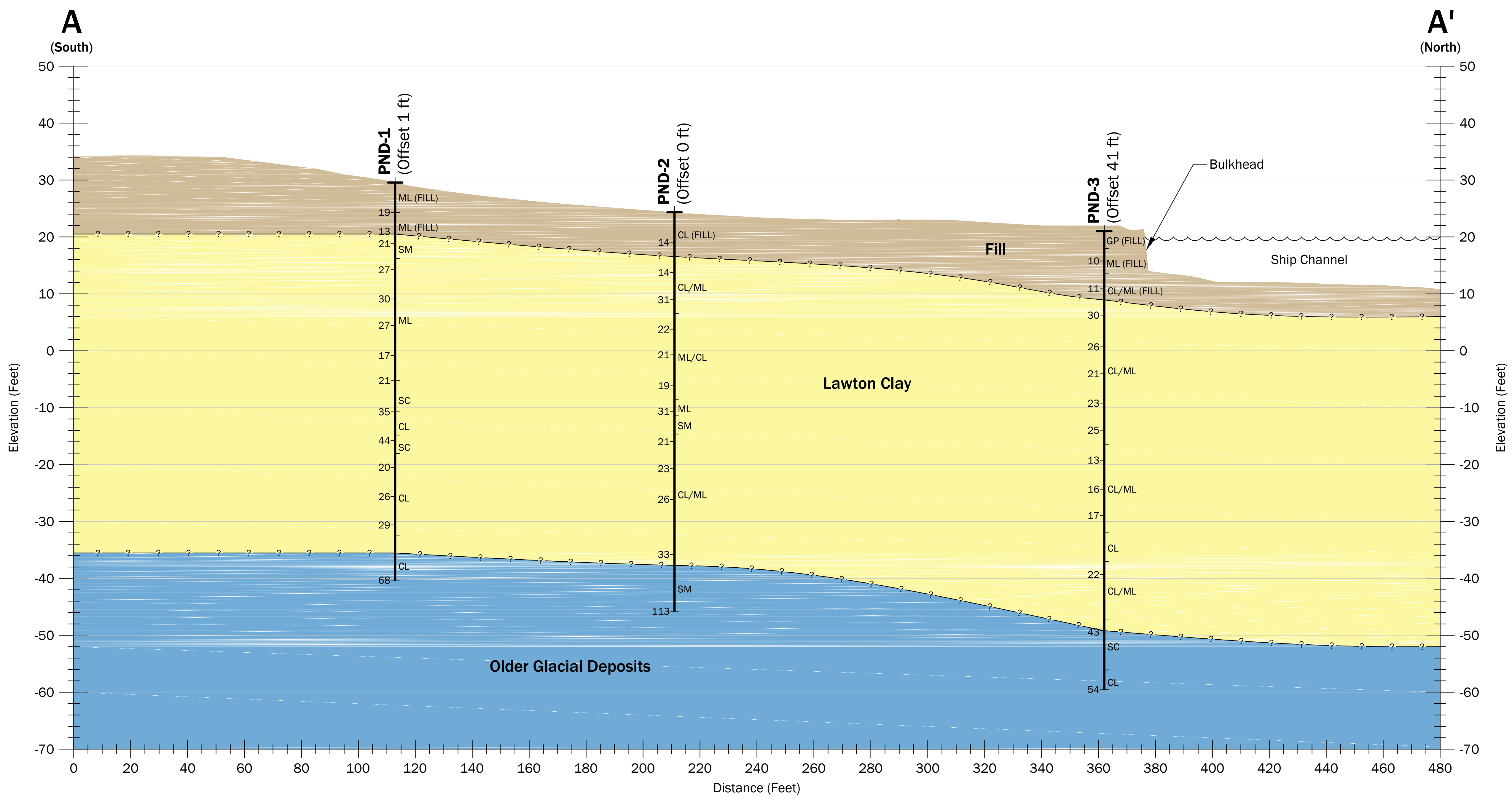
Figure 2

P:\0\0303128\CAD\00\Geotech\0030312800_F02_Site Plan.dwg TAB:Site Plan Date Exported: 05/30/17 - 15:51 by kcook



Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. The cross-sections are based on borings completed by PND.
3. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NAVD 88, unless otherwise noted.

Legend

GEI-X

Boring

Inferred Soil Contact

SM Soil Classification

Groundwater Measured in Piezometer

Blow Count

Fill

Lawton Clay

Older Glacially Consolidated Deposits

40 0 40
Horizontal Scale in Feet

20 0 20
Vertical Scale in Feet
Vertical Exaggeration: 2X

Cross Section A-A'

Port of Seattle - Salmon Bay Marina Due Diligence
Seattle, Washington

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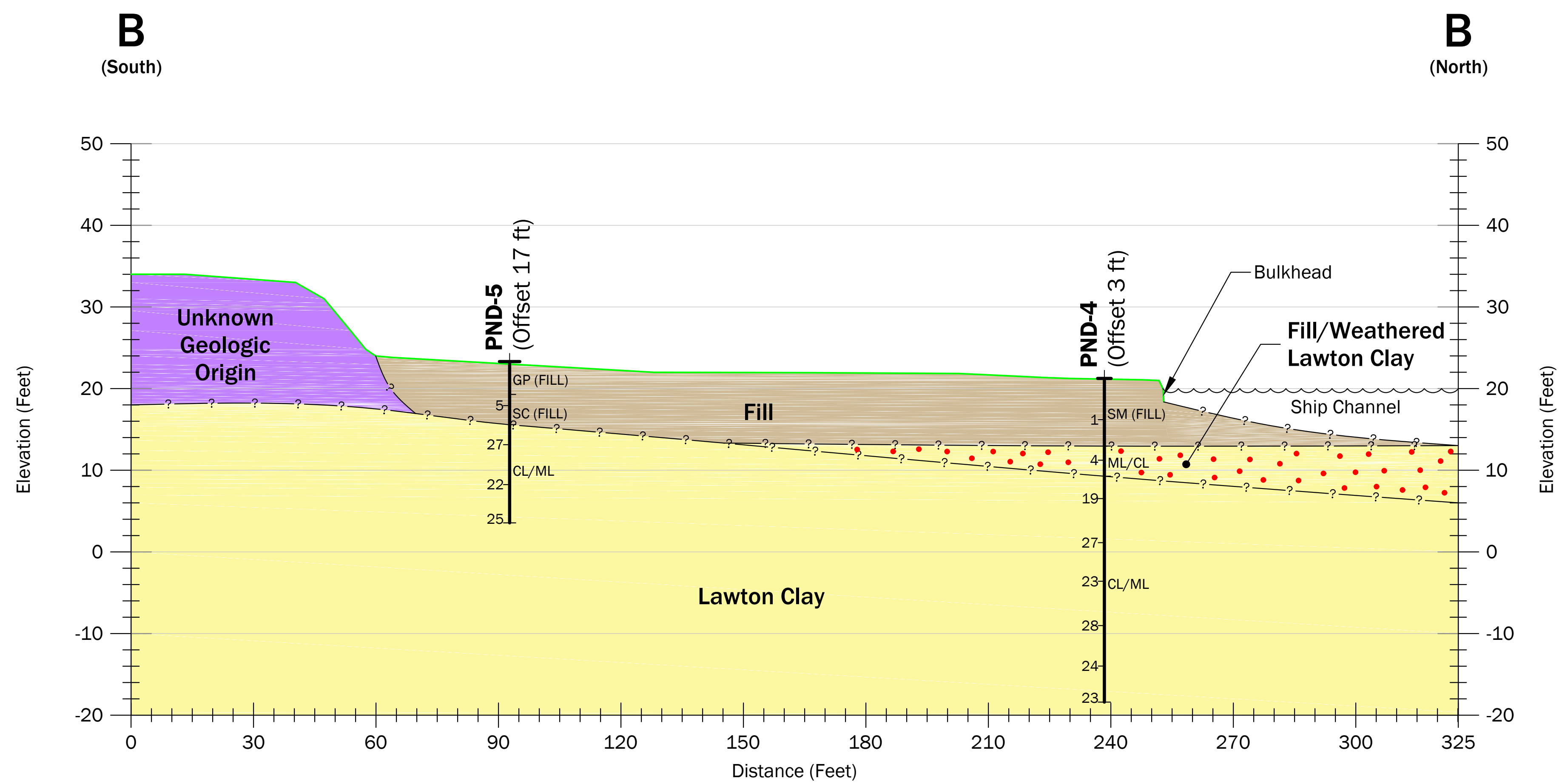
Figure 3

P:\0\0303128\CAD\00\Geotech\0030312800_F02_Site Plan.dwg TAB:Cross Section BB Date Exported: 06/02/17 - 11:24 by kcook



Legend

Boring

Inferred Soil Contact

Soil Classification

Groundwater Measured in Piezometer

Blow Count

Fill

Lawton Clay

Unknown Geologic Origin

Fill/Weathered Lawton Clay

Horizontal Scale in Feet (40 — 0 — 40)

Vertical Scale in Feet (20 — 0 — 20)

Vertical Exaggeration: 2X

Notes:

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. The cross-sections are based on borings completed by PND.
3. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Datum: NAVD 88, unless otherwise noted.

Cross Section B-B'

Port of Seattle - Salmon Bay Marina Due Diligence
Seattle, Washington

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Figure 4

COMMISSION
AGENDA MEMORANDUM

ACTION ITEM

Item No. 6d

Date of Meeting December 5, 2017

DATE: November 28, 2017

TO: Dave Soike, Interim Executive Director

FROM: David McFadden, Managing Director Economic Development
Jeffrey Utterback, Real Estate Development Director

SUBJECT: Salmon Bay Marina Acquisition and Development

Amount of this request: $18,579,120
Total estimated project cost: $30,479,120

ACTION REQUESTED

Request Commission authorization for the Executive Director to:

1. execute purchase sale agreement to acquire Salmon Bay Marina for $15,679,120;
2. execute an amendment to the existing Architectural/Engineering Services contract for Fisherman's Terminal for $2,000,000 for the planning and design of a 60,000 square foot light industrial building and related uplands site improvements;
3. invest $900,000 in covered moorage fire suppression systems, and marina start-up costs.

EXECUTIVE SUMMARY

Approximately 18 months ago the owners of Salmon Bay Marina (Draper Machine Works or "DMW") approached the Port about possibly purchasing the property. Salmon Bay Marina is an existing recreational marina immediately adjacent to the western edge of Fishermen's Terminal (FT). It contains five docks supporting 166 slips. The 5+ acre fee-simple site includes 2.23 acres in upland and 2.83 acres of fee-owned submerged land. An additional 1.73 acres of submerged land is leased from the Washington State Department of Natural Resources, for a total submerged site area of 4.56 acres.

The property has an approved Master Use Permit (MUP) for upland development of light industrial facilities. It also has a permit from the U.S. Army Corps of Engineers that will allow for the reconstruction and in-water dredging required for the replacement of docks D and E.

Port staff completed exhaustive due diligence on the property over a five-month period earlier this year. The property is reasonably well maintained with no serious deferred maintenance

issues. A Phase Two environmental assessment found brownfields contamination on some portions of the property.

Sellers (DMW) of Salmon Bay Marina have accepted the Port's offer of $15,679,120. This price reflects our original offer minus deductions for brownfields remediation:

Original Asking price from Seller	$18,400,000
Original price agreed in Letter of Intent (LOI)	$16,836,120
Port deductions for brownfields remediation	$1,157,000
Revised price	**$15,679,120**

Basis for Port Offer

- Port due diligence identified upland and in-water environmental contamination issues that may require remediation. The Port has reduced price based on remediation costs.
- The seller has provided the Port a full cost reduction for the uplands cleanup related to past MARCO shipyard contamination.
- Port is receiving all historic insurance policies from seller to cover potential future in-water claims. As a result, the Port is not receiving any indemnification from seller (nor are we indemnifying the seller).
- Seller remains potentially liable party for future environmental remediation.

Brownfields Assessment

Former MARCO Shipyard Site

- The cleanup area within the historical MARCO lease area is contaminated and may need to be remediated. Port consultants estimated that this work will cost $870,000.

In-Water Contamination (Docks D & E)

- The planned development of the property includes dredging of approximately 12,000 cubic yards (CY) of sediment. The upper 4-foot layer of sediments (approximately 4,000 CY) in the planned dredge area is contaminated and requires off-site disposal at a licensed landfill.
- The costs related to the handling and off-site disposal of these contaminated sediments is in addition to the normal costs we have assumed for the construction of the two newly permitted docks. The additional cost related to the in-water work under docks D & E is estimated at $287,000.

Upon acquisition, as part of the FT Expansion, the Port would use the MUP to build a 60,000 square foot light industrial building and related site improvements on the property's uplands. This facility would be leased out to maritime and manufacturing companies.

JUSTIFICATION

Salmon Bay Marina is adjacent to FT and presents a generational opportunity to purchase a property that is strategically located next to an important Port facility. The property's upland can be developed expeditiously and constructing and leasing a light industrial building would support maritime and manufacturing companies in the Ballard/Interbay area. An earlier Port study completed by Madison Bay found that:

- The Ballard Interbay industrial submarket has an extraordinarily low vacancy rate of 0.60% at the end of Q3-2015, below the Puget Sound industrial real estate market vacancy rate of 4.91%, and far below the national average of 6.70%.
- Suppliers and vendors supporting the [fishing] fleet have a strong preference to locate at or near Fishermen's Terminal, but lack of available space, high rents, and traffic are cited as obstacles to locating in the Ballard Interbay area.
- The suppliers and vendors prefer light industrial facilities with a warehouse/shop area, office space, and either grade-level or dock-high loading capabilities.
- The limited supply of industrial property in Seattle in general, and Ballard Interbay in particular, is resulting in rising rents and building sale prices.

The Port is in a position to relieve some of this pressure while supporting the fishing fleet and the maritime industrial sector by developing additional industrial space at Salmon Bay Marina.

Purchasing the property also protects industrial lands and helps sustain Seattle's working waterfront. There are many industrial properties in Seattle that are threatened by gentrification and zoning changes. Salmon Bay is a particularly important property though because it is adjacent to FT, one of our core commercial facilities supporting the fishing fleet.

As new light industrial facilities are added at FT over the next few years Salmon Bay adds capacity as FT gets denser. The additional parking, water access, and light industrial facilities at Salmon Bay Marina would complement long-term operations at FT and help to achieve the objectives recommended in the Port's 2016 FT Long-Term Strategic Plan.

There is also high demand for recreational boat slips. The Port operates four recreational marinas and Salmon Bay would complement these facilities. Port staff has developed significant core competencies for managing recreational marinas and the acquisition contemplates adding additional staff to operate SBM.

DETAILS

Upon Commission authorization staff would execute purchase sale agreement (PSA) with Salmon Bay Marina owners. The Sellers plan to use sale proceeds for a 1031 exchange so they have up to six months to find a suitable exchange property or investment. The PSA provides a minimum notice of 45 days to the Port when sellers have executed the 1031 exchange so the property will likely close sometime between March and July 2018.

Planning and design of the 60,000 square foot light industrial building and related uplands site improvements will begin after closing. These proposed facility improvements are related to the FT Long-Term Strategic Plan completed by the Port in 2016. As such, the Port proposes to utilize the services of Miller Hull Partnership, LLC, and the consultant currently under contract to perform planning and design for the FT development program improvements. The proposed amended value is $2,000,000 which increases the contract to a total of $3,500,000. In accordance with RCW 53.19.060, this serves as notification of the Port's intent to execute an amendment for more than 50% of the original contract value. This memorandum will be placed on file for public inspection at the Port's Bid Desk.

Staff to manage the marina would be added by midyear 2018. Maintenance and safety (sprinkler system) investments would be finished in 2018 or early 2019 depending on when the property actually closes.

Schedule

Activity	
Commission purchase/design/construction authorization	Q4 2017
Design start	Q3 2018
Construction start	Q3 2019
In-use date	Q3 2020

Cost Breakdown	This Request	Total Project
Property Acquisition (1)	$15,679,120	$15,979,120
Light Industrial Building Construction	$0	$11,600,000
Light Industrial Building and Uplands Improvements Planning & Design	$2,000,000	$2,000,000
Sprinkler Fire Suppression System (for existing covered docks)	$700,000	$700,000
Marina Start Up Costs	$200,000	$200,000
Total	$18,579,120	$30,479,120

(1) Total project cost includes previously authorized $300,000 for due diligence.

ALTERNATIVES AND IMPLICATIONS CONSIDERED

Option One: Do Nothing – Pass on Acquisition Opportunity

Cost Implications: None

Pros

- Retains Port capital for other priority projects and finance initiatives (ex. early repayment of debt – equivalent upfront cost provides $4 mil. per year cash flow with IRR of 4.2%).
- Avoids challenges and liabilities that come with acquiring and operating recreational marinas with aging infrastructure and covered moorage.
- Avoids environmental liabilities.

Cons

- Potential to lose this maritime land to a non-compatible and non-maritime /Industrial use.
- Loss of long term capacity for Fishermen's Terminal.
- Loss of ability to add needed light industrial space in the Ballard Interbay area at this site.
- Missed opportunity to lead or help with brownfields remediation and environmental enhancement at this site.

<u>Option Two: Purchase the marina : sub-options related to rebuilding or demolishing the docks</u>

Pros

- The purchase would protect maritime industrial land and provide needed space for local maritime and manufacturing companies.
- The property is adjacent to Fishermen's Terminal.
- Depending on development scenarios, the property generates the following Internal Rate of Return (IRR)
    - 4.09% with rebuilt docks.
    - 5.03% with demolishing the docks.
- The property would support new job creation. A new 60,000 square foot light industrial facility typically supports 100-120 maritime/manufacturing jobs.
- The property provides the Port a brownfields remediation opportunity.
- The Port has experience operating recreational marinas.
- The property's shoreline <u>may</u> provide a long-term opportunity for habitat restoration.
- Environmental liabilities are balanced by reduction in purchase price and assignment of historic insurance policies.

Cons

- Purchasing a recreational marina is not a Century Agenda priority.
- Buying an aging recreational marina could bring unforeseen maintenance costs and create constituent issues due to the need to raise rates to support needed improvements.
- Roof covered moorage brings additional risk of fire, snow/weather damage, and collisions.

- The acquisition and development uses Port capital at a time when there are other competing needs and not a lot of long term financial capacity.
- The property will not support Fishing Vessels. The cost of dredging and building commercial docks for these commercial vessels is prohibitive.

Option Three: Execute a Right of First Offer

Pros

- Retains some control over property if it goes to market.
- Potential to save money IF market is soft or no offer made.
- Saves Port capital for some time (unspecified).

Cons

- Potential to lose property to buyer willing to pay more than Port.
- May impact value of/feasibility for uplands building.
- Sellers may reject Right of First Offer.

FINANCIAL IMPLICATIONS

Annual Budget Status and Source of Funds

The Salmon Bay acquisition and development project is included in the 2018 Draft Plan of Finance under CIP #C800993. The Project will be funded by the tax levy.

Financial Analysis and Summary

Initial project cost for analysis*	$30,479,120
Business Unit (BU)	Maritime: Recreational Boating / Portfolio Management
Effect on business performance (NOI after depreciation)	Revenue, Expense, and Depreciation is planned to stabilize at the end of year 6 with NOI after Depreciation of approximately $1.16M.
IRR/NPV (if relevant)	4.09% IRR based on rebuilding docks
CPE Impact	N/A

*IRR calculation includes additional estimated future costs of ownership – see below for detail.

Future Revenues and Expenses (Total cost of ownership)

In addition to the initial capital investment included in this authorization request, the financial analysis includes an estimated $6.31 million (2017 dollars) for reconstruction of docks D and E within the next five years and $13.91 million (2017 dollars) for rebuilding docks A, B, and C in twenty years. The analysis also includes $1.95 million (2017 dollars) of re-investment in the

building in thirty years as well as a residual value of $37 million for the building and marina. These additional capital expenditures will require future authorization. The financial analysis includes revenues and expenses associated with the marina and the industrial building. Key operating assumptions include revenues from the flex industrial building of $24 per square foot and 95% occupancy reflecting the current strong market and staff and maintenance operating expenses for the marina; revenues and expenses are forecast to grow at 2.5% per year.

ADDITIONAL BACKGROUND

Among the existing boats moored at Salmon Bay Marina, approximately 10% of these vessels are derelict. These boats are not seaworthy and may not have insurance. The Purchase Sales Agreement requires the Seller to remove these vessels prior to the Port taking position of the property. We are also requiring Seller to remove all houseboats as a condition of sale.

ATTACHMENTS TO THIS REQUEST

(1) Presentation slides
(2) Purchase Sale Agreement
(3) Due Diligence Summary
(4) Salmon Bay Comprehensive Analysis and Options

PREVIOUS COMMISSION ACTIONS OR BRIEFINGS

None

Cornerstone ARCHITECTURAL GROUP

INVESTIGATION MEMO
Salmon Bay Marina Roof
Roof Condition Memo -
Covered Moorage A, B & C
Seattle, WA

To: Tim Leonard, Project Manager, Port of Seattle

From: Andre Coppin, Building Envelope Consultant, Cornerstone Architectural Group

May 1st, 2019

RE: Investigation & Condition Memo

Introduction:

Cornerstone Architectural Group was onsite on April 17th, 2019 from approximately 10am to 1:00pm, in order to provide a limited visual assessment of the existing metal roof system at areas clouded in diagram 1 below (*roofs A3, B3, B4, C3 & C4 – See plan attached*). Team members onsite were; John Mauney – Building Envelope Technologist (Cornerstone Architectural Group); Peter Brown – Structural Engineer (PSM Consulting Engineers) and Damian Bingham – Mechanical Engineer (FSI Consulting).

Each team member was tasked with reviewing a specific area of work as follows:
Cornerstone – Metal roof condition (document and photograph condition)
PSM – Structural integrity of the support system for the roof and potential skylights
FSI – Potential requirements for sprinkler system

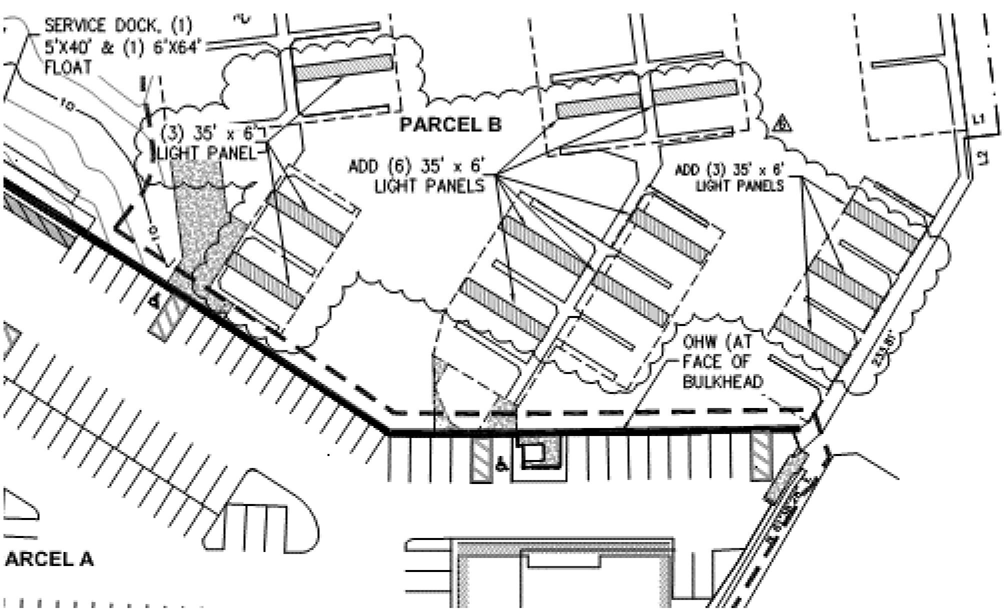


Diagram 1

Scope of Work:

The intended scope of work is the installation of skylights as indicated by the shaded/hatched areas in the clouded area in diagram 1 above.

Note: We believe these notes to be an accurate summary of discussions and conclusions. Please notify the writer of any additions or corrections.

Synopsis of Findings:

- The existing roof system is beyond the expected life span and is showing signs of current leaks and poses a life safety hazard due to the level of rusting and degradation observed.
- The structural system of the roof is compromised and does not meet current code.
- Per the fire code, our team is not finding where a sprinkler system is required.

Categorized findings:

A. Roofing –
    1. Fastener connection failure
    2. Failed attempted sealant repair at EACH fastener
    3. Severe roof deflection which leads to ponding water between each purlin
    4. Light gauge metal panels
    5. 36-inch spaced purlins (insufficient for metal roof of this type)
    6. Attempted misguided repairs (sealant of various types. Should be tested for asbestos)
    7. Possible water damage at failed fasteners

B. Structural –
    1. Twisted beams (load transfer inadequate)
    2. Long horizontal cracks in beams
    3. No visible connection between column and purlins (need to verify if tenon exist)
    4. Metal roof is not structural

C. Mechanical –
    1. Due to the nature and use of the moorage, our team recommends installation of the dry standpipe system for increased safety. We will verify with SDCS.

Determination Statement:

The roof system at the three roofs has failed due to outdated design, lack of maintenance and damage from over loading of snow or persons walking on the roof.

Overarching Constraints:

- Potential work over water (special insurance and bonding required)
- Potential work over live aboard boat owners and boats
- Inadequate structural connections between purlins and beams and columns
- Damaged sheet metal roofing (ponding and rusted fasteners)
- Damage/lack of positive connection between metal roof panels and purlins that can lead to blow-off and life safety issues
- Inadequate working surface due to minimum gauge of roofing (26 gauge)

Options:

A. Option 1 – Replace roof and install skylights
B. Option 2 – Install sky-lights in existing roof system (***We DO NOT recommend this option due to the potential for life safety issues during any construction work and general safety for the occupants & general public***)

Recommendation

Our team recommends option 1 due to the following factors –

1. Potential life safety concerns with lack of positive connect between metal roofing and support structure. Basically, the roofs could blow-off and cause harm to the public due to the fastener issues outlined above.
2. Removal of the existing metal roof will provide the opportunity to repair/replace deteriorated framing

Photos:

Photo 1: Sealant at EVERY fastener

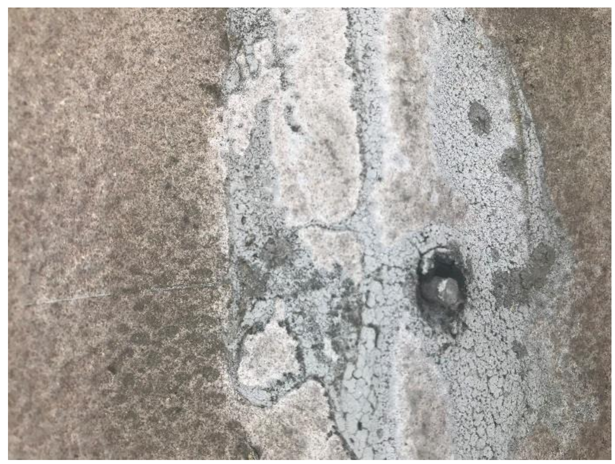


Photo 2: Typical fastener

Photo 3: Fastener backout/Split

Photo 4: Failed sealant repair at seam

Photo 5: Fastener backout

Photo 6: Ponding/Deflection between Purlins

Photo 6: Goose in a pond

Photo 7: Split beam

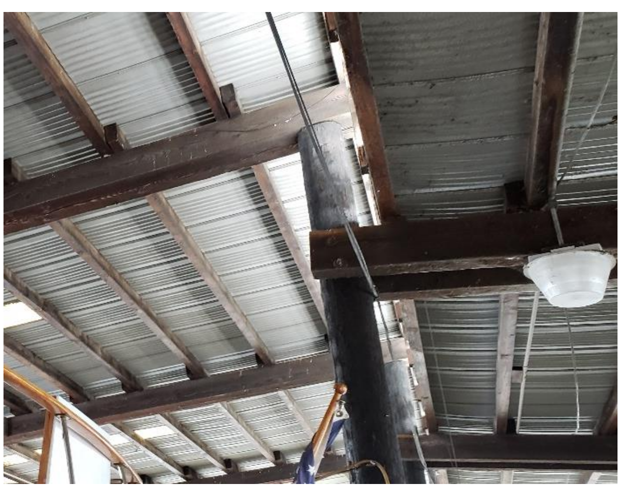


Photo 8: No visible connection at column/beam

Photo 9: Partial view of Roof A

Budget Estimates and Scope of Work

Based on our review and discussion with the Port on Friday April 26th, please find below two estimates based on the following scope of work –

a. Scope of Work
   i. Replace existing metal roofing
   ii. Install skylights per agreement with EPA
   iii. Upgrade structural connections
   iv. Add fire protection system

Note: Our team is recommending this scope of work due to the current condition of the roofs reviewed.

Budget Estimate 1: Based on the original scope of work (replace only the roofs where skylights are to be installed) our Preliminary estimate is as follows:

A. Replace Metal Roofing	26,000 SF @ $20/SF	$520,000
B. Install Skylights	3,250 SF @ $60/SF	$195,000
C. Upgrade structure/repair beams	26,000 SF @ $7/SF	$182,000
D. Install Fire Sprinkler System	26,000 SF @ $10 /SF	$260,000
E. Sub-total Construction Cost		$1,157,000
F. Overhead & Profit	25% of E	$289,250
G. Over Water Delta Increase	10% of E	$115,700
H. Construction Cost (E+F+G)		$1,561,950

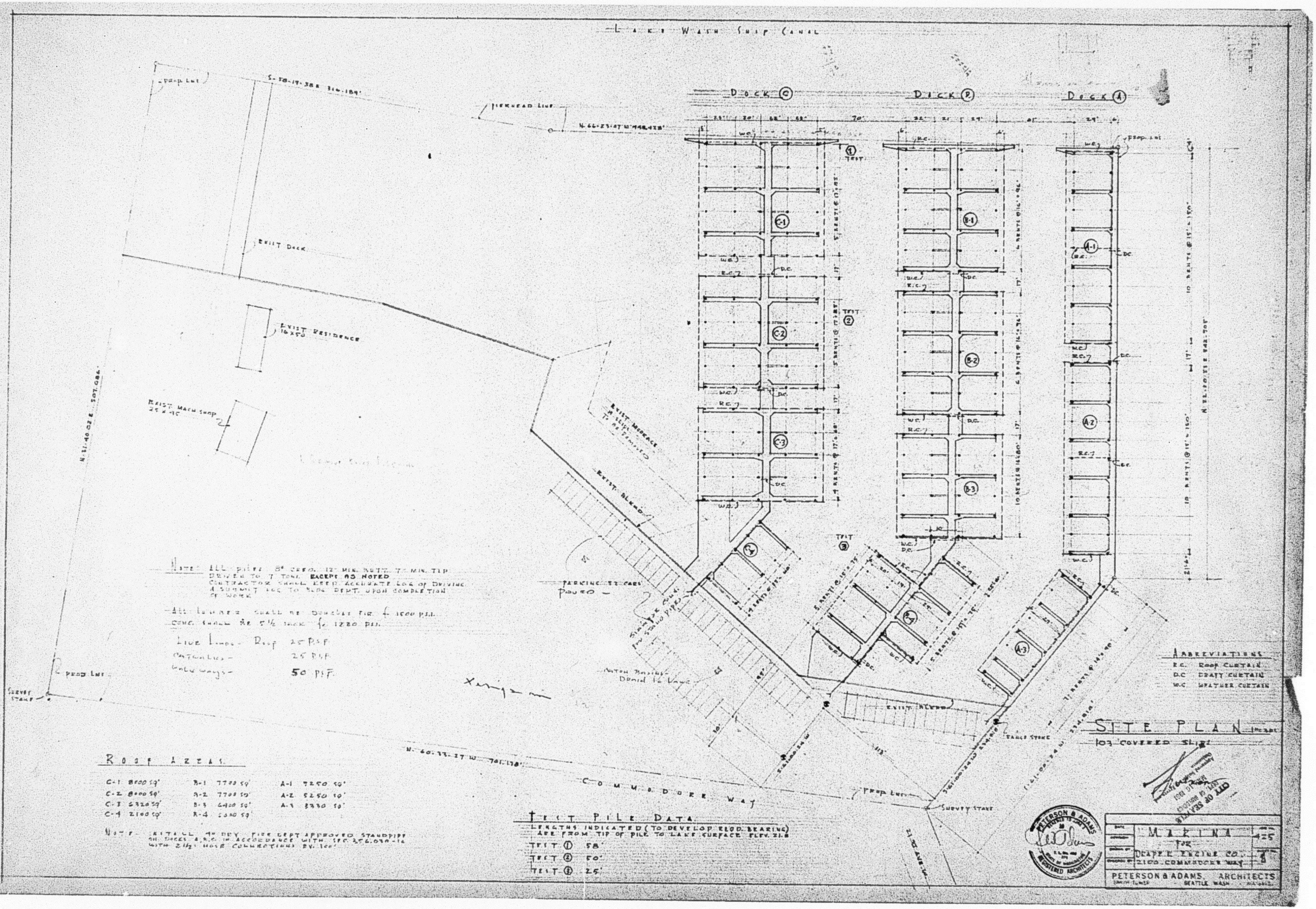
Budget Estimate 2: Based on the review of the 5 roofs for the installation of the skylights and extrapolating for the rest of the marina, our Preliminary estimate is as follows:

A. Construction Cost	63,000 SF @ $60.08/SF	$3,785,040

Note: $60.08 is the overall SF cost for the work in Estimate 1 above

Caveats to Estimates

1. Our team only reviewed the 5 roofs (*A3, B3, B4, C3 & C4)* to receive skylights. Moving forward we will need to review all other roofs to determine the specific level of repairs required.
2. Structural and mechanical estimates are our team's best guess based on experience. However, SDCS may require additional work to overcome the age of the structures and to bring them up to code.
3. Replacement of potential deteriorated structural members will lead to increased cost.



LAKE WASH SHIP CANAL
DOCK C
DOCK B
DOCK A
PIERHEAD LINE
PROP. LINE
EXIST. DOCK
EXIST. RESIDENCE 16x50
EXIST. MACH. SHOP
EXIST. BLKHD.
C-1
C-2
C-3
C-4
B-1
B-2
B-3
B-4
A-1
A-2
A-3
TEST 1
TEST 2
TEST 3
W.C.
R.C.
D.C.
PARKING
SURVEY STAKE
RANGE STONE
COMMODORE WAY
N. 60-33-37 W. 701.178'
NOTE: ALL PILES 8" CREO. 12" MIN. BUTT 7" MIN. TIP
DRIVEN TO 7 TONS EXCEPT AS NOTED
CONTRACTOR SHALL KEEP ACCURATE LOG OF DRIVING
& SUBMIT LOG TO BLDG. DEPT. UPON COMPLETION
OF WORK
Live Loads - Roof 25 P.S.F.
50 P.S.F.
ROOF AREAS
C-1 8000 SQ'
C-2 8000 SQ'
C-4 2100 SQ'
B-1 7700 SQ'
B-2 7700 SQ'
B-3 6400 SQ'
A-1 7250 SQ'
A-2 5250 SQ'
A-3 3330 SQ'
TEST PILE DATA
LENGTHS INDICATED (TO DEVELOP REQD. BEARING)
ARE FROM TIP OF PILE TO LAKE SURFACE ELEV. 21.8
TEST 1 58'
TEST 2 50'
TEST 3 25'
ABBREVIATIONS
R.C. ROOF CURTAIN
D.C. DRAFT CURTAIN
W.C. WEATHER CURTAIN
SITE PLAN
103 COVERED SLIPS
PETERSON & ADAMS
REGISTERED ARCHITECTS
CITY OF SEATTLE
MARINA
FOR
2100 COMMODORE WAY
PETERSON & ADAMS, ARCHITECTS
SEATTLE, WASH.

Port of Seattle

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INSPECTION REPORT

DATE: **November 4, 2022**

TO: **Danny Good, WPM Facilities Project Manager**

FROM: **Taesan Hose P.E. S.E., Phoebe Williams**

SUBJECT: **SaBM Covered Moorage Docks A, B, & C – Roof Structure Condition Assessment**

INTRODUCTION

Port of Seattle (POS) Engineering visited Salmon Bay Marina (SaBM) on 9/12/2022 at the request of Danny Good, from Waterfront Project Management (WPM), to perform a structural condition assessment of covered moorage docks A, B and C. WPM requested a primary focus on:

1. Identifying structural deficiencies on the covered moorage roof structure, with immediate attention towards structural connections between piles, girders, and purlins.
2. Detail sketches to address inadequate connections between existing roof members.
3. Recommendations on the existing roof capacity as it relates to repairing and/or replacing the failing roof panels.

The scope of this assessment involves the use of visual inspection methods to determine the condition of the existing roof structure. No mechanical observation methods (drilling, sounding, etc.) are included in this scope. In addition to visual observation, measurements were taken of key roof elements to determine the general adequacy of the existing members to support existing dead and snow loads.

Figure 1 – Plan View of Salmon Bay Marina (SaBM)

BACKGROUND

Salmon Bay Marina is located along the Lake Washington Ship Canal in Seattle, Washington, Northwest from Fishermen's Terminal. The existing site consists of upland paved areas and small service buildings, a vertical bulkhead, three fixed covered moorage docks (A, B, and C), and three linear floating docks (D, E, and F). Covered moorage docks A, B, and C were constructed circa 1960. The structure consists of timber walkways and a timber supported roof, both of which are supported by continuous creosote timber piles.

The purchase of the SaBM property by the Port of Seattle in 2018 included an approved permit for site improvements, including allowances for the Port of Seattle to improve the property. Studies in 2018 included a comprehensive dive investigation by Echelon Engineering Inc and a pre-purchase general assessment by the Port of Seattle ("Salmon Bay Marina Due Diligence Effort Underwater Inspection, Seattle, Washington" report dated June 2017).

In 2019, Cornerstone Architectural Group, in partnership with PSM Consulting Engineers, provided a limited visual assessment of the existing metal roof system on portions of Docks A, B, and C (see **Figure 2)** for the intention of skylight installations. Cornerstone's assessment determined "the roof system at the three roofs has failed due to outdated design, lack of maintenance, and damage from overloading of snow or persons walking on the roof." Cornerstone ultimately did not recommend installing skylights in the existing roof system "due to the potential for life safety issues during any construction work and general safety for the occupants & general public."

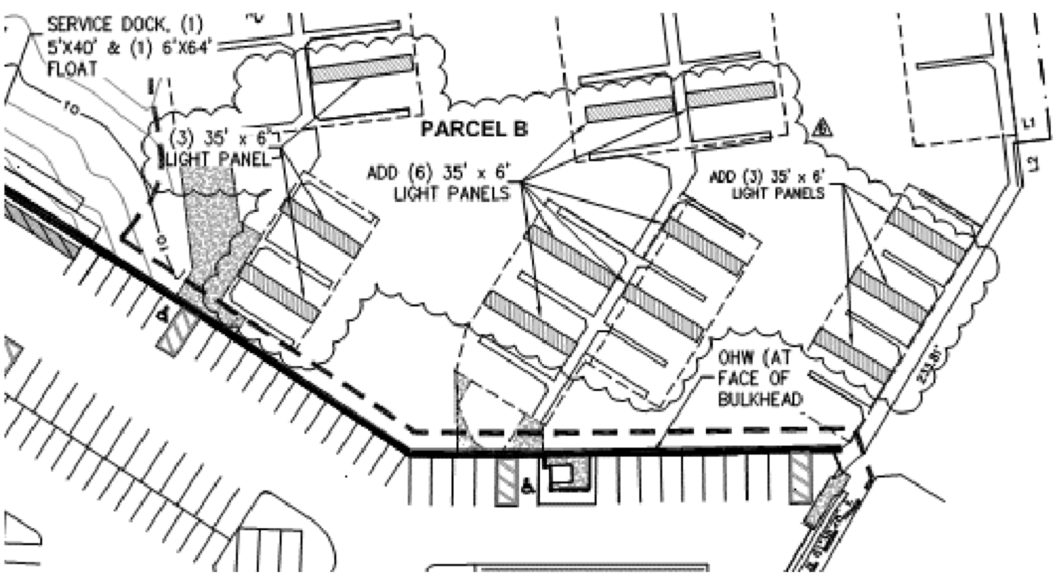

Figure 2 – Extent of Cornerstone's Visual Assessment at Docks A, B, & C (clouded area)

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SITE VISIT FINDINGS

Two Port of Seattle engineers conducted a site visit on Monday, September 12th, 2022. During this site visit, each of the three covered docks (A, B, and C) were visually inspected with a focus on the timber roof structure. In addition to the visual inspection, several representative photos (see **Figures 3 through 10**) and measurements were taken in order to analyze key members and connections of the roof structure for dead and snow loads.

In general, the roof girders and joists are in **Good condition.** Occasional signs of splitting and warping were observed in the girder members (see **Figures 9 and 10**). Moderate weathering can also be seen at the ends of the girders where they are more exposed to rain and sun but does not appear to affect the primary spans of the girders.

The following deficiencies in docks A, B, and C were determined from the site visit and the follow-up analysis:

1. No code-compliant lateral system is evident for either a wind or seismic event. Based on the Echelon Engineering report (#17-2517, June 2017), untreated battered piles occur at deeper water sections of the structure and tie in below the timber walkway. At the roof level, only cantilevered piles support incidental lateral loads.
2. Girder members (generally E-W) range from 100% to 180% of their design capacity (with the exception of adequately sized edge members at the edge of each roof). See **DCR Heat Map**.
3. Joists members (generally N-S) range from 100% to 150% of their design capacity. See **DCR Heat Map**.
4. Thru-bolt connections from large double-girder members to the piles are inadequate. See **DCR Heat Map**.
5. Where girders rest on top of existing piles, no visible connection can be seen.
    a. Example of this issue: In July of 2018, a pile was impacted by a boat, which lead the girder above to be shifted. Once shifted, the girder was only bearing on approximately 40% of the existing pile. No indication of a hidden dowel connection was observed after the pile shifted. Port Engineering addressed the repair by shifting the pile back under the girder and using channels to create a positive attachment. See **Figure 12**.
6. Joists have an inadequate connection to the girders for uplift forces in a wind event. Additionally, girders resting on top of piles have an inadequate connection for uplift forces.
7. Intermittent twisting and horizontal splitting of girders.

FUTURE REPLACEMENT OF METAL ROOF

Port Engineering understands that the existing metal roof is well passed its service life and needs repair or replacement.

The majority of existing girder and joist members are inadequate for current Code-based gravity loads (see **DCR Heat Map**). Connection retrofits will improve the basic safety of the structure but do not change the inadequacy of the primary roof-supporting members for Code-based dead and snow loads.

In addition to the general inadequacy of the roof to support Code-based gravity loads, the canopy structure has no identifiable lateral system other than cantilever piles. Any added weight will therefore have an adverse effect to both the gravity and lateral system, both of which do not comply with existing Code-based loads or design.

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For these reasons, there is no justification for adding significant dead loads to the existing roof system (such as a metal roof or foam/pvc overlay).

CONCLUSIONS AND RECOMMENDATIONS

Deficiencies in both the existing lateral system and the undersized roof girders/joists cannot be addressed without triggering significant modifications to the structure. For example, replacing the existing girders and joists with larger members would add significant weight and trigger Code-compliance requirements for the structure below, which could not be met without installing a Code-compliant lateral system and possibly adding piles.

One key issue that can be addressed immediately is addressing the deficient connections between the roof supporting timber members. These proposed retrofit connections address a lack of mechanical attachment between members, connections to resist wind uplift forces, and additional capacity where existing connections are under-designed. While these retrofits will increase the safety of the existing roof structure, they do not address the undersized girders/joists or the lack of a sufficient lateral system. See the attached **Sketches (SK's)** for the common condition retrofits:

1. **SK1** – Typical girder-to-pile channel connection where the girder width is less than or equal to the pile diameter
2. **SK2** – Typical girder-to-pile bent-plate connection where the girder width exceeds the pile diameter
3. **SK3** – Typical double girder thru-bolt connection retrofit, Option A
4. **SK4** – Typical double girder thru-bolt connection retrofit, Option B
5. **SK5** – Typical joist to girder connection retrofit

Regarding the failing roof panels, Port Engineering views the following options as possible solutions:

1. Entirely remove the existing roof panels and replace the panels with a new system weighing less than or equal to the existing roof panels.
2. Use an epoxy (or similar) coating that adds negligible weight to the existing panels. This option will only address leakage issues, however, and will not change the sagging of existing panels or the lack of safety with accessing the roof.
3. Remove the roof cover all-together, converting the existing covered moorage to uncovered moorage. This would include removing all roof panels, girders and joists, and cutting down existing piles as required to maintain the existing timber walkways.

Port Engineering views any form of overlay (e.g., metal roof panels or foam w/ pvc covering) as an unacceptable option due to the added gravity and seismic loads.

All of these connection upgrades (SK's) and roof panel options require verification with Port Environmental and/or the Seattle Department of Construction and Inspection for any Code-related permitting requirements.

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If any notable or abrupt change is observed in the covered mooring structure at Docks A, B, and C, or if you have any questions concerning this report, please contact Port of Seattle Engineering.

Sincerely,

Phoebe Williams, EIT
Taesan Hose, PE, SE
Port of Seattle, Engineering

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Fig 3 – General Roof Framing at Dock A

Fig 4 – General Roof Framing at Dock B (Dock C Similar)

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Fig 5 – Typical Girder Connections at Dock C Roof Ridge (Dock B Similar)

Fig 6 – Typical Girder Bearing on Pile Without Visible Connection

Fig 7 – Mechanical Equipment and Girder Connection Retrofit

Fig 8 – Girder to Pile Retrofit

Fig 9 – Twisting/Warping of Girders

Fig 10 – Splitting and Weathering at Exposed Girder End

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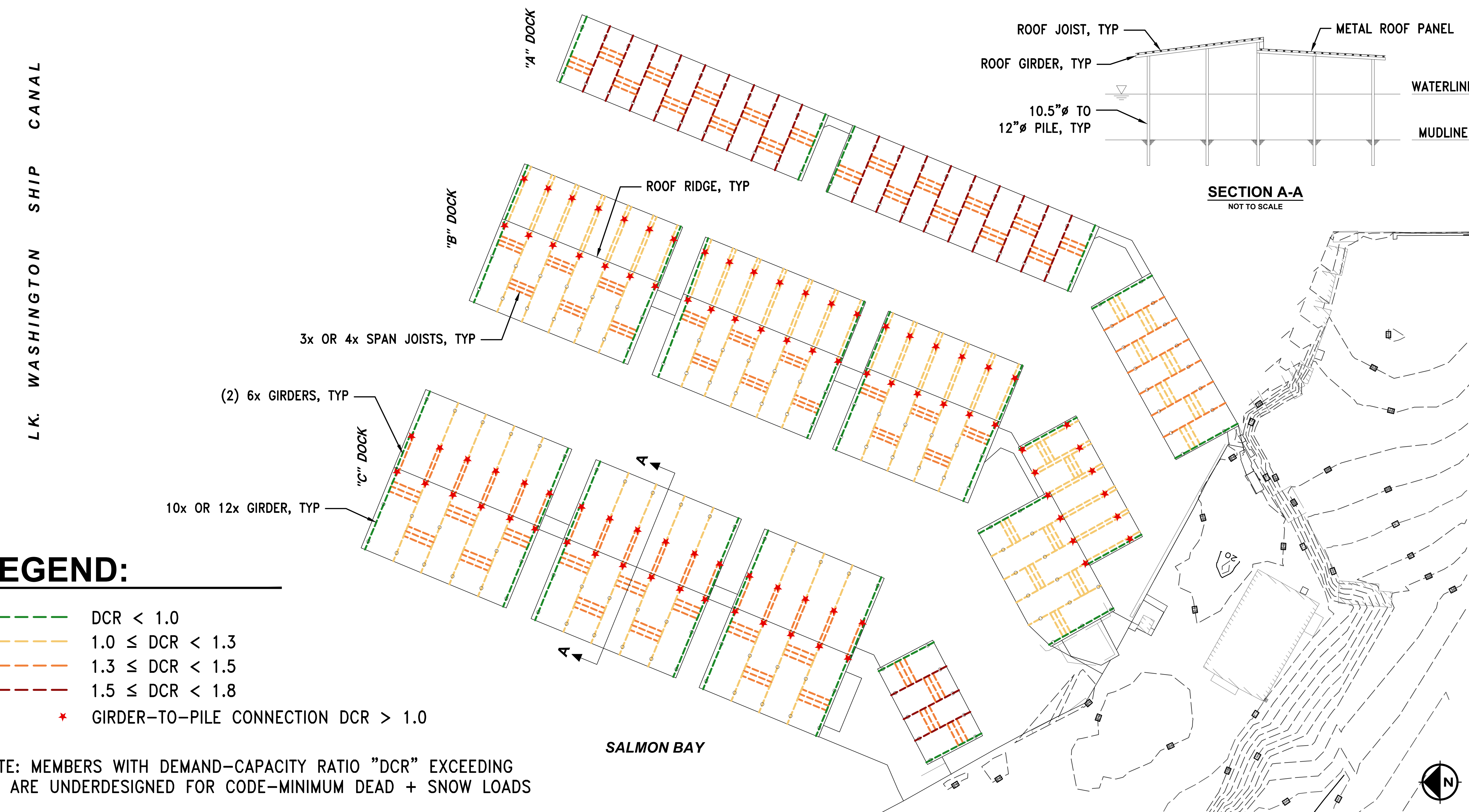
Fig 11 – 2018 Boat Impact Incident with Less Than 50% Bearing at Top of Pile and No Visible Mechanical Connection (Repaired Shortly After Incident with Channels and Thru-Bolts)



LEGEND:

- – – – – – (green) DCR < 1.0
- – – – – – (yellow) 1.0 ≤ DCR < 1.3
- – – – – – (orange) 1.3 ≤ DCR < 1.5
- – – – – – (red) 1.5 ≤ DCR < 1.8
- ★ GIRDER–TO–PILE CONNECTION DCR > 1.0

NOTE: MEMBERS WITH DEMAND–CAPACITY RATIO "DCR" EXCEEDING 1.0 ARE UNDERDESIGNED FOR CODE–MINIMUM DEAD + SNOW LOADS

REVISIONS			
NO.	DATE	BY	DESCRIPTION

PROJECT MANAGER:
PROJECT ENGINEER: TAESAN HOSE
DESIGN ENGINEER: PHOEBE WILLIAMS
DRAFTER: PLW
SCALE: NTS
DATE: 10/17/2022
CHECKED/APPROVED BY: TAESAN HOSE

Port of Seattle **SALMON BAY MARINA**

PROJECT: **SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT**

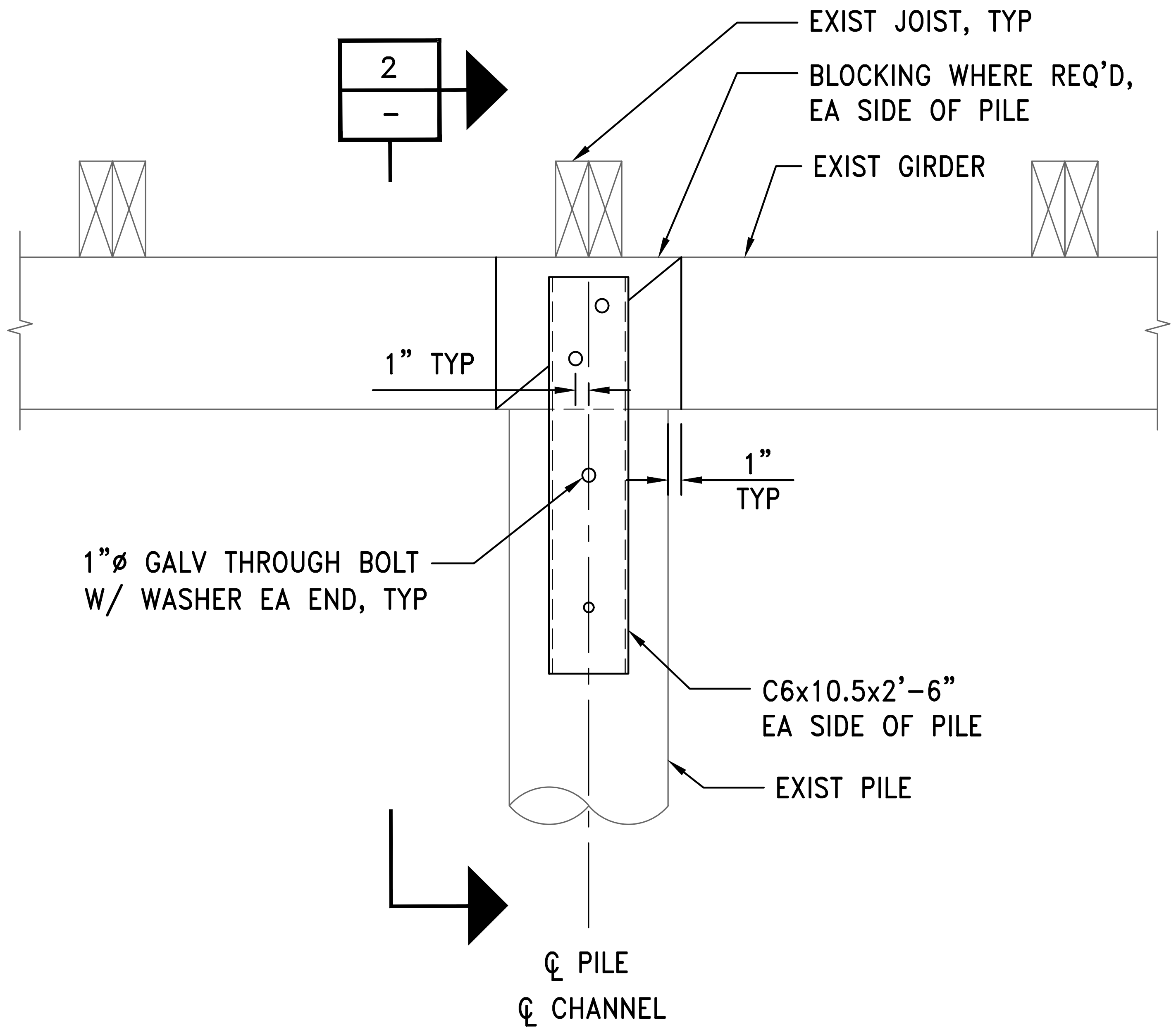
SHEET TITLE: **GIRDER/JOIST DCR HEAT MAP**

WORK PROJECT NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO.

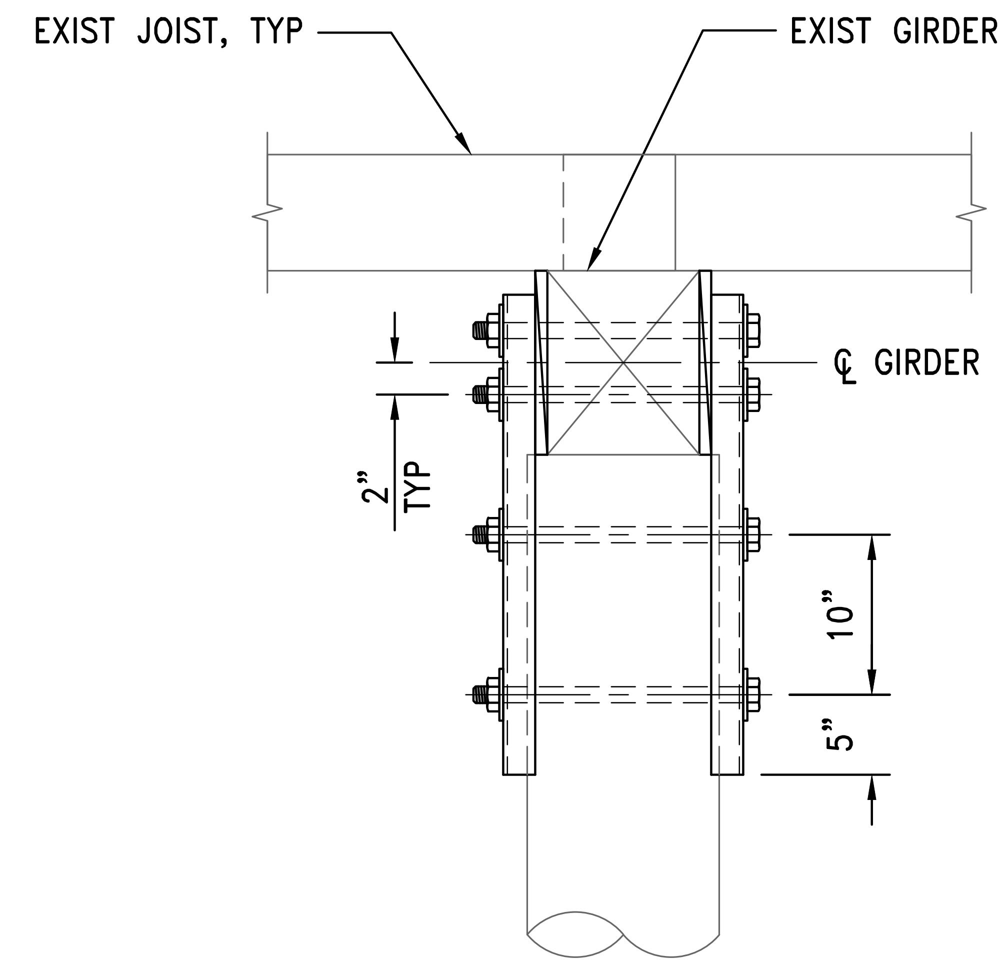
HEAT MAP



DETAIL

SINGLE GIRDER CHANNEL CONNECTION
FOR GIRDER WIDTH < OR = PILE DIAMETER

1
–



SECTION

SINGLE GIRDER CHANNEL CONNECTION
FOR GIRDER WIDTH < OR = PILE DIAMETER

2
–

REVISIONS			
NO.	DATE	BY	DESCRIPTION

PROJECT MANAGER:

PROJECT ENGINEER: TAESAN HOSE

DESIGN ENGINEER: PHOEBE WILLIAMS

DRAFTER: PLW

SCALE: 1" = 1'-0"

DATE: 10/13/2022

CHECKED/APPROVED BY: TAESAN HOSE

Port of Seattle **SALMON BAY MARINA**

PROJECT: **SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT**

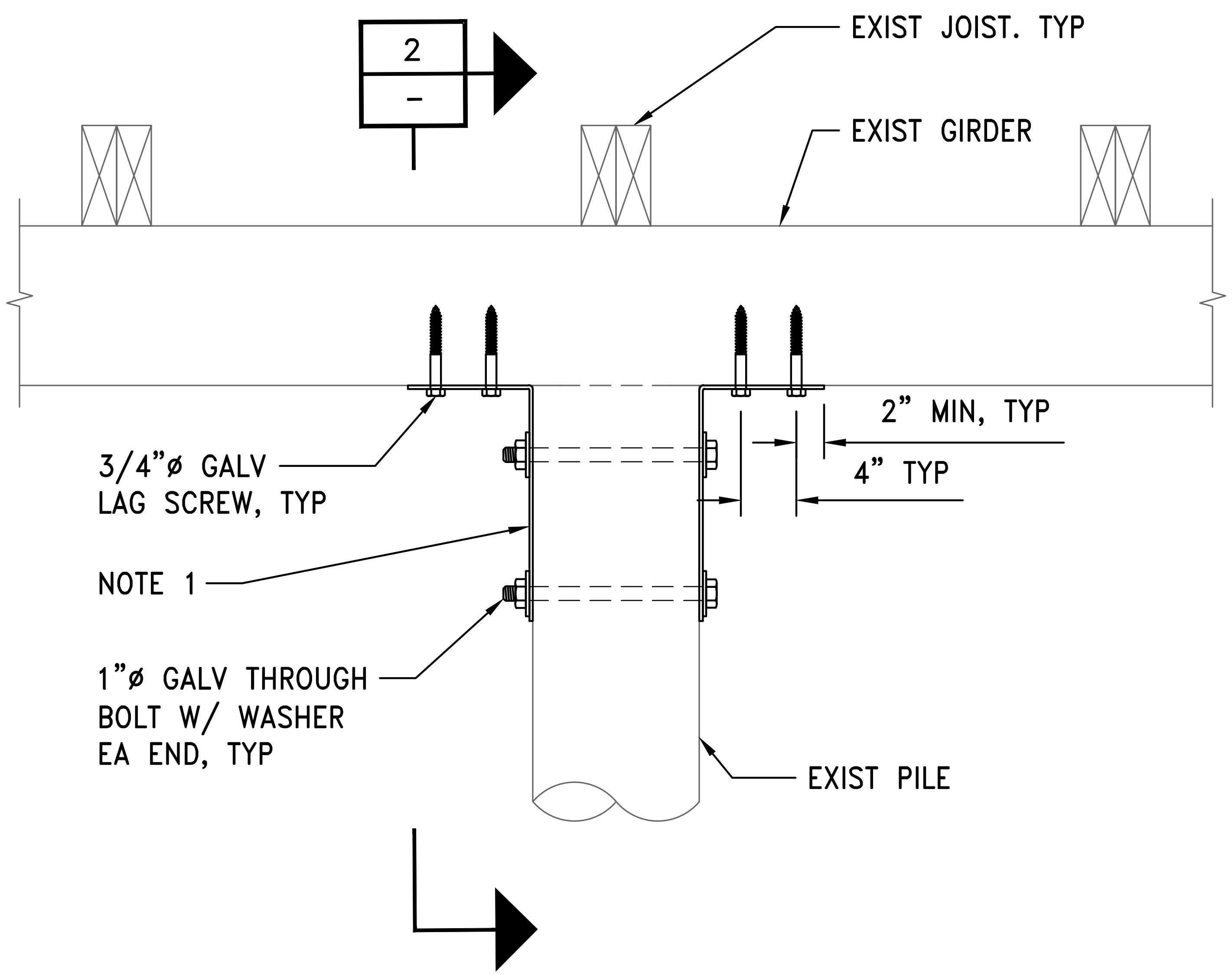
SHEET TITLE: **CONNECTION REPAIR DETAILS**

WORK PROJECT NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO.

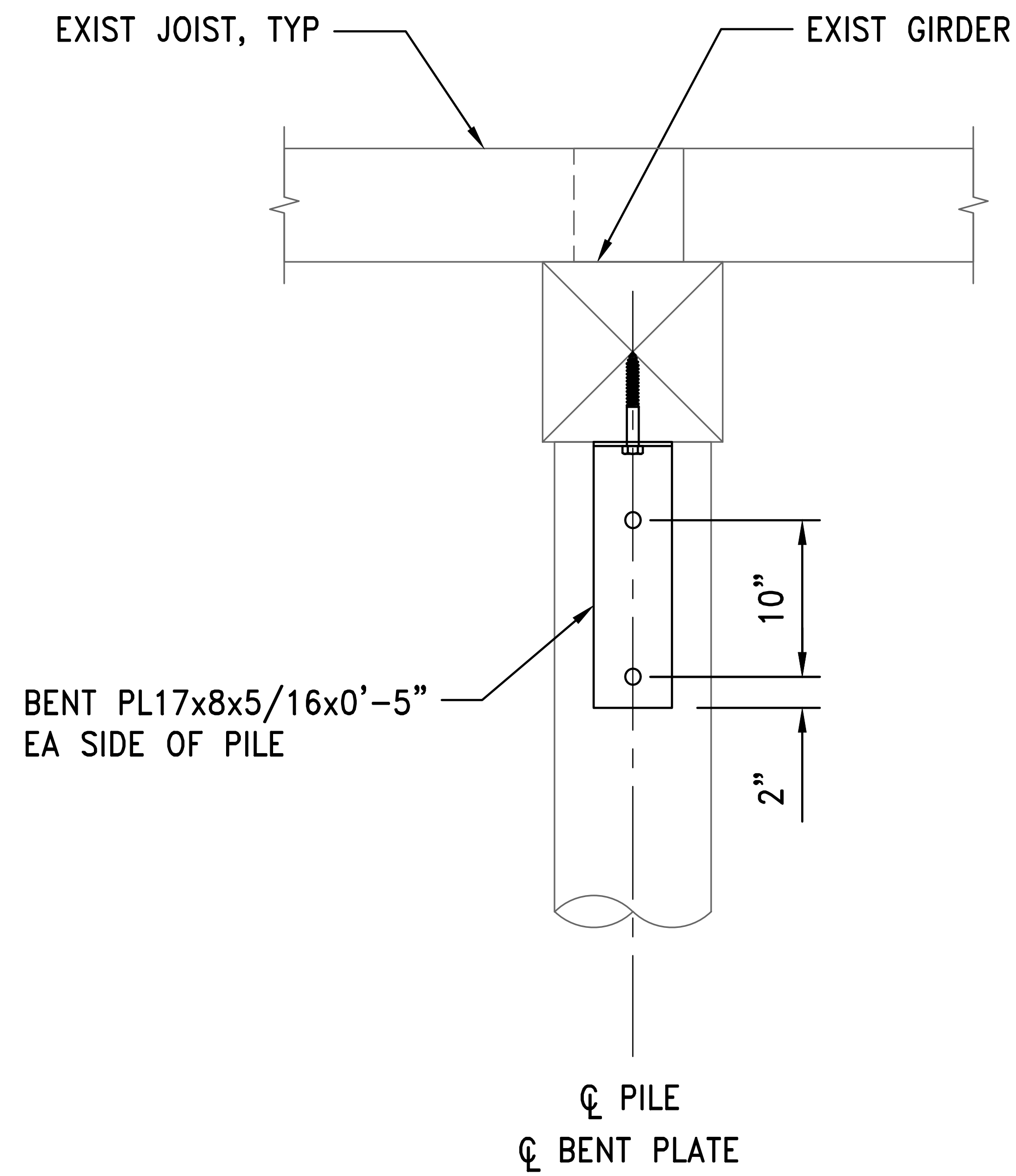
SK1



NOTES:
1. BENT PLATE AND BOLTS NOT REQUIRED ON SIDE OF PILE WHERE ROOF TRANSITIONS TO CANOPY.

DETAIL 1 / –

SINGLE GIRDER ANGLE CONNECTION
FOR GIRDER WIDTH > PILE DIAMETER



SECTION 2 / –

SINGLE GIRDER ANGLE CONNECTION
FOR GIRDER WIDTH > PILE DIAMETER

REVISIONS			
NO.	DATE	BY	DESCRIPTION

PROJECT MANAGER:

PROJECT ENGINEER: TAESAN HOSE

DESIGN ENGINEER: PHOEBE WILLIAMS

DRAFTER: PLW

SCALE: 1" = 1'-0"

DATE: 10/13/2022

CHECKED/APPROVED BY: TAESAN HOSE

Port of Seattle **SALMON BAY MARINA**

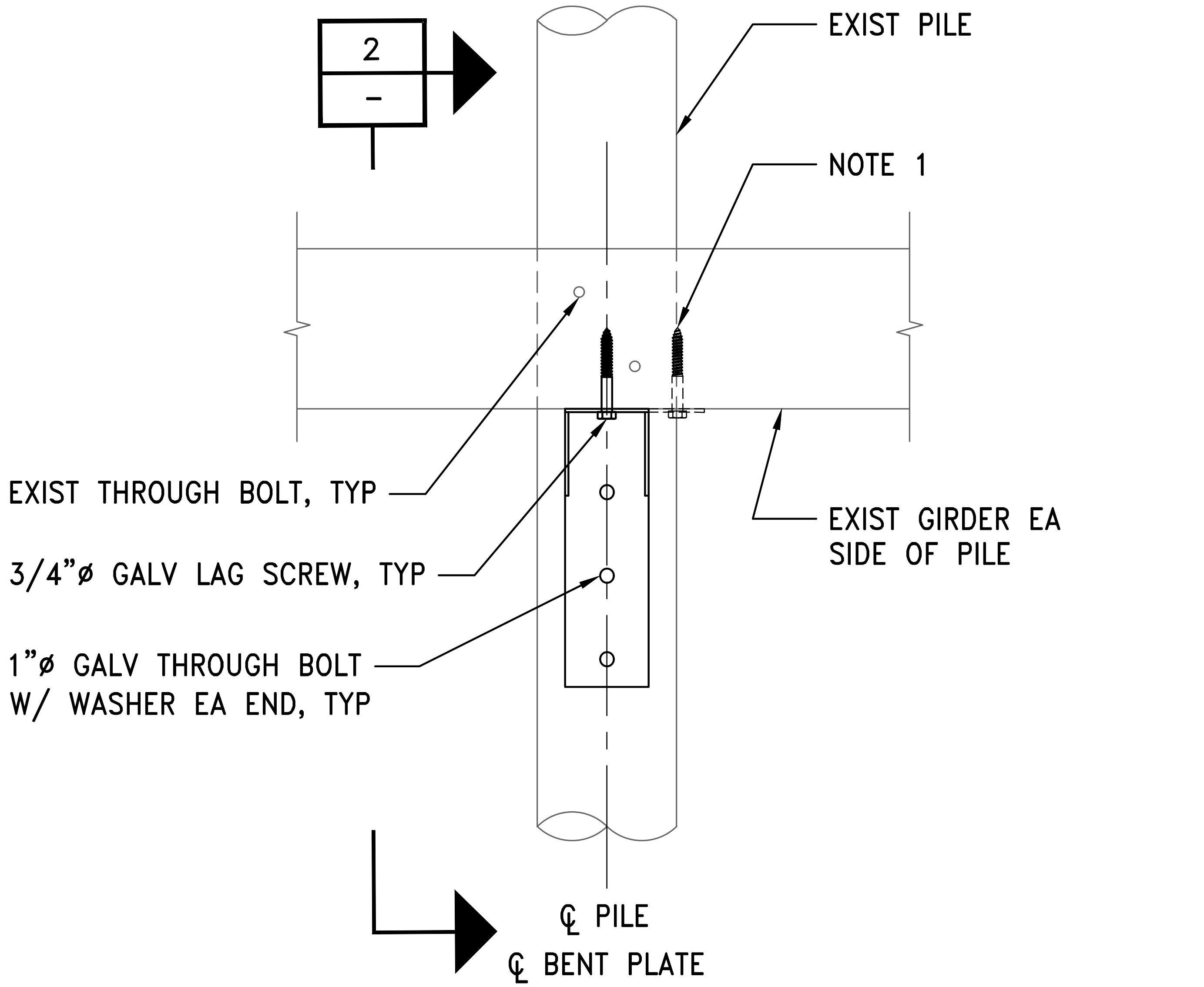
PROJECT: **SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT**

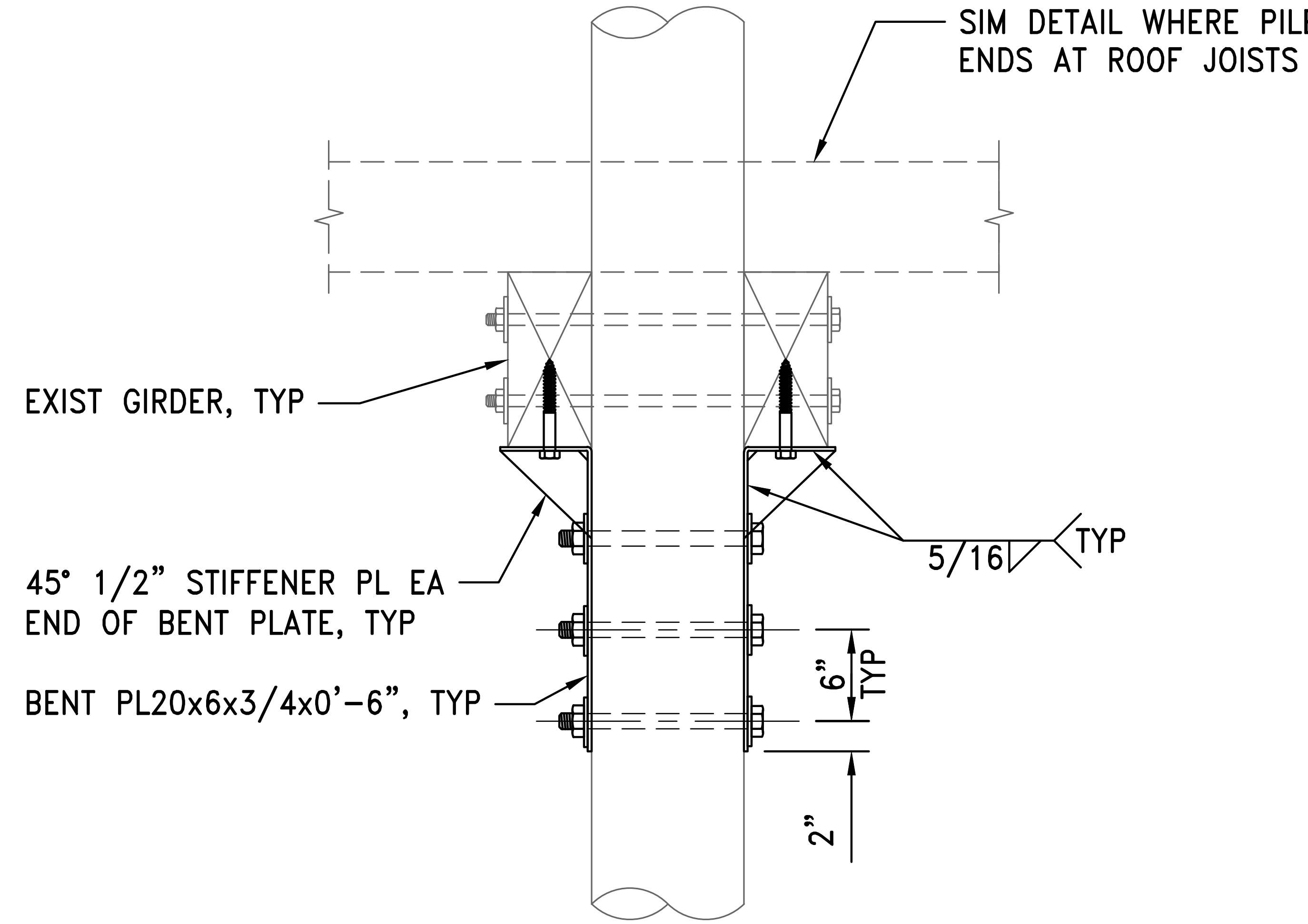
SHEET TITLE: **CONNECTION REPAIR DETAILS**

WORK PROJECT NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO. **SK2**





NOTES:

1. WHERE LAG SCREW CONFLICTS WITH EXISTING THROUGH BOLT, EXTEND STEEL BEARING PLATE AND LOCATE LAG SCREW OFFSET FROM BENT PLATE CENTERLINE.

DETAIL 1/–
DOUBLE GIRDER BEARING CONNECTION
OPTION A

SECTION 2/–
DOUBLE GIRDER BEARING CONNECTION
OPTION A

REVISIONS

NO.	DATE	BY	DESCRIPTION

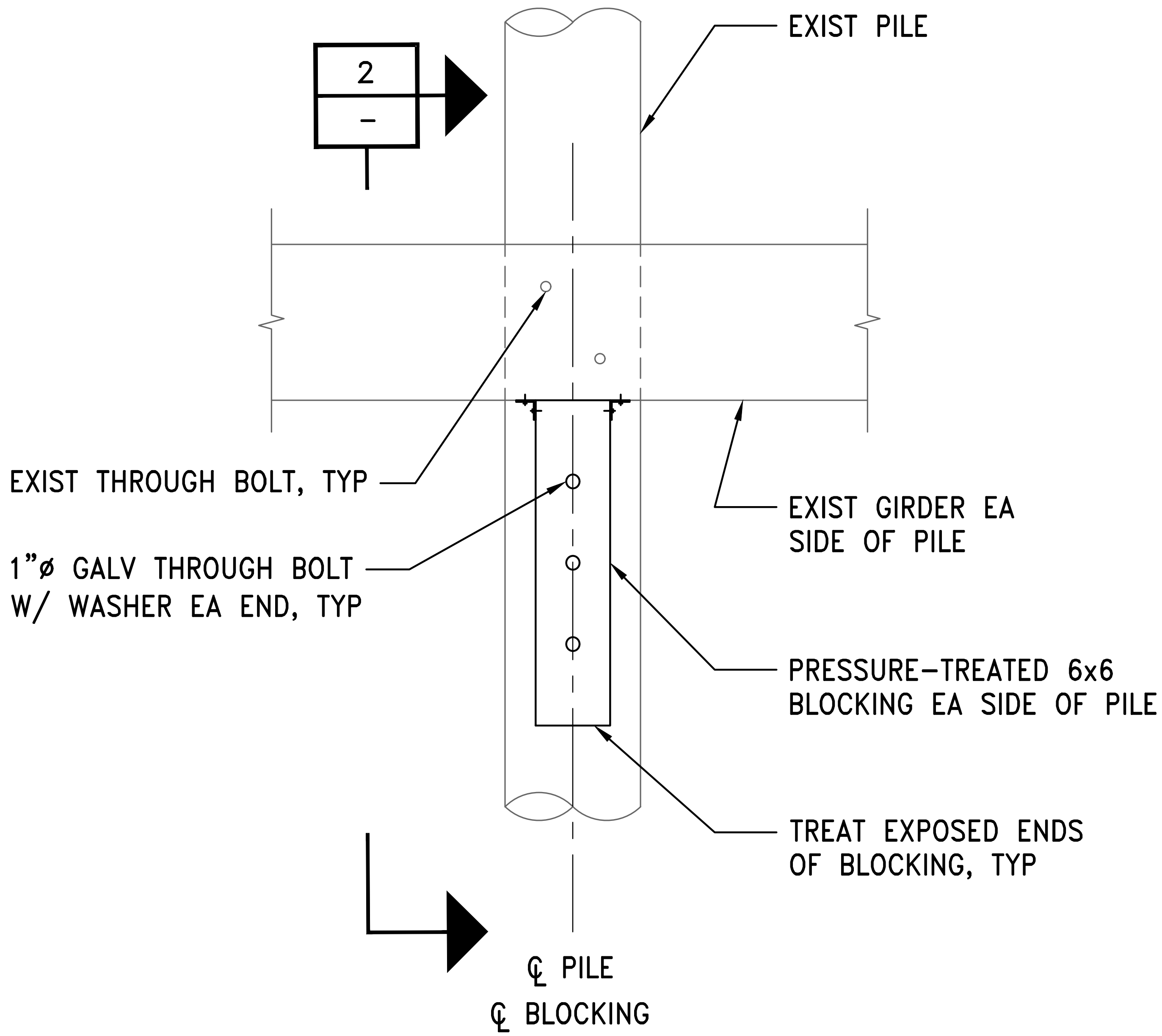
PROJECT MANAGER:
PROJECT ENGINEER: TAESAN HOSE
DESIGN ENGINEER: PHOEBE WILLIAMS
DRAFTER: PLW
SCALE: 1" = 1'-0"
DATE: 10/13/2022
CHECKED/APPROVED BY: TAESAN HOSE

Port of Seattle SALMON BAY MARINA

PROJECT: SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT

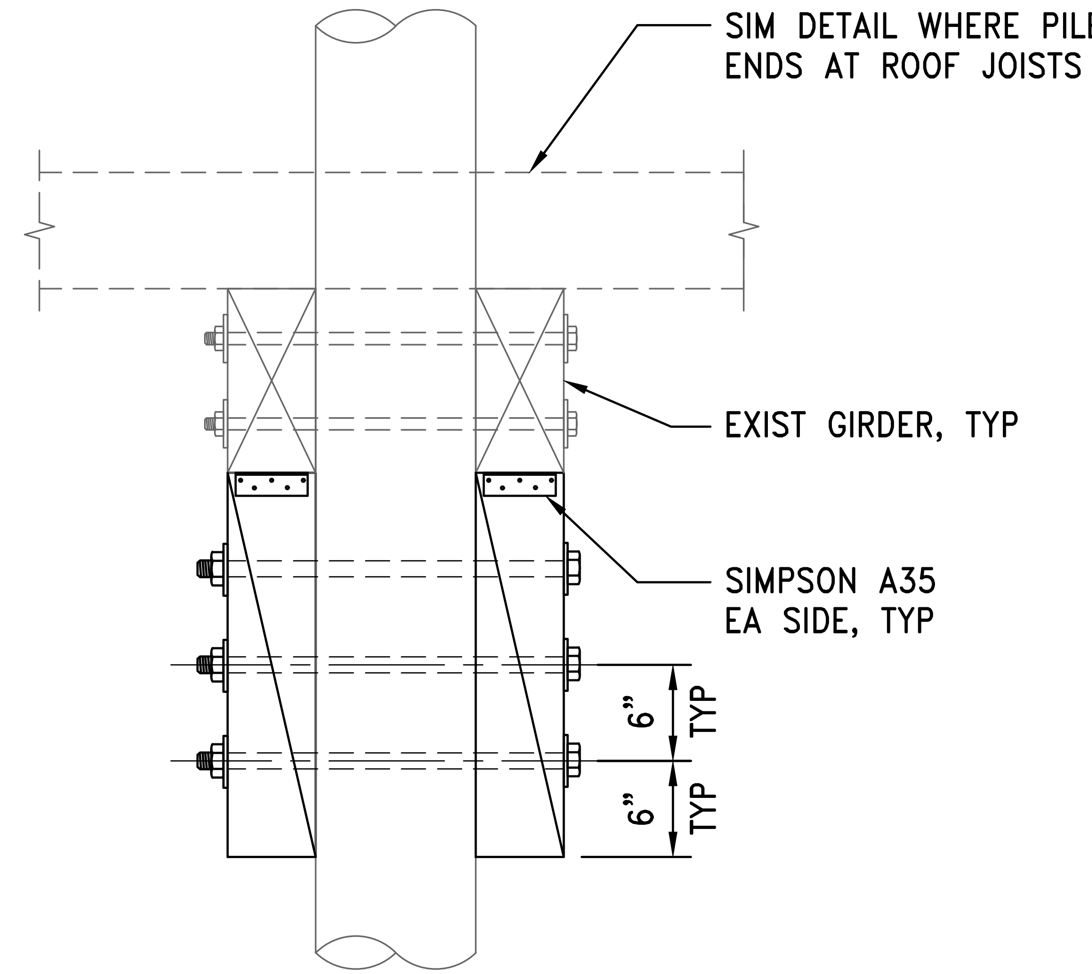
SHEET TITLE: CONNECTION REPAIR DETAILS

WORK PROJECT NO.
CONSULTANT'S NO.
PORT OF SEATTLE NO.
SK3



DETAIL 1 / –

DOUBLE GIRDER BEARING CONNECTION
OPTION B



SECTION 2 / –

DOUBLE GIRDER BEARING CONNECTION
OPTION B

REVISIONS			
NO.	DATE	BY	DESCRIPTION

PROJECT MANAGER:
PROJECT ENGINEER: TAESAN HOSE
DESIGN ENGINEER: PHOEBE WILLIAMS
DRAFTER: PLW
SCALE: 1" = 1'-0"
DATE: 10/13/2022
CHECKED/APPROVED BY: TAESAN HOSE

Port of Seattle **SALMON BAY MARINA**

PROJECT: **SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT**

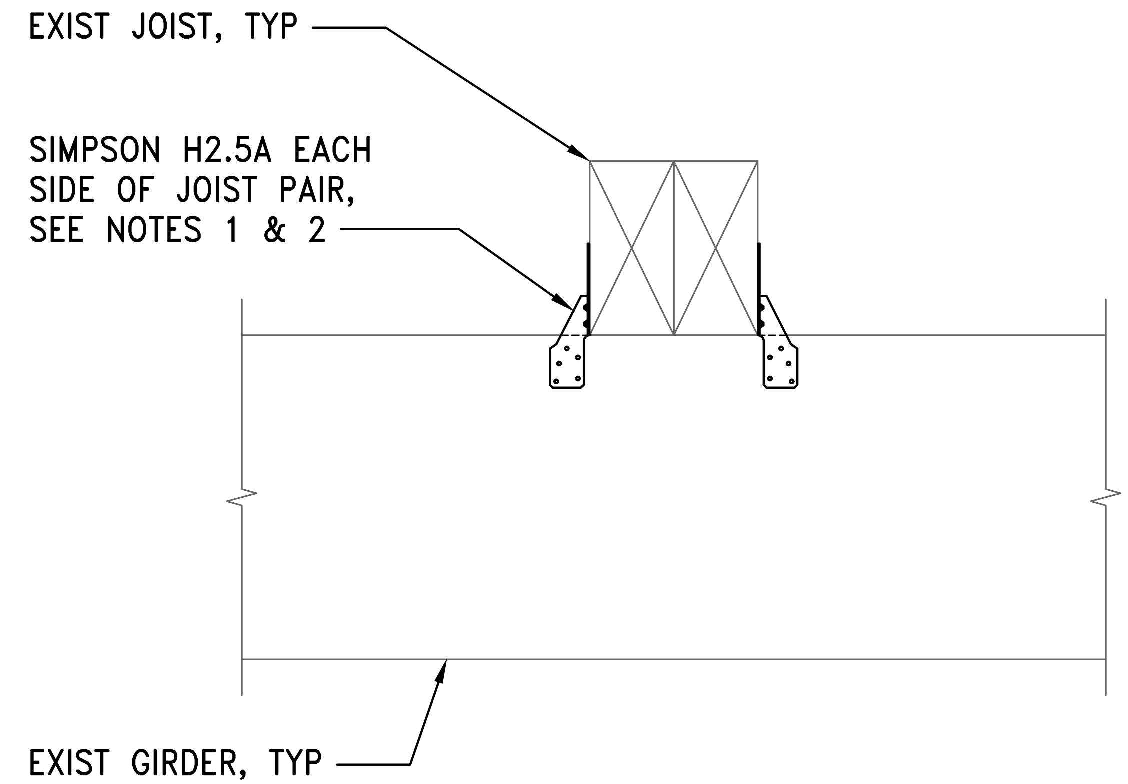
SHEET TITLE: **CONNECTION REPAIR DETAILS**

WORK PROJECT NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO.

SK4



NOTES:
1. H2.5A TIE SHALL HAVE A MINIMUM ZMAX FINISH FOR ADDED CORROSION PROTECTION
2. AT SINGLE JOIST LOCATIONS, PROVIDE ONE H2.5A TIE (I.E., EDGE GIRDERS).

DETAIL
JOIST TO GIRDER CONNECTION

1
–

REVISIONS			
NO.	DATE	BY	DESCRIPTION

PROJECT MANAGER:
PROJECT ENGINEER: TAESAN HOSE
DESIGN ENGINEER: PHOEBE WILLIAMS
DRAFTER: TDH
SCALE: 1-1/2" = 1'-0"
DATE: 10/13/2022
CHECKED/APPROVED BY: TAESAN HOSE

Port of Seattle SALMON BAY MARINA

PROJECT: SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT

SHEET TITLE: CONNECTION REPAIR DETAILS

WORK PROJECT NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO.

SK5

Baseline Condition Assessment Report

Document no: W3Y17302-TNE-03
Version: R01

Port of Seattle

Salmon Bay Marina Docks A-C Roof Safety
June 24, 2024

Baseline Condition Assessment Report

Client name:	Port of Seattle		
Project name:	Salmon Bay Marina Docks A-C Roof Safety		
Document no:	W3Y17302-TNE-03	**Project no:**	W3Y17302
Version:	R01	**Project manager:**	Aldo Ferrufino
Date:	June 24, 2024	**Prepared by:**	Discipline Leads

Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
R00	April 30, 2024	Draft for Review	Discipline Lead	Rick Jordison	Philippa Carter	Aldo Ferrufino
R01	June 24, 2024	Reissue to address Port comments	Discipline Lead	Rick Jordison	Philippa Carter	Aldo Ferrufino

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Contents

Appendices

Figures

1. Introduction

1.1 Description of Facility

Salmon Bay Marina is located east and east of the Ballard Locks and next to the Ballard Bridge. This is along the north side of Seattle and along the south shore of the Lake Washington Ship Canal, Northwest from Fishermen's Terminal. The covered moorage docks A, B, and C were constructed circa 1960.

The structure consists of timber walkways and a timber-supported roof, both supported by continuous creosote timber piles. The timber piles also support the docks (Dock A, Dock B, and Dock C) that service several dozen private marine vessels, providing shore power, water, and other accommodations to the over 100 boat slips.

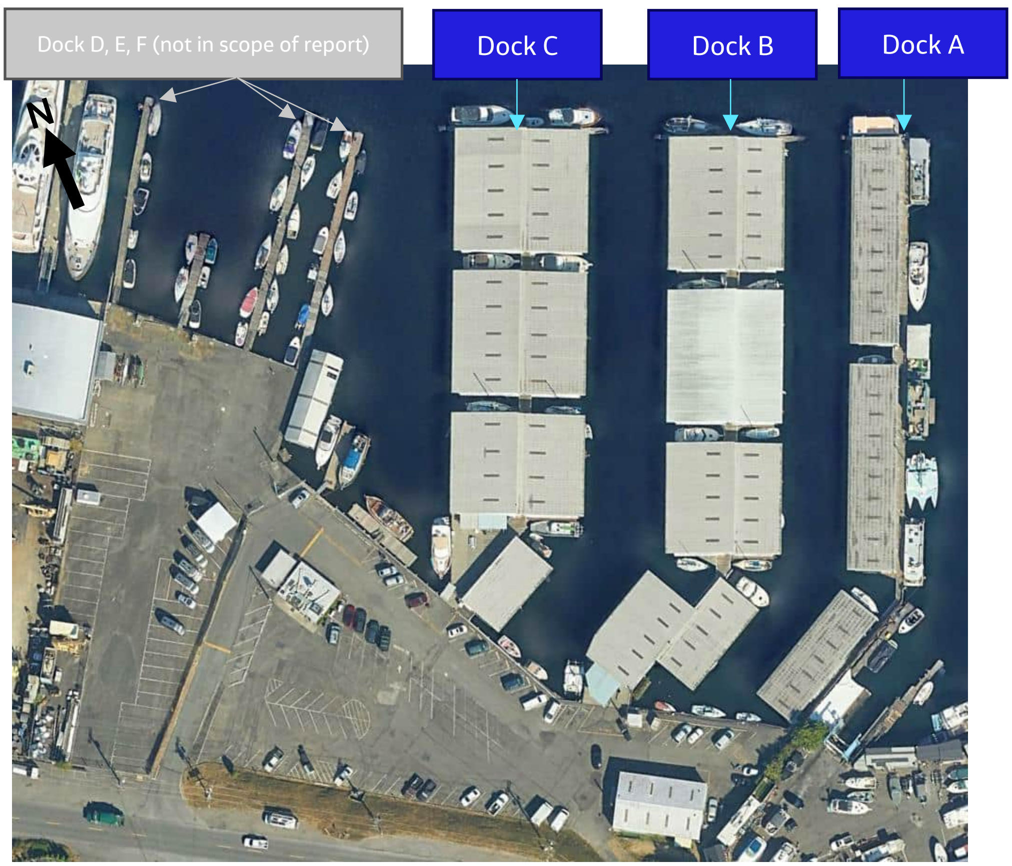

Figure 1 - Plan View showing Dock A, B, and C at Salmon Bay Marina (SaBM)

1.2 Project Location

A Vicinity Map and Location Plan of the project site are provided in Figure 2.

Figure 2 – Project Vicinity Map

1.3 Purpose of Document

To support both the feasibility study and conceptual design of Salmon Bay Marina Docks A-C Roof Safety Project, the project team discipline leads undertook a visual site inspection on Wednesday April 17th 2024. This visual site inspection included the roof structures of Docks A to C, and included the following disciplines:

- Structural
- Architectural
- Electrical
- Fire Safety

The attendees of the site visit on Wednesday April 17th 2024 are listed below:

- Rut Perez-Studer (Port)
- Julie Yun (Port)
- Andre Sidler (Port)
- Adam Goodman (Port)
- Alex Niccoli (Port)
- Bob Huffman (Port)
- Rick Jordison (Jacobs)
- Connie Kuney-Pitts (Jacobs)
- Amir Lofti (Jacobs)

- Jack Campbell (Jacobs)
- Curtis Smith (Elcon)

This report documents the observations and findings at the time of the site visit, including photos taken during the site visit of the roof structure at Salmon Bay Marina Docks A-C, and summarizes the findings from the routine pile inspection undertaken by Jacobs.

Jacobs has prepared this report for the sole purpose of providing the Port of Seattle with visual observations at the time of the site visit and only to assist in the feasibility study of Salmon Bay Marina Roof Study. Any information provided by the Port and/or third parties, have been relied upon in the preparation of this report is presumed accurate. Jacobs has no liability under this report and site visit over the condition of the asset, its safety and use, current and future.

1.4 Previous Studies Summary

The Port of Seattle (Port) purchased Salmon Bay Marina (SaBM) in 2018. As part of this purchase there was an approved permit for site improvements (never acted upon and has since lapsed). Studies undertaken as part of the due diligence effort included a dive investigation by Echelon Engineering Inc and a pre-purchase general assessment by the Port.

In 2019, Cornerstone Architectural Group, in partnership with PSM Consulting Engineers, provided a limited visual assessment of the existing metal roof system on portions of Docks A, B, and C for the intention of skylight installations. Cornerstone's assessment determined "the roof system at the three roofs has failed due to outdated design, lack of maintenance, and damage from overloading of snow or persons walking on the roof." Cornerstone ultimately did not recommend installing skylights in the existing roof system "due to the potential for life safety issues during any construction work and general safety for the occupants & general public."

Since 2019, the Port has undertaken some further studies relevant to Docks A-C:

- SaBM Covered Moorage Docks A, B, & C – Roof Structure Condition Assessment, Port of Seattle (2022). This report summarizes findings from a site visit of Docks A, B and C at Salmon Bay Marina conducted in September 2022. In general findings were that "roof girders and joists" were reported in "Good condition". "Occasional signs of splitting and warping were observed in the girder members" … "Moderate weathering can also be seen at the ends of the girders where they are more exposed to rain and sun but does not appear to affect the primary spans of the girders." The following deficiencies were found and summarized in the report:
    - "No code-compliant lateral system is evident for either a wind or seismic event. At the roof level, only cantilevered piles support incidental lateral loads.
    - "Girder members (generally E-W) range from 100% to 180% of their design capacity.
    - Joists members (generally N-S) range from 100% to 150% of their design capacity.
    - Thru-bolt connections from large double-girder members to the piles are inadequate.
    - Where girders rest on top of existing piles, no visible connection can be seen."

  The report recommends that the existing metal roof is well passed its service life and needs repair or replacement and presents recommendations of connection upgrades and possible solutions to address the failing roof panels.

- Salmon Bay Marina Evaluation for Improvements, Port of Seattle (2022). This report considers four options 1) reconfiguration of A-C docks, 2) roof repair 3) roof replacement 4) permanent roof removal. This report references the structural deficiencies and findings as per the previous referenced bullet point, and highlights the no risk of fire due to lack of sprinkler system.
- Salmon Bay Marina Electrical Condition Assessment Report, Port of Seattle (2023). This report includes an electrical condition assessment of moorage docks A, B, C, D, E as well as upland assets. The report provides a visual assessment of electrical equipment, and indicates issues requiring attention. The report concludes that "In general Dock A, B, C exhibit similar conditions, and major electrical equipment appears to have been installed in or around 2004 and generally in good condition. Overhead lighting is in poor condition, Engineering was told not all fixtures are functional. Some electrical equipment and shorepower pedestals exhibit damaged supports."

2. Routine Pile Inspection Summary

Jacobs Engineering Group Inc. (Jacobs) performed a routine level inspection of Salmon Bay Marina on behalf of the Port of Seattle. The inspection was carried out between February 20th and February 22nd, 2024.

2.1 Purpose

The primary purpose of the inspection was to assess the general overall condition of the timber piles, assign condition assessment ratings, catalog information of all defects, and assign recommended actions, where applicable. Upon completion of the inspection, a condition assessment rating was assigned to each element group, including the timber piles supporting the docks and walkway.

2.2 Methodology

The scope of this inspection comprises a Level 1 visual inspection of 100 percent of all timber piles and Level II/Level III detailed inspections at 10 percent of the selected piles. All dive operations were performed in accordance with requirements set forth in the Occupational Safety and Health Administration (OSHA) federal commercial diving standards. All dive team members are certified by the Association of Diving Contractors International (ADCI). The ASCE Waterfront Facilities Inspection and Assessment Manual outlines the summary of inspection levels as shown in Figure 3.

		Detectable Defects			
Level	Purpose	Steel	Concrete	Timber	Composite
I	General visual/ tactile inspection to confirm as-built condition and detect severe damage	• Extensive corrosion, holes • Severe mechanical damage	• Major spalling and cracking • Severe reinforcement corrosion • Broken piles	• Major loss of section • Broken decking, caps, stringers, piles, and bracings • Severe abrasion or marine borer attack	• Permanent deformation • Broken piles • Major cracking or mechanical damage
II	Visual/tactile inspection to detect surface defects normally obscured by marine growth, coating, corrosion, etc.	• Moderate mechanical damage • Corrosion pitting and loss of section	• Surface cracking, spalling, and erosion • Rust staining • Exposed reinforcing steel and/or prestressing strands	• External pile damage due to marine borers • Splintered piles • Loss of bolts and fasteners • Rot or insect infestation	• Cracking • Delamination • Material degradation

III	Visual/tactile inspection to detect hidden or interior damage, evaluate loss of cross-sectional area, or evaluate material homogeneity	• Thickness of material • Electrical potentials for cathodic protection • Thickness of coatings	• N/A	• Internal damage, voids, marine borer activity • Decrease in material strength	• N/A

Figure 3 - Summary of the Inspection Levels

The routine level inspection was conducted by a three-person team consisting of a Lead Engineer-Diver, a Diving Supervisor, and an Engineer-Diver. All work was performed in general accordance with ASCE's Waterfront Facility and Assessment Manual MOP-130, unless otherwise noted. A Level I inspection effort, consisting of a close visual examination, was performed on 100 percent of accessible structural elements, including timber piles beneath the docks and walkway along the bulkhead and timber pile caps at the interior end of Dock C. Additionally, 10 percent of timber piles were further subject to Level II and Level III inspection efforts (refer to Appendix A for Level II and Level III locations). The Level II and Level III pile were chosen at random and measured at three locations; top, middle and mudline This included the removal of marine growth at three elevations: mean low water (MLW); mid-water or approximately midway between MLW and the mudline; as well as just above the mudline. The purpose of the Level II and III inspections was to identify any defects hidden by marine growth, to identify surface conditions, and to identify any loss of cross-sectional area (section loss) of the timber due to fungal rot. Additionally, as part of the Level III inspection, a diameter and pick penetration depth were recorded at each elevation to determine the minimum effective diameter.

Dive operations were staged from a Jacobs dive van and met all guidelines governing commercial safe diving practices. All diving operations were conducted using surface-supplied diving equipment including a Kirby Morgan 57 diving helmet, a three-part umbilical with continuous hard-wire communications, and all associated commercial diving equipment.

2.3 Observations

The timber piles are in **Fair** condition, with 387 of the 445 inspected timber piles exhibiting only minor deterioration. The timber piles supporting the walkways and superstructure at Docks A, B, and C exhibit minor deterioration typical to piles in a freshwater environment, characterized by a softening of the exterior 0.25in. of timber below water and minor checking up to 0.25 in. above water.

A total of 43 timber plumb and batter piles support the offshore wave screens located at the north end of each dock. Moderate to advanced deterioration was observed at 21 of these timber piles: including reduced bearing at the pile/post interface and corrosion of the steel fishplate and/or connection

hardware. Severe deterioration was also observed at an additional 8 wave screen piles: including loss of bearing at the pile/post interface, severe corrosion of the fishplates and connection hardware, and failure of the bolted timber batter pile connection.

Figure 4: Dock C, Inshore Platform - Timber Pile Cap with Severe Section Loss at its End Due to Rot

Advanced deterioration was also observed at the 27 timber piles supporting the inshore-most platform at Dock C, primarily due to fungal rot as shown in Figure 4. Section loss up to 35 percent was observed at 15 timber piles, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional two timber piles. The presence of fungal rot at both the top of pile and bottom of pile cap resulted in reduced bearing at 6 pile locations. The most severe cases of bearing loss were accompanied by crushing and rotation of the lower 12 in. by 12 in. timber cap.

A total of 27 timber piles supports the timber walkway running the length of timber sheet pile bulkhead between Dock A and Dock C. The inshore timber piles exhibit minor fungal rot above and below water. Section loss up to 35 percent was observed at one timber pile, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional five timber piles. The timber piles with severe section loss exhibited other severe deterioration, including splitting and breakage within the top 54 in. of pile.

2.4 Recommendations

Recommended Priority repairs include repair of nine timber piles with severe section loss supporting the walkway along the bulkhead and at the inshore platform at Dock C, replacement of severely corroded connection hardware at six locations along the wave screens, restoration of bearing at the pile/post interface at six locations along the wave screens, and replacement of crushing timber pile caps above three timber piles under the inshore platform at Dock C.

Recommended routine repairs include repair of 21 timber piles with moderate to major section loss along the bulkhead and at the inshore platform at Dock C and replacement of moderately corroded connection hardware at 21 locations along the wave screens.

It is also recommended that the piles at Salmon Bay Marina be reinspected within 5 years, in accordance with ASCE's guidelines.

The Routine Pile Inspection Report is appended and can be found in Appendix A.

The cost estimate for the recommendations pertaining to the Routine Pile Inspection Report can be found in Appendix B.

3. Visual Condition Assessment

The below section presents the visual condition assessment observations and photographs taken during the site visit. This includes the visual inspection of uncovered elements, or cabinets as applicable, in areas which were safe to access of Docks A, B and C only. The photographs and observations presented in this section are representative of all three docks.

3.1 Overall Roof / Structural

The roof structure consists of metal roofing material sitting on timber purlins that are supported by timber girders which in turn are supported by creosote-treated timber piles. Most of the existing girder-to-pile connections consist of a girder bearing on a pier, with no visible positive hardware-based anchorage. A second typical girder-to-pile connection has parallel timber girders on either side of the pile connected with a thru-bolt. There are no significant lateral bracing elements – lateral forces appear to be resisted by the piles acting as cantilevers extending out of the mud.

Overall, the timbers appear to be in good condition for their age and exposure to the elements. The roofing material and supports do not appear to be adequate for any significant live loading, which limits access for maintenance work that can be done on the roof.

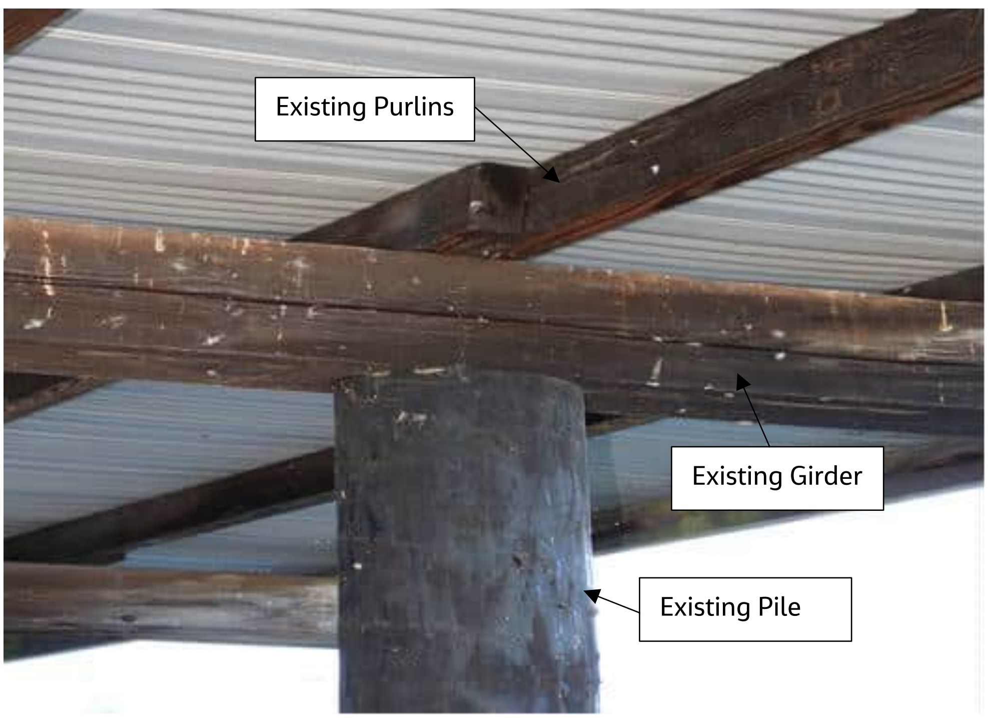

Figure 5 – Typical Gravity Connection

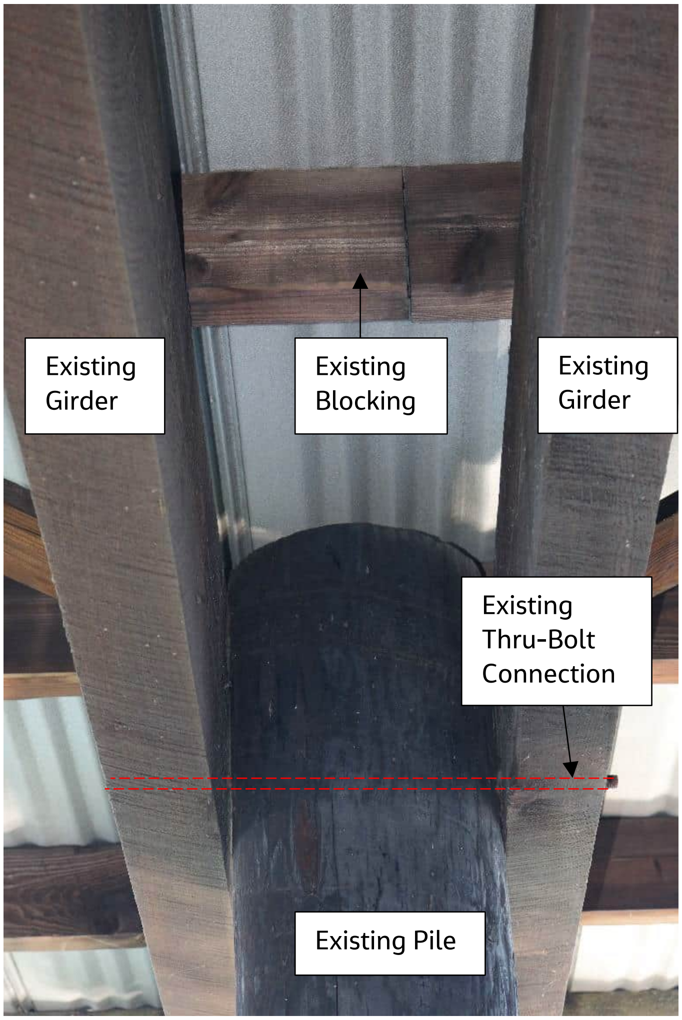

Figure 6 - Example of the Thru-Bolt Girder-to-Pile Connection.

There are locations, especially at the exposed girder ends or at locations of roof leaks where water intrusion is occurring. Some girders have large horizontal splitting and others are twisting intermittently throughout the three docks. Some timber piles exposed to the weather are showing signs of the creosote leaching out of them.

Figure 7 - Example of Weathering at Exposed Ends of a Girder

Figure 8 - Example of Large Horizontal Checks in a Girder

Figure 9 - Example of Twisting Members

Figure 10 - Example of Creosote Leaching Out of Timber Pile due to Sun Exposure.

3.1.1 Post Site Visit Photos and Observations

There have been various retrofits performed on some girder-to-pile connections to provide a positive connection.

Figure 11 – Retrofits- Examples of Girder-to-Pile Connections.

3.2 Architectural

The boathouses at the walkway level are in generally fair condition and seem to be well kept.

Although no specific improvements appear to have been made to address Americans with Disabilities Act (ADA) or accessibility as it relates to recreational boating and fishing facilities, since the original construction, there appear to be no significant barriers present that would keep the facility from being considered substantially “barrier free”. Figure 12 are illustrative of slopes applicable for recreational boating and fishing facilities.

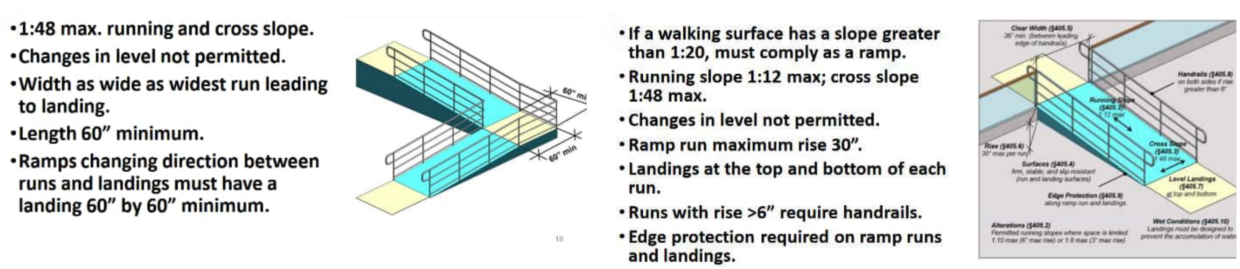

Figure 12 - Illustration of Slopes Applicable for Recreational Boating and Fishing Facilities (Source: Accessibility Online Webinar Series Accessible Recreational Boating and Fishing Piers August 4, 2022)

The roof, however, is known to leak excessively. The roofing and roof framing have been found unsafe for maintenance access.

Signs of age, distress and deterioration can be seen on the roof, hanging screens, and clerestories, (both with and without louvers). This is probably largely due to the inability to access these areas safely because of the inadequacy of the supporting structure, which inhibits repair and maintenance work.

Some of the original construction seems exceptionally light and doesn't appear capable of withstanding extreme weather conditions. Although they have stood for many years, advanced deterioration may accelerate the probability of failures to the roof and its supporting elements.

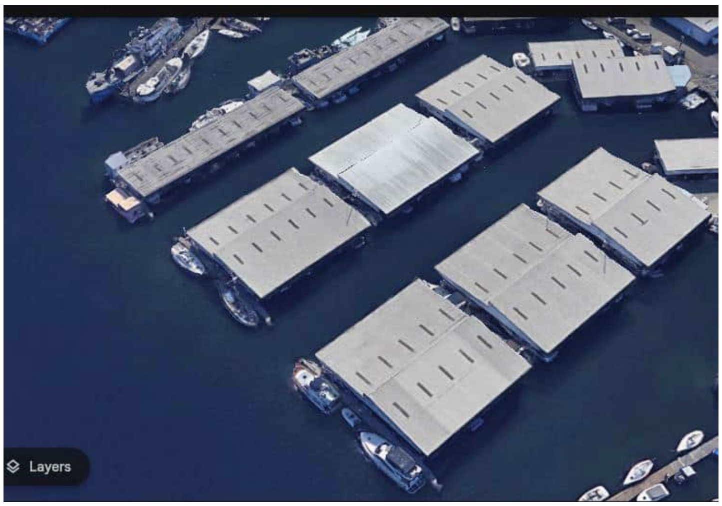

Figure 13 – Plan View of Docks A (left), B (middle) to C (right) at Salmon Bay Marina (SaBM)

Although a weather resisting treatment or membrane appears to have been added following the investigation memo by Cornerstone Architectural Group dated May 1, 2019, many of the issues noted in that memo still appear to be plaguing the boathouse roofs, namely:

1. Fastener connection failure
2. Failed attempted sealant repair at fasteners
3. Severe roof deflection which leads to ponding water between each purlin
4. Light gauge metal panels appear to be sagging in some areas between the framing members.
5. 36-inch spaced purlins (insufficient for metal roof of this type)
6. Attempted misguided repairs (sealant of various types. Should be tested for asbestos)
7. Possible water damage at failed fasteners

The roof seems to have received sealing treatment to the topside of the roof and appears to have served only to conceal the above issues by covering them.

Recent water damage suggests the roof is not preventing water intrusion to the structural underside as shown in Figure 13

Figure 14 – Roof Showing Recent Water Damage

Figure 15 - Typical Boathouse Side Wall

Figure 14 depicts the typical boathouse side wall, note the mounting of electrical power outlet and junction box mounted. The plywood and paint appear to be in good condition, well maintained.

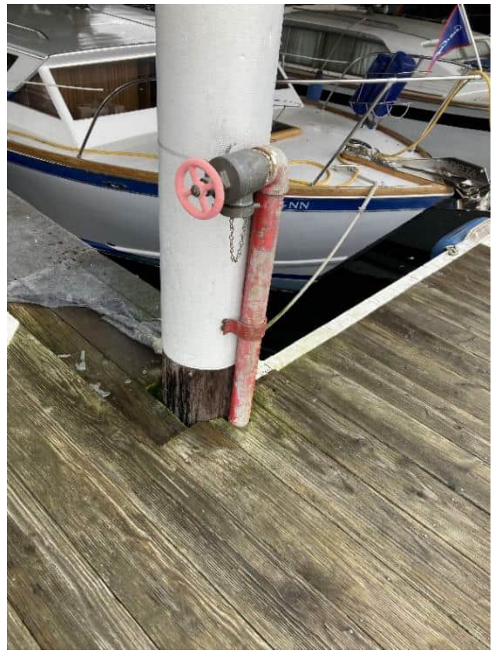

Figure 16 – General Fire Protection on the Docks

Fire protection on the docks is limited to hand-held fire extinguishers and dry-pipe hydrants, which would be charged at an upland Siamese connection, which is noted later in this report (see Figure 15 above; and Figure 24 in Section 3.4 - Fire Protection).

Figure 17 - Dropped Wind Screens

The dropped wind screens are lightly constructed, almost temporary in appearance, but holding up moderately well despite some apparent water damage that can be seen here.

Figure 18 - Typical Life Ring Mounted to Boathouse Side Wall

Figure 19 – Roof Skylights

The skylights that were installed don't add much usable natural light into the boathouses and have apparently exacerbated the leaking of the roofs. The light penetration will be required if rebuilt.

Figure 20 – Image Showing Wood Boats and Vintage Boats Berthed in the Undercover Moorings

Figure 21 – Image Showing Wood Boats and Vintage Boats Berthed in the Undercover Moorings

Many of the boats are wood construction and vintage and would be best sheltered from the elements during long-term storage.

Figure 22 – An Existing Light Fixture

The typical condition of the space is exemplified by the existing light fixture and the worn-out wood louver at the roof clerestory, which is likely in poor condition due to the difficulty of safely accessing the roof areas for routine maintenance, hindering regular upkeep and repair.

3.3 Electrical

A detailed breakdown of the existing electrical equipment and quantity at each dock is provided in Table 1 of the Salmon Bay Marina Electrical Condition Assessment Report, which outlines the specific type of equipment and its corresponding quantity at each dock:

- Dock A: Three (3) wall mounted panels and one (1) deck mounted transformer.
- Dock B: Six (6) wall mounted panels, two (2) wall mounted disconnects, one (1) rafter mounted transformer and one (1) deck mounted transformer.
- Dock C: Six (6) wall mounted panels, two (2) wall mounted disconnects, one (1) rafter mounted transformer and one (1) deck mounted transformer.

3.3.1 Existing Line Voltage Infrastructure – Dock A

Dock A's electrical distribution equipment is comprised of two 480-240 volt transformers, one 120/240 volt distribution panelboard and three 120/240 volt branch circuit panelboards. All panelboards, disconnects, transformers and shorepower pedestals are rated for outdoor use. All conduits feeding each transformer and panelboard, as well as all branch circuits serving the shorepower pedestals are fed from below deck.

Figure 23 - Typical Hanging Transformer Suspended from Roof Structure (only at Dock B and Dock C)

Figure 24 - Typical Water and Power Hookups at Boat Slips

3.3.2 Line Voltage Infrastructure – Dock A – Roof Modification Impacts

As noted above, all major power conduits are routed below deck and should have no impact on roof modifications.

3.3.3 Existing Line Voltage Infrastructure – Dock B

Dock B's electrical distribution equipment is comprised of two 480-240 volt transformers, two 120/240 volt distribution panelboards and four 120/240 volt branch circuit panelboards. All panelboards, disconnects, transformers and shorepower pedestals are rated for outdoor use, other than Transformer T4 which is missing one weather shield. All conduits feeding each transformer and panelboard, as well as all branch circuits serving the shorepower pedestals are fed from below deck, with one exception: Transformer T4 has been installed in the roof's rafters. While transformers do not need much routine maintenance, its location ~10' above the deck does pose a challenge to Port maintenance personnel should any work need to be performed on the transformer. No separately derived ground conductor could be observed from this transformer.

3.3.4 Line Voltage Infrastructure – Dock B – Roof Modification Impacts

All major power conduits are routed below deck and should have no impact on roof modifications other than Transformer T4. A minimum clearance of 12" from Transformer T4 and all combustible materials could not be verified and would impact any reroofing efforts. Should the roof be demolished, a structural analysis would need to be performed to assess how much of the existing roof support structure would need to be maintained or modified to keep the transformer in its current location. Should the support structure be demolished, additional pilings and decking material would need to be constructed within an existing slip to house transformer at deck level in addition to the rerouting of conduits from the transformer and its primary and secondary sources.

3.3.5 Existing Line Voltage Infrastructure – Dock C

Dock C's electrical distribution equipment is comprised of two 480-240 volt transformers, two 120/240 volt distribution panelboards and four 120/240 volt branch circuit panelboards. All panelboards, disconnects, transformers and shorepower pedestals are rated for outdoor use, other than Transformer T6

which is missing one weather shield. All conduits feeding each transformer and panelboard, as well as all branch circuits serving the shorepower pedestals are fed from below deck, with one exception: Transformer T6 has been installed in the roof's rafters. While transformers do not need much routine maintenance, its location ~10' above the deck does pose a challenge to Port maintenance personnel should any work need to be performed on the transformer. No separately derived ground conductor could be observed from this transformer.

3.3.6 Line Voltage Infrastructure – Dock C – Roof Modification Impacts

All major power conduits are routed below deck and should have no impact on roof modifications other than Transformer T6. A minimum clearance of 12" from Transformer T6 and all combustible materials could not be verified and would impact any reroofing efforts. Should the roof be demolished, a structural analysis would need to be performed to assess how much of the existing roof support structure would need to be maintained or modified to keep the transformer in its current location. Should the support structure be demolished, additional pilings and decking material would need to be constructed within an existing slip to house transformer at deck level in addition to the rerouting of conduits from the transformer and its primary and secondary sources.

3.3.7 Existing Lighting Infrastructure – Docks A, B, C

A majority of the luminaires on each of the docks were observed to be mounted to the roof support beams. The power conduits and wiring serving these luminaires were in turn routed along the roof support beams to the nearest panelboard.

3.3.8 Lighting Infrastructure – Docks A, B, C – Roof Modification Impacts

Should the roof support beams be demolished, most lighting and the conduits and wiring serving that lighting would in turn need to be demolished. New pole mounted or bollard lights, as well as new conduit and wiring would need to be installed to replace the existing lighting.

3.3.9 Existing Low Voltage Infrastructure – Docks A, B, C

While the initial distribution of communications cabling (phone, cable tv) is distributed below the deck, a majority of the local distribution of cabling to each slip is routed through the roof's support beams. Individual satellite dishes were observed to be mounted atop the roof and distributed down through the roof support beams to local slips. It is unknown at this time what portion of the communications cabling is in use.

3.3.10 Low Voltage Infrastructure – Docks A, B, C Roof Modification Impacts

Should the roof support beams be demolished, the local distribution of communications cabling would need to be replaced and rerouted via the underside of the deck to local slips. We suspect a majority of the existing cabling is not active and would not need to be replaced. We suggest the Port reach out to local communications utility providers for a list of active users as the facility to assess how much of this infrastructure would need to be replaced. Should the roof and its support beams be demolished, we would assume local slip tenants would wish to install satellite dishes on neighboring pilings.

3.4 Fire Protection

Each of the three piers are provided with an independent 4-inch dry standpipe, and 2-½ fire hose valve connections spaced intermittently along the length of each pier. A freestanding fire department connection, with two, 2-½ inch hose connections, is mounted at the entrance to each pier for fire department use.

Fire hydrants for fire department use are located along W Commodore Way.

Each pier is provided with fire extinguishers spaced intermittently along the length of each pier, with their locations identified by required signage, mounted above fire extinguisher cabinets.

Figure 25 – Existing Fire Protection System

Appendix A. Routine Pile Inspection Report

Salmon Bay Marina

Routine Inspection

Seattle, Washington

Document Number: W3Y17302-TNE-01

March 2024

PORT OF SEATTLE.

SALMON BAY MARINA

SEATTLE, WASHINGTON

ROUTINE INSPECTION

MARCH 2024

Document Number: W3Y17302-TNE-01

Submitted By:

Jacobs Engineering Group, Inc.

1100 112th Avenue NE, Suite 500

Bellevue, WA 98004

Executive Summary

Jacobs Engineering Group Inc. (Jacobs) performed a routine level inspection of Salmon Bay Marina on behalf of the Port of Seattle. The inspection was carried out between February 20th and February 22nd, 2024.

The primary purpose of the inspection was to assess the general overall condition of the timber piles, assign condition assessment ratings, catalog information of all defects, and assign recommended actions, where applicable. Upon completion of the inspection, a condition assessment rating was assigned to each element group, including the timber piles supporting the docks and walkway. The scope of this inspection comprises a visual inspection of 100 percent of all timber piles and Level II/Level III detailed inspections at 10 percent of the selected piles. All dive operations were performed in accordance with requirements set forth in the Occupational Safety and Health Administration (OSHA) federal commercial diving standards. All dive team members are certified by the Association of Diving Contractors International (ADCI).

The routine level inspection was conducted by a three-person team consisting of a Lead Engineer-Diver (Team Leader) working under the direction of a Washington State P.E. (as responsible charge), a Diving Supervisor, and an Engineer-Diver. The Lead Engineer Diver is a Professional Engineer in New York and New Jersey. Their Washington State P.E. application, pending at the time of inspection, has since been approved.

The timber piles are in **Fair** condition, with 387 of the 445 inspected timber piles exhibiting only minor deterioration. The timber piles supporting the walkways and superstructure at Docks A, B, and C exhibit minor deterioration typical to piles in a freshwater environment, characterized by a softening of the exterior 0.25in. of timber below water and minor checking up to 0.25 in. above water.

A total of 43 timber plumb and batter piles support the offshore wave screens located at the north end of each dock. Moderate to advanced deterioration was observed at 21 of these timber piles: including reduced bearing at the pile/post interface and corrosion of the steel fishplate and/or connection hardware. Severe deterioration was also observed at an additional 8 wave screen piles: including loss of bearing at the pile/post interface, severe corrosion of the fishplates and connection hardware, and failure of the bolted timber batter pile connection.

Advanced deterioration was also observed at the 27 timber piles supporting the inshore-most platform at Dock C, primarily due to fungal rot. Section loss up to 35 percent was observed at 15 timber piles, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional two timber piles. The presence of fungal rot at both the top of pile and bottom of pile cap resulted in reduced bearing at 6 pile locations. The most severe cases of bearing loss were accompanied by crushing and rotation of the lower 12 in. by 12 in. timber cap.

A total of 27 timber piles supports the timber walkway running the length of timber sheet pile bulkhead between Dock A and Dock C. The inshore timber piles exhibit minor fungal rot above and below water. Section loss up to 35 percent was observed at one timber pile, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional five timber piles. The timber piles with severe section loss exhibited other severe deterioration, including splitting and breakage within the top 54 in. of pile.

Recommended Priority repairs include repair of nine timber piles with severe section loss supporting the walkway along the bulkhead and at the inshore platform at Dock C, replacement of severely corroded connection hardware at six locations along the wave screens, restoration of bearing at the pile/post interface at six locations along the wave screens, and replacement of crushing timber pile caps above three timber piles under the inshore platform at Dock C.

Recommended routine repairs include repair of 21 timber piles with moderate to major section loss along the bulkhead and at the inshore platform at Dock C and replacement of moderately corroded connection hardware at 21 locations along the wave screens.

It is also recommended that the piles at Salmon Bay Marina be reinspected within 5 years, in accordance with ASCE's guidelines.

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1. Introduction

Jacobs Engineering Group Inc. (Jacobs) performed a routine level inspection of Salmon Bay Marina, on behalf of the Port of Seattle. The inspection was carried out between February 20th and February 21st, 2024, by a three-man team of engineer divers using surface-supplied diving equipment. This report provides details of the inspection scope, methodology, findings, and recommended actions, with accompanying photos and figures.

Salmon Bay Marina is located along the north side of Seattle and positioned along the south shore of the Lake Washington Ship Canal. The facility comprises three timber pile-supported docks along the east half of the property and three floating docks along the west half. The timber pile-supported docks (Dock A, Dock B, and Dock C) service several dozen private marine vessels, providing shore power, water, and other accommodations to the over 100 boat slips.

1.1 Inspection History

The most recent underwater inspection was performed in 2017 by Echelon Engineers, Inc. This inspection will act as the basis for comparison and for the timber piles.

1.2 Inspection Procedure

The routine level inspection was conducted by a three-person team consisting of a Lead Engineer-Diver (Team Leader) working under the direction of a Washington State P.E. (as responsible charge), a Diving Supervisor, and an Engineer-Diver. The Lead Engineer Diver is a Professional Engineer in New York and New Jersey. Their Washington State P.E. application was pending at the time of inspection and has since been approved. All work was performed in general accordance with ASCE's Waterfront Facility and Assessment Manual MOP-130, unless otherwise noted. A Level I inspection effort, consisting of a close visual examination, was performed on 100 percent of accessible structural elements, including timber piles beneath the docks and walkway along the bulkhead, timber sheet piles along the bulkhead, and timber pile caps at the interior end of Dock C. Additionally, 10 percent of timber piles were further subject to Level II and Level III inspection efforts. This included the removal of marine growth at three elevations: mean low water (MLW); mid-water or approximately midway between MLW and the mudline; as well as just above the mudline. The purpose of the Level II and III inspections was to identify any defects hidden by marine growth, to identify surface conditions, and to identify any loss of cross-sectional area (section loss) of the timber due to fungal rot. Additionally, as part of the Level III inspection, a diameter and pic depth were recorded at each elevation to determine the minimum effective diameter.

Dive operations were staged from a Jacobs dive van and met all guidelines governing commercial safe diving practices. All diving operations were conducted using surface-supplied diving equipment including a Kirby Morgan 57 diving helmet, a three-part umbilical with continuous hard-wire communications, and all associated commercial diving equipment.

1.3 Damage Grade Assessment

For this report, the following general condition assessment ratings, developed by the ASCE Waterfront Facilities Inspection and Assessment guidelines, were utilized for the individual element groups.

The general damage grade assessment ratings for individual timber elements are based on a five-point assessment scale and are listed and defined below:

- **No Defects**: No apparent loss of material.
- **Minor**: Checks, splits, and gouges less than 0.5 in. wide.

- **Moderate**: Loss of diameter up to 15 percent. Check and splits greater than 0.5 in. wide. Cross sectional loss up to 25 percent.
- **Major**: Loss of diameter between 15 and 30 percent. Check and splits through cross section. Cross sectional loss between 25 and 50 percent.
- **Severe**: Complete breakage. Fully non-bearing. Cross sectional loss exceeding 50 percent.

1.4 Condition Assessment Rating

Each structural element or group of elements inspected within a facility is given a condition assessment rating, as well as the facility overall. The ratings provide guidance regarding the recommended priorities of follow-up actions to be taken by the owner. The condition assessment rating of the overall structure and elements comprising the structure is established using the information gathered during the inspection process. The severity, type, and quantity of damage, defects, and deterioration on a structure, as well as the overall impact that a set of conditions has on the facility, are processed to derive the defined condition assessment ratings. The general condition assessment ratings for the entire facility as well as its individual structures and element groups are based on a six-point assessment scale developed by the ASCE. The six condition assessment ratings are:

- **Good**: No problems or only minor problems noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs or upgrades are required.
- **Satisfactory**: Limited minor to moderate defects or deterioration observed, but no overstressing observed. No repairs or upgrades are required.
- **Fair**: All primary structural elements are sound; but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present, but do not significantly reduce the load bearing capacity of the structure. Repairs are recommended, but the priority of the recommended repairs is low.
- **Poor**: Advanced deterioration or overstressing observed on widespread portions of the structure but does not significantly reduce the load bearing capacity of the structure. Repairs may be carried out with moderate urgency.
- **Serious**: Advanced deterioration, overstressing or breakage may have significantly affected the load bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. Repairs may need to be carried out on a high priority basis with urgency.
- **Critical**: Very advanced deterioration, overstressing or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur and load restrictions should be implemented as necessary. The capacity of the structure is critically deficient relative to the structural requirements. Repairs may need to be carried out on a very priority basis with strong urgency.

1.5 Recommended Actions

Based on the overall condition assessments of the structures and the individual component groups, and the structural impacts of the observed defects or deterioration, recommended actions were assigned to either prevent unsafe conditions or to determine order-of-magnitude cost estimates for future actions including rehabilitation, design, and inspection work. Recommended actions can be categorized into the following four general types of actions: Emergency/Immediate Actions, General Repair Recommendations, Additional Investigation and Engineering Analysis, or No Action.

Recommended Emergency/Immediate level actions require prompt response to prevent unsafe conditions at the structure. These recommendations may include restricting access to portions of the structure, identifying deteriorated elements that require immediate strengthening, and/or scope for additional analysis to determine if the condition can be tolerated through redundant load paths. Notification, as required, is made immediately upon discovery of the condition warranting an emergency response.

General repair recommendations are grouped into two different levels of importance: Priority and Routine. Priority level actions are required to maintain the structure in a safe operating condition and/or prevent the discovered condition from continuing to a point where future repairs will be significantly more costly. Unless noted otherwise, Priority level actions should be implemented within one to three years depending on the severity of the condition. Routine level actions indicate tasks that should be undertaken as part of a scheduled maintenance program or other scheduled project. Postponing recommended Routine level actions will not compromise the stability of the structure. Unless noted otherwise, Routine level actions that consist of rehabilitation should be implemented within one year after the completion of the next scheduled Routine Level inspection.

Additional investigations and/or engineering analyses are recommended when more information is needed to better determine the overall structural condition, the cause or significance of non-typical defects or deterioration, or an appropriate repair method. No action could be recommended when a facility is relatively new and does not exhibit any defects or deterioration warranting repair, or when no further action is necessary at a facility until the next scheduled inspection.

2. Description of Facility

Salmon Bay Marina is located along the north side of Seattle and positioned along the south shore of the Lake Washington Ship Canal. The facility comprises three timber pile supported docks along the east half of the property and three floating docks along the west half. The timber pile supported docks (Dock A, Dock B, and Dock C) service several dozen private marine vessels, providing shore power, water, and other accommodations to the over 100 boat slips.

The timber piles measure 9 in. to 12 in. wide, with no discernable pattern to the change in pile diameter across the facility (Photo 2-1). The piles along the three docks extend form the mudline to approximately 12ft to 4ft above MLW (mean low water) and support the roof structure of the protective enclosures. Conversely, the piles beneath the inshore platforms at Dock B and Dock C, as well as the bulkhead and wave screens, extend approximately 3ft above MLW.

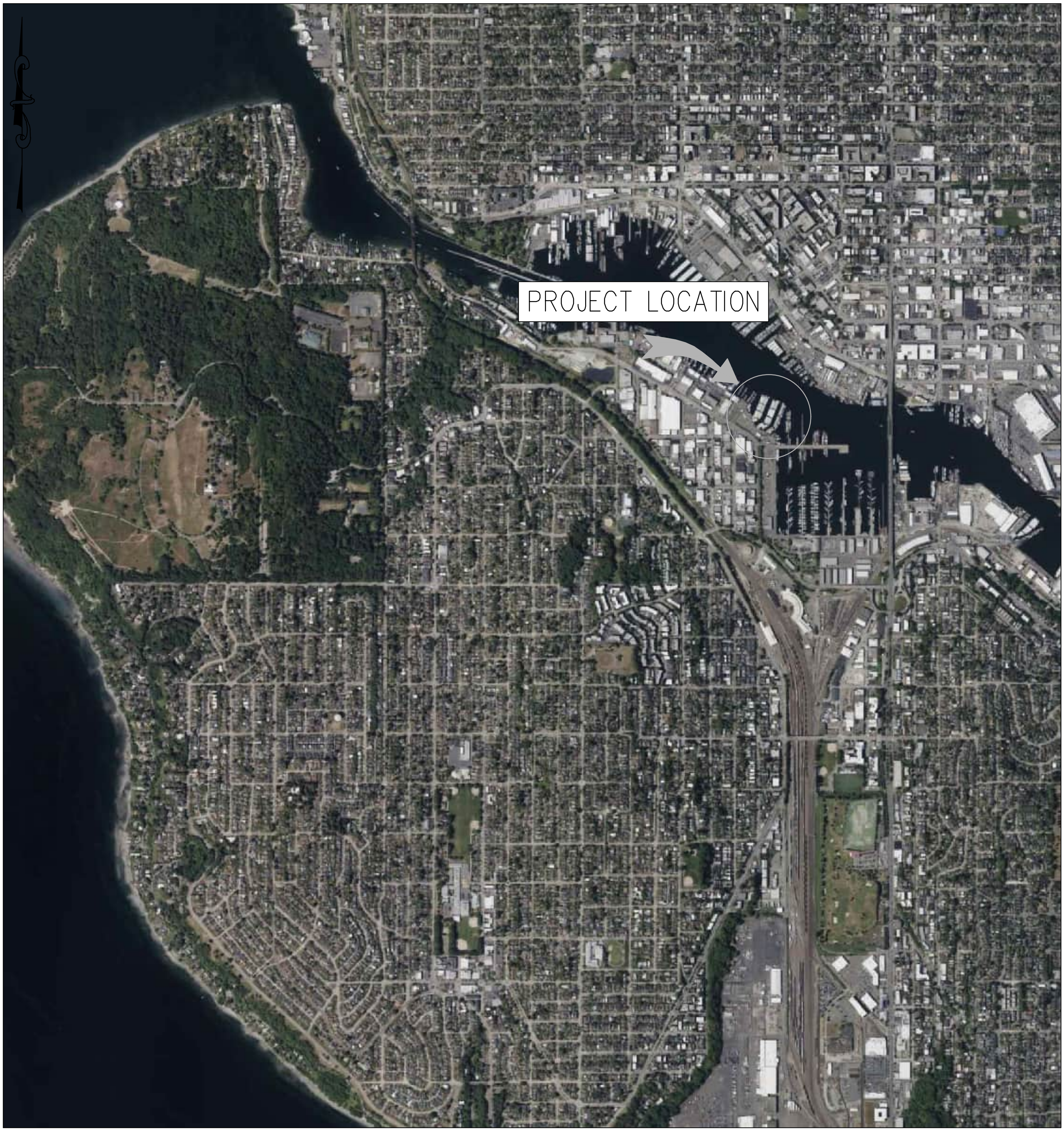
Dock A comprises 114 timber plumb and batter piles arranged into 33 bents. Each bent typically contains 3 to 4 piles, with the eastern-most pile supporting a low-water barrier to protect the berthed vessel from wake produced by ship traffic in the canal. A wave screen supported by an additional nine piles is positioned at the offshore end of the dock to limit the effects of wake on the berthed vessels.

Dock B is composed of 119 timber plumb and batter piles arranged into 29 bents. Each bent typically contains 4 piles. A wave screen supported by an additional 15 piles is positioned at the offshore end of the dock to limit the effects of wake on the berthed vessels (Photo 2-2). A small platform is positioned inshore of dock and affords access to the entrance. The platform is supported by 12 timber piles supporting a latticework of timber pile caps and stringers. Concrete grout repairs are present over the top 4.5 ft of 11 piles (Photo 2-3).

Dock C comprises 103 timber plumb and batter piles arranged into 22 bents. Each bent typically contains 5 piles. A wave screen supported by an additional 19 piles is positioned at the offshore end of the dock to limit the effects of wake on the berthed vessels. A platform is positioned inshore of dock, affording access to the Dock C entrance, and is supported by 27 timber piles supporting a latticework of timber pile caps and stringers. Gaps between the top of pile and bottom of timber pile cap at several locations are shimmed by 12 x 12 timber pile cap sections to restore bearing.

A timber sheet pile bulkhead retains fill along the parking lot that runs the length of the property. Intermittent timber piles at the face of the bulkhead support a narrow walkway that carries marina utilities to the three docks and acts as the emergency egress point from the water via retractable in-water safety ladders (Photo 2-4).

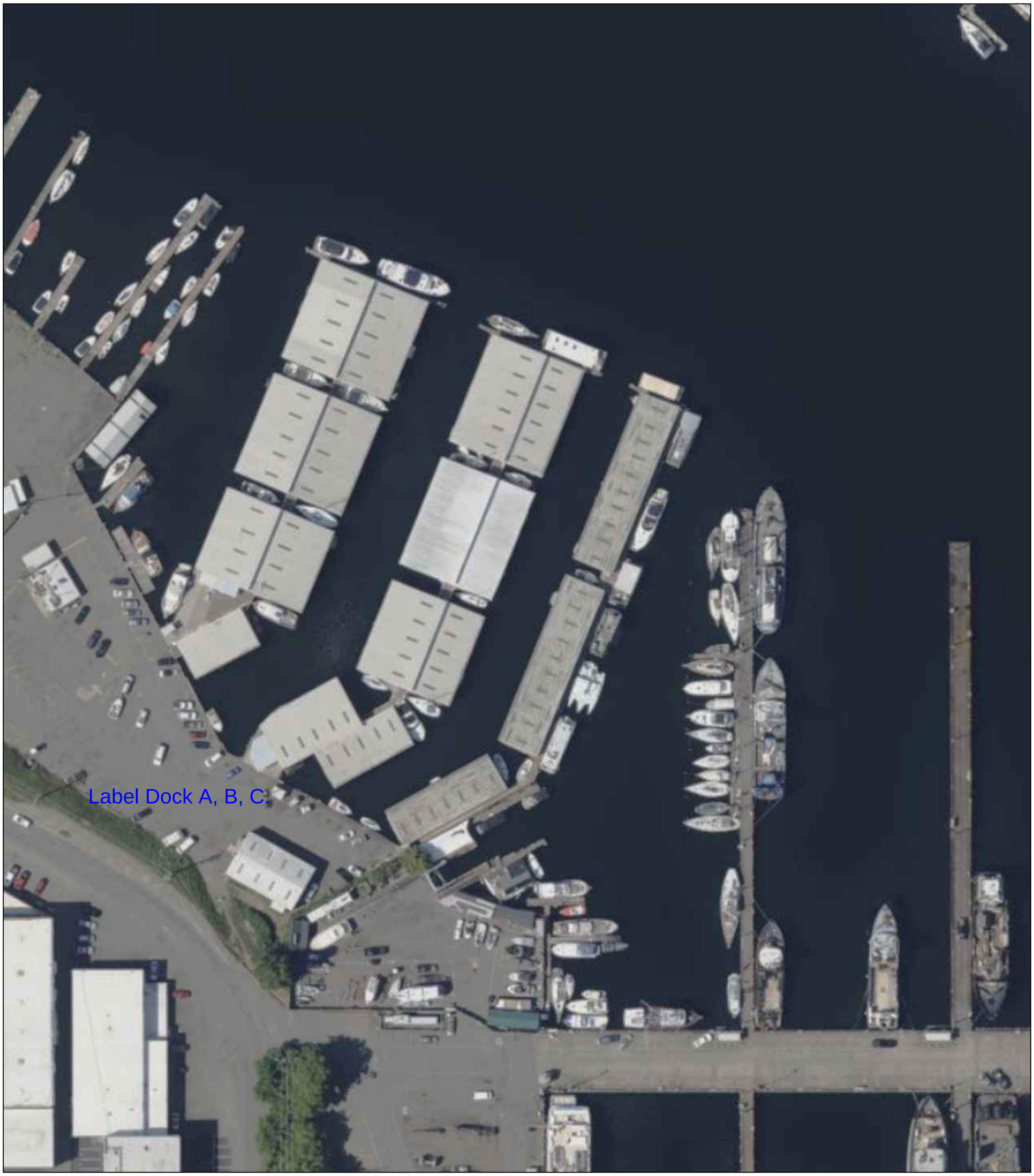
A Vicinity Map and Location Plan of the project site are provided in Figures 2-1 and 2-2, respectively.



Jacobs

PORT OF SEATTLE
MARINE FACILITIES
SEATTLE, WA
SALMON BAY MARINA
ROUTINE INSPECTION
VICINITY MAP

FIG 2–1



Jacobs

PORT OF SEATTLE
MARINE FACILITIES
SEATTLE, WA
SALMON BAY MARINA
ROUTINE INSPECTION
LOCATION PLAN

FIG 2–2

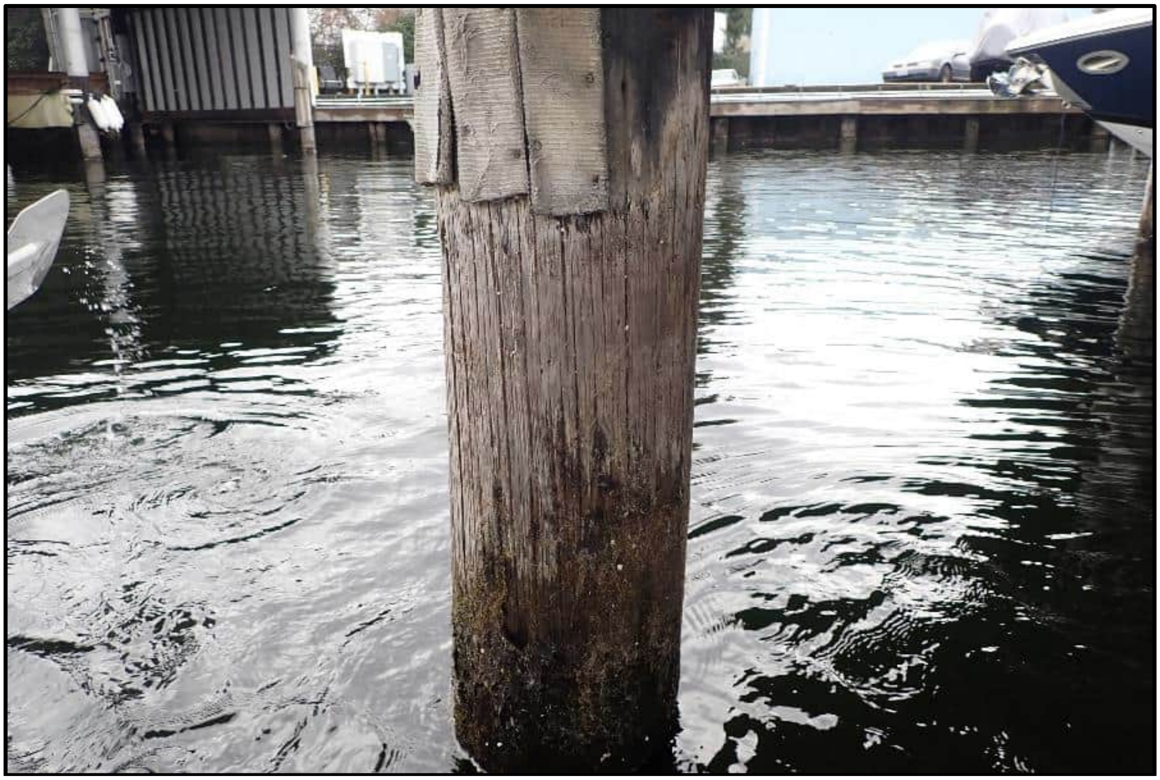


Photo 2-1: Typical timber pile ranging between 9 in. and 12 in. wide, along Docks A, B, and C.

Photo 2-2: Wave screen at the offshore end of the Docks A, B and C.

Photo 2-3: Typical concrete bag repair at Docks A, B, and C.

Photo 2-4: Intermittent timber piles at the face of the timber sheet pile bulkhead.

3. Existing Conditions

3.1 Timber Piles

The timber piles are in **Fair** condition, with 387 of the 445 inspected timber piles exhibiting only minor deterioration. The timber pile supporting the walkways and superstructure at Docks A, B, and C exhibit minor deterioration typical to piles in a freshwater environment, characterized by a softening of the exterior 0.25in. of timber below water and minor checking up to 0.25 in. above water. Additionally, concrete bag repairs are installed at 96 timber piles beneath the three docks. Repairs typically start at the bottom of the deck soffit and average between 48 in. and 60 in. long.

A total of 43 timber plumb and batter piles support the offshore wave screens located at the north end of each dock. Moderate to advanced deterioration was observed at 21 timber piles: including reduced bearing at the pile/post interface and corrosion of the steel fishplate and/or connection hardware. Severe deterioration was also observed at an additional 8 piles: including loss of bearing at the pile/post interface (Photo 3-1), severe corrosion of the fishplates and connection hardware (Photo 3-2), and failure of the bolted timber batter pile connection (Photo 3-3).

Advanced deterioration was also observed at the 27 timber piles supporting the inshore-most platform at Dock C, primarily due to fungal rot. Section loss up to 35 percent was observed at 15 timber piles, section loss between 35 and 50 percent was observed at two timber piles (Photo 3-4), and section loss greater than 50 percent was observed at an additional two timber piles (Photo 3-5). The presence of fungal rot at both the top of pile and bottom of pile cap resulted in reduced bearing at 6 pile locations. The most severe cases of bearing loss were accompanied by crushing and rotation of the lower 12 in. by 12 in. timber cap (Photo 3-6).

A total of 27 timber piles supports the timber walkway running the length of timber sheet pile bulkhead between Dock A and Dock C. The inshore timber piles exhibit minor fungal rot above and below water. Section loss up to 35 percent was observed at one timber pile, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional five timber piles (Photo 3-7). The timber piles with severe section loss exhibited other severe deterioration, including splitting and breakage within the top 54 in. of pile (Photo 3-8). Additionally, the timber sheet pile bulkhead was examined during inspection of the walkway piles. The timber sheeting exhibits isolated minor deterioration between walkway piles 1 and 27. The bulkhead was largely obscured by marine growth below water. Above water, and where cleaned for detailed inspection, the sheet piles showed no signs of advanced deterioration.

A summary of conditions for the timber piles along the three docks and bulkhead walkway are provided in Table 3-1 and Table 3-2, respectively.

Table 3-1: Summary of Timber Dock Pile Conditions

Structure	Total No. Inspected	Rating Condition									
		No Defect		Minor		Moderate		Major		Severe	
		No.	Approx. (%)	No.	Approx. (%)	No.	Approx. (%)	No.	Approx. (%)	No.	Approx. (%)
Dock A	123	0	0	115	94	3	2	5	4	0	0
Dock B	146	0	0	130	89	1	1	7	5	8	5
Dock C	149	0	0	123	83	15	10	7	5	4	2
Docks	418	0	0	368	88	19	5	19	5	12	2

Table 3-2: Summary of Walkway Pile Conditions

Structure	Total No. Inspected	Rating Condition									
		No Defect		Minor		Moderate		Major		Severe	
		No.	Approx. (%)	No.	Approx. (%)	No.	Approx. (%)	No.	Approx. (%)	No.	Approx. (%)
Walkway	27	0	0	19	70	1	4	2	7	5	19

Inspected pile locations, as well as associated damage grades at each location, are presented in Figures 3-1 through 3-3.

Photo 3-1: Loss of bearing at pile/post interface along the offshore wave screen.

Photo 3-2: Corrosion through full thickness of steel fish plate at pile/post connection of timber pile at offshore wave screen.

Photo 3-3: Failed connection at top of pile due to fungal rot at offshore wave screen.

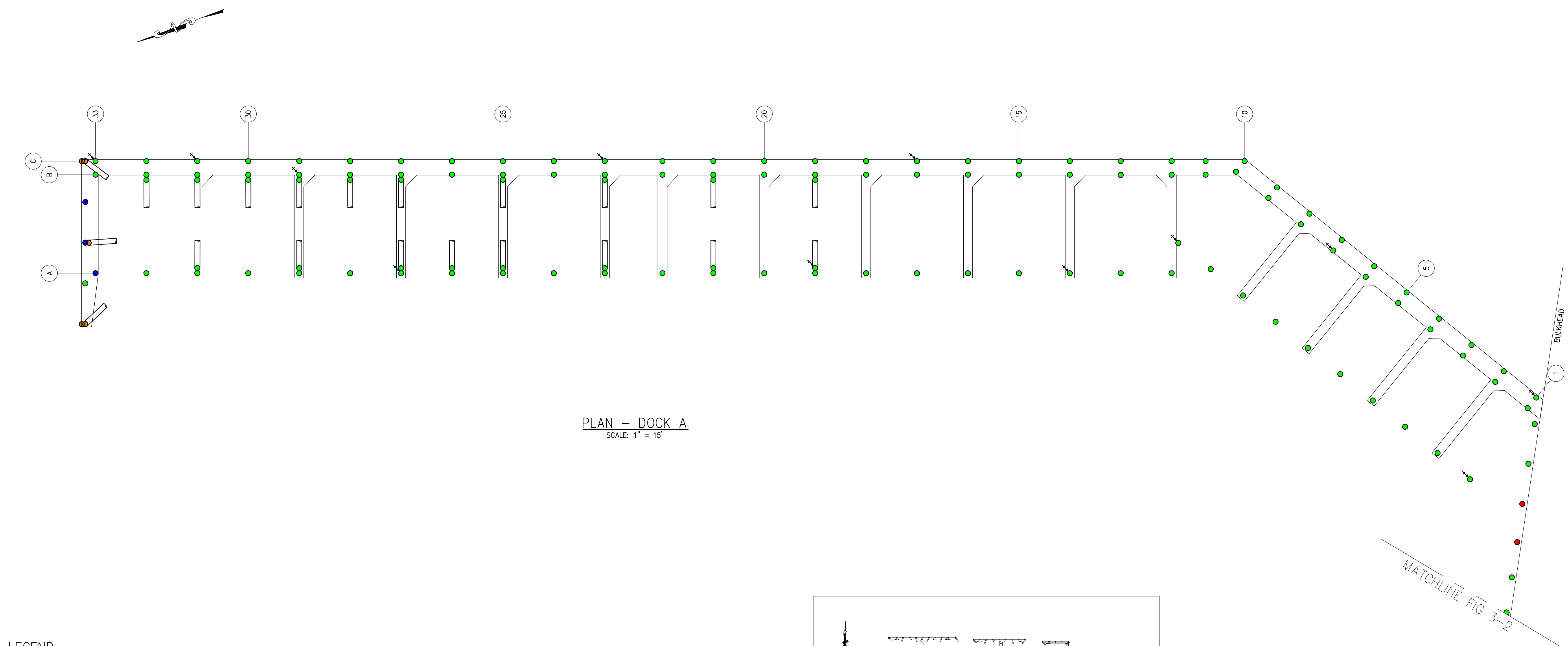
Photo 3-4: Timber pile with major section loss due to fungal rot at top of pile.

Photo 3-5: Timber pile with severe section loss due to fungal rot through core of pile.

Photo 3-6: Severe reduction in bearing due to rotation and crushing of lower timber cap shimming the connection between the pile and pile cap.

Photo 3-7: Timber pile with severe section loss due to fungal rot at top of pile along timber bulkhead.

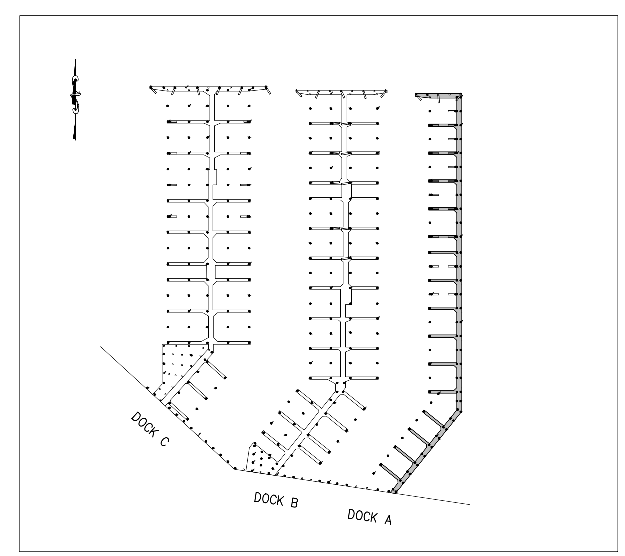
Photo 3-8: Timber pile with severe section loss and splitting at top of pile due to fungal rot along timber bulkhead.



PLAN – DOCK A
SCALE: 1" = 15'

LEGEND

- 2-4 PHOTO LOCATION
- LEVEL II & III LOCATIONS
- 12"ø TIMBER PILE
- 12"ø TIMBER BATTER PILE
- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED MAJOR (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED SEVERE (PRIORITY REPAIR TO BE IMPLEMENTED IN 1 TO 3 YEARS)



KEY PLAN

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

DESIGNED BY G.L.
DRAWN BY G.L.
CHECKED BY
PROJECT ENGR

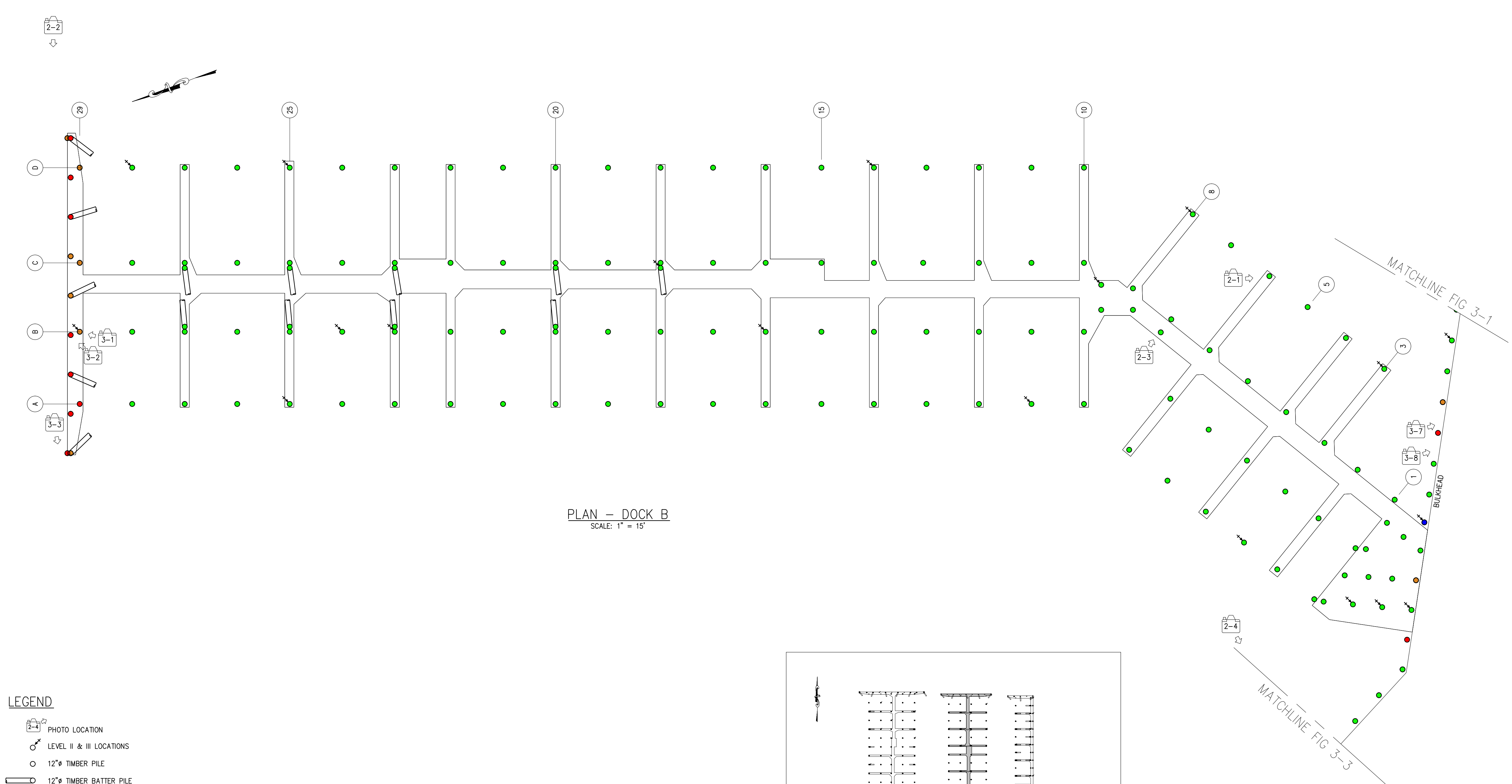
PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

PILE DEFICIENCY PLAN
SHEET 1 OF 3

SCALE 1" = 15'
REVISION
DATE

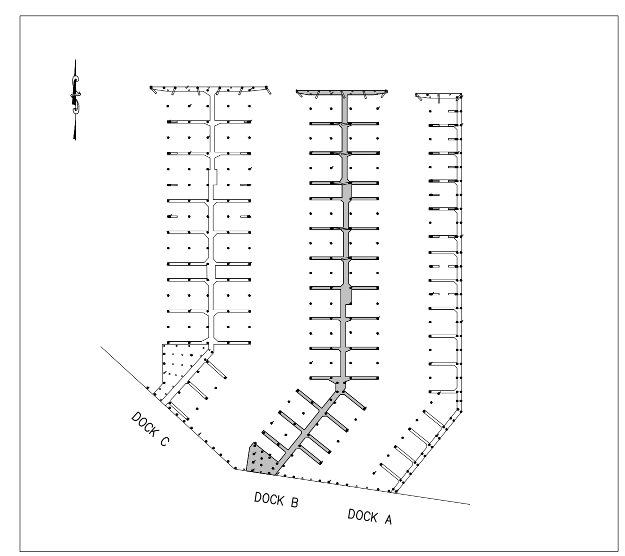
DRAWING NO.
FIG 3–1



PLAN – DOCK B
SCALE: 1" = 15'

LEGEND

- PHOTO LOCATION
- LEVEL II & III LOCATIONS
- 12"ø TIMBER PILE
- 12"ø TIMBER BATTER PILE
- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED MAJOR (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED SEVERE (PRIORITY REPAIR TO BE IMPLEMENTED IN 1 TO 3 YEARS)



KEY PLAN

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

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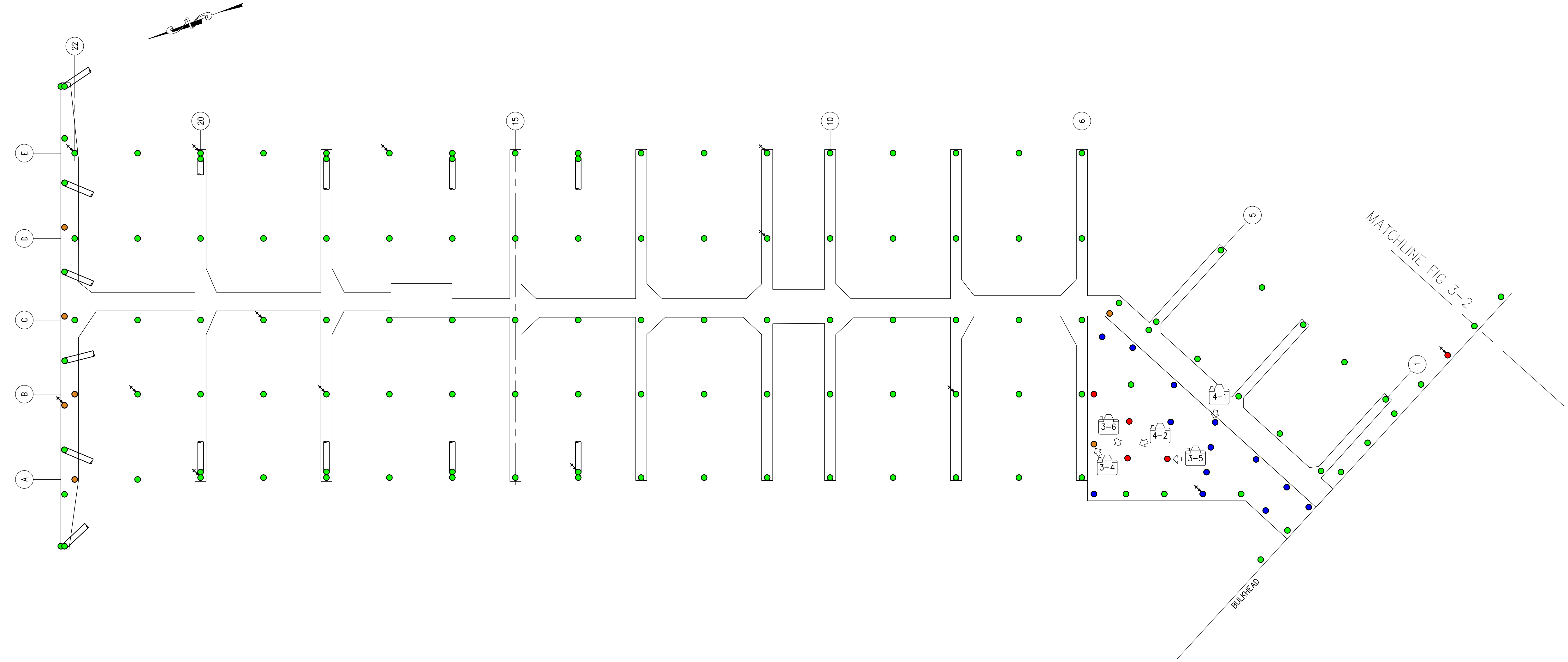
PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

PILE DEFICIENCY PLAN
SHEET 2 OF 3

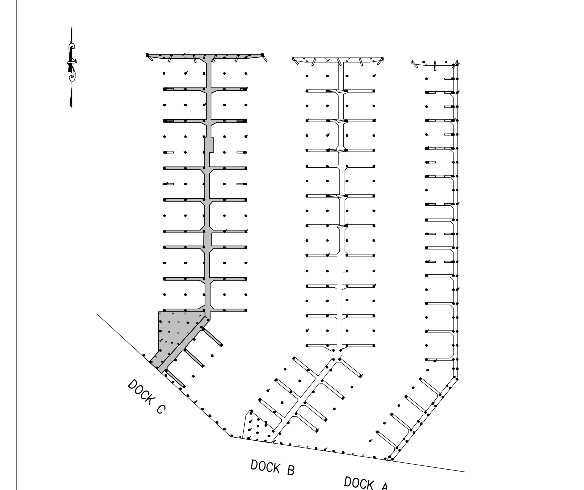
SCALE 1" = 15'
DATE
REVISION
DRAWING NO.
FIG 3–2



PLAN – DOCK C
SCALE: 1" = 15'

LEGEND

- PHOTO LOCATION
- LEVEL II & III LOCATIONS
- 12"ø TIMBER PILE
- 12"ø TIMBER BATTER PILE
- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED MAJOR (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED SEVERE (PRIORITY REPAIR TO BE IMPLEMENTED IN 1 TO 3 YEARS)



KEY PLAN

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
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SCALE ACCORDINGLY

REVISIONS

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DRAWN BY G.L.
CHECKED BY
PROJECT ENGR

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

PILE DEFICIENCY PLAN
SHEET 3 OF 3

SCALE 1" = 15'
REVISION
DATE
DRAWING NO.
FIG 3–3

4. Discussion

4.1 Timber Piles

The timber piles along the primary segments of Dock A, Dock B, and Dock C showed few signs of deterioration and, considering the age of the timber piles (circa. 1960), the softening of the outer ¼ in. of timber is expected. The checking above water is typical to an organic material such as timber, which develops inherent and unique characteristics or, in this case, flaws.

Comparison to the inspection results in the 2017 inspection report reveals little change in the overall condition of the timber piles. The piles noted along the bulkhead with severe deterioration remain in the comparable condition. Similarly, the timber wave screen piles showed similar levels of severe deterioration, both at the pile connections and at the pile/post interface. Timber piles not previously noted as severely damaged can likely be considered previously deteriorated, as the scope of the 2017 inspection lacked the breadth to encompass all timber piles.

The timber piles supporting the inshore platform at Dock C, as well as along the bulkhead and offshore wave screens, show greater levels of section loss and quantities of severe defects. Increased levels of fungal rot at these locations, attributable to the lower top of pile elevations, has resulted in increased localized deterioration. Exposure of the timber grain to standing moisture and has, over the years, softened the fibers of the material and reduced the rigidity of the cross-section. With the piles unable to dry, the saturated fibers crush and deform under compressive loads, evidenced by the similarly impacted timber elements that have since rotated and crushed under normal loading (Photo 4-1 and Photo 4-2). Conversely, the timber piles along the docks extend well above the waterline. The ends of the timber piles are safeguarded, covered by the protective enclosures housing the boat slips. This accounts for the lack of fungal rot in the timber piles along the three docks.

Photo 4-1: Dock C, Inshore Platform - Timber pile cap with severe section loss at its end due to rot.

Photo 4-2: Dock C, Inshore Platform - Timber stringer crushing between the deck above and timber pile cap below due to rot.

5. Recommended Repair Actions

Recommended repair actions for each structure are broken down based on the overall condition of the structures and the individual component groups, and the structural impacts of the observed deterioration. Recommended actions are broken down into the following four general types of actions.

- **Emergency/Immediate**: Actions that require prompt response to prevent unsafe conditions at the structure. These recommendations may include restricting access to portions of the structure, identifying deteriorated elements that require immediate strengthening, and/or scope for additional analysis to determine if the condition can be tolerated through redundant load paths.

- **Priority**: Actions that are required to maintain the structure in a safe operating condition and/or prevent the discovered condition from continuing to a point where future repairs will be significantly more costly. Unless noted otherwise, Priority level actions should be implemented within one to three years depending on the severity of the condition.

- **Routine**: Actions that indicate tasks that should be undertaken as part of a scheduled maintenance program or other scheduled project. Postponing recommended Routine level actions will not compromise the stability of the structure. Unless noted otherwise, Routine level actions that consist of rehabilitation should be implemented within one year after the completion of the next scheduled Routine Level inspection.

- **Additional Investigations**: Actions that are recommended when more information is needed to better determine the overall structural condition, the cause or significance of non-typical defects or deterioration, or an appropriate repair method.

5.1 Timber Piles

No Immediate repairs are recommended for the timber piles.

The following Priority repairs are recommended, to be implemented with 1 to 2 years of this inspection.

- Repair of nine timber piles with severe section loss along the walkway and at the inshore platform of Dock C.
- Replacement of severely corroded connection hardware at six locations along the wave screens.
- Restoration of bearing at the pile/post interface at six locations along the wave screens.
- Replacement of crushed/rotated timber pile caps above three timber piles at the inshore platform of Dock C.

The following Routine repairs are recommended, to be implemented with 3 to 5 years of this inspection.

- Repair of 21 timber piles with moderate to major section loss along the walkway and at the inshore platform of Dock C.
- Replacement of moderately corroded connection hardware at 21 locations along the wave screens.

It is additionally recommended that Salmon Bay Marina be reinspected within 5 years. This is the maximum interval recommended between Routine Level Inspections by the ASCE's Underwater Waterfront Facilities Inspection and Assessment Manual for timber structures in Fair condition and located in marine environments.

Appendix B. Recommended Repairs Cost Estimate

Salmon Bay Marina
Pile Repairs

Seattle, WA

Conceptual Repairs Cost Estimates

June 7, 2024

Prepared for:

Jacobs Engineering Group Inc.
1100 112th Avenue NE
Suite 500
Bellevue, WA 98004-5118

PRODIMS
PROJECT MANAGEMENT SERVICES

520 Kirkland Way, Suite 301
Kirkland, WA 98033
tel: (425) 828-0500
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www.prodims.com

Estimate Summary

PRODIMS PROJECT MANAGEMENT SERVICES
520 Kirkland Way, Suite 301
Kirkland, WA 98033
tel: (425) 828-0500
fax: (425) 828-0700
www.prodims.com

Name:	**Salmon Bay Marina**
Second Name:	**Pile Repairs**
Location:	**Seattle, WA**
Design Phase:	**Conceptual Cost Estimates**
Date of Estimate:	**June 7, 2024**
Date of Revision:	
Month of Cost Basis:	**June, 2024**

Master Estimate Summary

Subtotal Direct Cost $ 2,353,115

	Percentage of Previous Subtotal		Amount			
Scope Contingency	25.0%	$	588,279	Subtotal	$	2,941,394
General Conditions/Mobilization	10.0%	$	294,139	Subtotal	$	3,235,533
Home Office Overhead	6.0%	$	194,132	Subtotal	$	3,429,665
Profit	8.0%	$	274,373	Subtotal	$	3,704,039
Escalation NIC - Costs in Today's Dollars	0.00%	$	-	Subtotal	$	3,704,039

TOTAL ESTIMATED CONSTRUCTION COST → $ 3,704,039

Salmon Bay Priority Repairs Summary by Detail

Summary of Repairs		Direct Cost	with Markups from Above		Total of Each Repair
Priority Repairs					
Repair 9 timber piles with severe section loss along the walkway and at the inshore platform of Dock C. - 3 Methods					
Timber Post with Scab Plates - Repair 5 timber piles with severe section loss along the walkway and at the inshore platform of Dock C.	**$**	**141,955**	57.41%	**$**	**223,451**
Timber Block - Repair 2 Piles - Severe	**$**	**42,302**	57.41%	**$**	**66,588**
Timber Post with Scab Plates and 1" Through Bolt at Wave Screen - Repair 1 timber pile - Severe	**$**	**28,651**	57.41%	**$**	**45,099**
Replacement of severely corroded connection hardware at six locations along the wave screens with Fish Plates/Bolts. - Severe	**$**	**249,355**	57.41%	**$**	**392,510**
Restoration of bearing at the pile/post interface at six locations along the wave screens. - 2 Methods					
Restore Bearing with Angles, Bolts, Blocks and Shims - 2 Locations	**$**	**56,210**	57.41%	**$**	**88,480**
Restore Bearing with Shims - 3 Locations (Combined with Fish	**$**	**12,426**	57.41%	**$**	**19,560**
Replacement of crushed/rotated timber pile caps above three timber piles at the inshore platform of Dock C.	**$**	**57,622**	57.41%	**$**	**90,703**

TOTAL ESTIMATED CONSTRUCTION COSTS - Priority Repairs → $ 926,392

520 Kirkland Way, Suite 301
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Name:	**Salmon Bay Marina**
Second Name:	**Pile Repairs**
Location:	**Seattle, WA**
Design Phase:	**Conceptual Cost Estimates**
Date of Estimate:	**June 7, 2024**
Date of Revision:	
Month of Cost Basis:	**June, 2024**

Master Estimate Summary

Salmon Bay Routine Repairs Summary by Detail

Summary of Repairs	Direct Cost	with Markups from Above	Total of Each Repair
Routine Repairs			
Repair of 21 timber piles with moderate to major section loss along the walkway and at the inshore platform of Dock C.			
Timber Block - Repair 21 Piles - Moderate to Major	$ 336,440	57.41%	$ 529,589
Timber Post with Scab Plates and 1" Through Bolt at Wave Screen - Repair 21 timber piles - Moderate to Major	$ 575,811	57.41%	$ 906,384
Replacement of moderately corroded connection hardware at 21 locations along the wave screens.			
Replacement of moderately corroded connection hardware along the wave screens with Fish Plates/Bolts. 21 Locations	$ 852,343	57.41%	$ 1,341,673

TOTAL ESTIMATED CONSTRUCTION COSTS - Routine Repairs → $ 2,777,647

Estimate Assumptions:

This estimate is based on the Repair Concepts received 5-17-24
This estimate does not include Washington State Sales Tax.
All soft costs are the owner's responsibility to determine and verify. The Soft costs estimate has been excluded from the construction cost estimate.
Escalation is not included. Construction Costs are in today's dollars.

Estimate Qualifications:

The estimates is not be relied on solely for proforma development and financial decisions. Further design and planning should be completed.
Summary sheet markups are cumulative, not additive. Percentages are added to the previous subtotal rather than the direct cost subtotal.
Estimated labor is based on an 8 hour per day 5 days a week. Accelerated schedule overtime work has not been included.
Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
If only 1 or 2 bids are received the bids could be 40% to 100% more than the cost estimate based on empirical experience.
State of Washington General Contractor/ Construction Manager (GC/CM) contracts typically raises construction costs. It is Not Included in this estimate.
Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
Division 0/ Division 1 specifications are presumed to have normal ranges for liquidated damages, construction schedule and terms & conditions. These divisions are typically written after the final estimate. Please contact the cost estimator for a review, if desired.
Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.
The construction cost estimate does not include an estimate of owner soft costs such as taxes, A/E fees, owner contingencies and permit fees.
Construction reserve contingency for change orders is not included in the estimate.
Any modifications to the plans via addendums and code review for permits will cause cost increases and are not included in this estimate.
Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.
Imposition of tariffs and market instability of resources such as fuel, insurance and labor occurring after estimate date are not included.
Contractors imposing different bidding conditions from plans and specifications on subcontractors are not bidding from the plans and specifications.
Modifications to the proposed construction schedule and modifying the phasing plans after this estimate will affect construction cost and are not included.
The estimate includes a reasonable construction escalation that can be determined based on market conditions for up to the next 6 months.
Since this project has a midpoint of construction further than 6 months, increases in escalation are not included beyond the rate shown in the estimate.

Estimate Detail

PRODIMS PROJECT MANAGEMENT SERVICES
520 Kirkland Way, Suite 301
Kirkland, WA 98033
Phone: 425-828-0500 Fax: 425-828-0700
www.prodims.com

Name: **Salmon Bay Marina**
Second Name: **Salmon Bay Marina**
Location: **Seattle, WA**
Design Phase: **Conceptual Cost Estimates**
Date of Estimate: **June 7, 2024**
Date of Revision:
Month of Cost Basis: **June, 2024**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
G- Sitework - Priority Repairs											
Timber Post with Scab Plates - Repair 5 timber piles with severe section loss along the walkway and at the inshore platform of Dock C.											
G2040- Site Development											
	Cut Deteriorated Pile Top 24" to 60" Depending on Pile and Dispose - Non-Hazardous	5	each	$ 600.00	$ 3,000.00	$ 200.00	$ 1,000.00	$ 48.00	$ 240.00	$ 848.00	$ 4,240.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Dock Spike 1/2" Dia, 2 Per Post	10	each	$ 76.50	$ 765.00	$ 8.50	$ 85.00	$ 5.10	$ 51.00	$ 90.10	$ 901.00
	Timber Post 12"x12"x up to 5'-0"	5	each	$ 552.50	$ 2,762.50	$ 97.50	$ 487.50	$ 39.00	$ 195.00	$ 689.00	$ 3,445.00
	Timber Scab Plate 6"x12"x up to 9'-0" Long with 1" Bolt Approx 18 Each at a 9' Long Piece	10	each	$ 1,160.00	$ 11,600.00	$ 290.00	$ 2,900.00	$ 17.40	$ 174.00	$ 1,467.40	$ 14,674.00
	1" Dia Through Bolt ~18" L with 2 Nuts at Pile	90	each	$ 60.00	$ 5,400.00	$ 40.00	$ 3,600.00	$ 6.00	$ 540.00	$ 106.00	$ 9,540.00
	Drill Hole In Pile for 1" Through Bolt	90	each	$ 71.25	$ 6,412.50	$ 3.75	$ 337.50	$ 4.50	$ 405.00	$ 79.50	$ 7,155.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	10	day	$ 7,800.00	$ 78,000.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 78,000.00
	Tug - Equipment	10	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 24,000.00	$ 2,400.00	$ 24,000.00
Totals	**Timber Post with Scab Plates - Repair 5 timber piles with severe section loss along the walkway and at the inshore platform of Dock C.**									**Total Direct Costs ->**	**$ 141,955.00**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Timber Block - Repair 2 Piles - Severe											
G2040- Site Development											
	Cut Deteriorated Pile Top 24" to 60" Depending on Pile and Dispose - Non-Hazardous	2	each	$ 600.00	$ 1,200.00	$ 200.00	$ 400.00	$ 48.00	$ 96.00	$ 848.00	$ 1,696.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Timber Block 12"x12"x3'-0"	2	each	$ 446.25	$ 892.50	$ 78.75	$ 157.50	$ 31.50	$ 63.00	$ 556.50	$ 1,113.00
	6x6x3/8x6" Angle with 2 Each 1" Holes	4	each	$ 413.00	$ 1,652.00	$ 287.00	$ 1,148.00	$ 42.00	$ 168.00	$ 742.00	$ 2,968.00
	1" Dia 18"L Lag Screw	4	each	$ 42.25	$ 169.00	$ 22.75	$ 91.00	$ 3.90	$ 15.60	$ 68.90	$ 275.60
	1" Dia Through Bolt ~16" L with 2 Nuts at Pile	2	each	$ 48.00	$ 96.00	$ 32.00	$ 64.00	$ 4.80	$ 9.60	$ 84.80	$ 169.60
	Drill Hole In Pile for 1" Through Bolt	2	each	$ 71.25	$ 142.50	$ 3.75	$ 7.50	$ 4.50	$ 9.00	$ 79.50	$ 159.00
	Tapered Wood Block Approx 8"x8"x 3'-0" Long. Shop Fabrication Block into Taped Block	8	each	$ 401.63	$ 3,213.00	$ 70.88	$ 567.00	$ 28.35	$ 226.80	$ 500.85	$ 4,006.80
	1" Dia Through Bolt ~16" L with 2 Nuts at Wood Block and Wale	8	each	$ 48.00	$ 384.00	$ 32.00	$ 256.00	$ 4.80	$ 38.40	$ 84.80	$ 678.40
	Drill Hole In Wale for 1" Through Bolt	8	each	$ 71.25	$ 570.00	$ 3.75	$ 30.00	$ 4.50	$ 36.00	$ 79.50	$ 636.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	3	day	$ 7,800.00	$ 23,400.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 23,400.00
	Tug - Equipment	3	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 7,200.00	$ 2,400.00	$ 7,200.00
Totals	**Timber Block - Repair 2 Piles - Severe**									**Total Direct Costs ->**	**$ 42,302.40**
Timber Post with Scab Plates and 1" Through Bolt at Wave Screen - Repair 1 timber pile - Severe											
G2040- Site Development											
	Cut Deteriorated Pile Top 24" to 60" Depending on Pile and Dispose - Non-Hazardous	1	each	$ 600.00	$ 600.00	$ 200.00	$ 200.00	$ 48.00	$ 48.00	$ 848.00	$ 848.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Dock Spike 1/2" Dia, 2 Per Post	2	each	$ 76.50	$ 153.00	$ 8.50	$ 17.00	$ 5.10	$ 10.20	$ 90.10	$ 180.20
	Timber Post 12"x12"x up to 5'-0"	1	each	$ 552.50	$ 552.50	$ 97.50	$ 97.50	$ 39.00	$ 39.00	$ 689.00	$ 689.00

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Timber Scab Plate 6"x12"x up to 9'-0" with 1" Bolt Approx 18 Each	2	each	$ 1,160.00	$ 2,320.00	$ 290.00	$ 580.00	$ 17.40	$ 34.80	$ 1,467.40	$ 2,934.80
	1" Dia Through Bolt ~18" L with 2 Nuts at Pile	18	each	$ 60.00	$ 1,080.00	$ 40.00	$ 720.00	$ 6.00	$ 108.00	$ 106.00	$ 1,908.00
	Drill Hole In Pile for 1" Through Bolt	18	each	$ 71.25	$ 1,282.50	$ 3.75	$ 67.50	$ 4.50	$ 81.00	$ 79.50	$ 1,431.00
	1" Dia Through Bolt ~24" L with 2 Nuts at Wood Block and Wale	1	each	$ 127.50	$ 127.50	$ 42.50	$ 42.50	$ 10.20	$ 10.20	$ 180.20	$ 180.20
	Drill Hole In Wave Screen for 1" Through Bolt	1	each	$ 70.50	$ 70.50	$ 4.50	$ 4.50	$ 4.50	$ 4.50	$ 79.50	$ 79.50
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	2	day	$ 7,800.00	$ 15,600.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 15,600.00
	Tug - Equipment	2	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 4,800.00	$ 2,400.00	$ 4,800.00
Totals	**Timber Post with Scab Plates and 1" Through Bolt at Wave Screen - Repair 1 timber pile - Severe**									**Total Direct Costs ->**	**$ 28,650.70**
Replacement of severely corroded connection hardware at six locations along the wave screens with Fish Plates/Bolts. - Severe											
G2040- Site Development											
	Dap Pile in 4 Locations for New Large Fish (Scab) Plate	24	each	$ 1,140.00	$ 27,360.00	$ 60.00	$ 1,440.00	$ 72.00	$ 1,728.00	$ 1,272.00	$ 30,528.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Timber Fish (Scab) Plate 6"x8"x 6'-0" L	24	each	$ 800.00	$ 19,200.00	$ 200.00	$ 4,800.00	$ 12.00	$ 288.00	$ 1,012.00	$ 24,288.00
	1" Dia Bolt 20" L with Nut and Washer	48	each	$ 105.00	$ 5,040.00	$ 35.00	$ 1,680.00	$ 8.40	$ 403.20	$ 148.40	$ 7,123.20
	Drill Hole In Pile for 1" Bolt	48	each	$ 70.50	$ 3,384.00	$ 4.50	$ 216.00	$ 4.50	$ 216.00	$ 79.50	$ 3,816.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	18	day	$ 7,800.00	$ 140,400.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 140,400.00
	Tug - Equipment	18	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 43,200.00	$ 2,400.00	$ 43,200.00
Totals	**Replacement of severely corroded connection hardware at six locations along the wave screens with Fish Plates/Bolts. - Severe**									**Total Direct Costs ->**	**$ 249,355.20**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Restore Bearing with Angles, Bolts, Blocks and Shims - 2 Locations											
G2040- Site Development											
	Dap Pile in 4 Locations for New Wood Blocks	8	each	$ 380.00	$ 3,040.00	$ 20.00	$ 160.00	$ 24.00	$ 192.00	$ 424.00	$ 3,392.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	3x3x3/8x6" Angle with 4 Each 1" Holes	4	each	$ 202.50	$ 810.00	$ 22.50	$ 90.00	$ 13.50	$ 54.00	$ 238.50	$ 954.00
	Oak and Galvanized Steel Shims as Needed per Post	2	each	$ 595.00	$ 1,190.00	$ 105.00	$ 210.00	$ 42.00	$ 84.00	$ 742.00	$ 1,484.00
	Timber Block - Field Verify/Fabricate including Drilling 2 each 1" Hole	8	each	$ 800.00	$ 6,400.00	$ 200.00	$ 1,600.00	$ 12.00	$ 96.00	$ 1,012.00	$ 8,096.00
	1" Dia Bolt Through Bolt 18" L with 2 Nuts and Washers	8	each	$ 75.00	$ 600.00	$ 25.00	$ 200.00	$ 6.00	$ 48.00	$ 106.00	$ 848.00
	Drill Hole In Pile for 1" Bolt	8	each	$ 70.50	$ 564.00	$ 4.50	$ 36.00	$ 4.50	$ 36.00	$ 79.50	$ 636.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	4	day	$ 7,800.00	$ 31,200.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 31,200.00
	Tug - Equipment	4	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 9,600.00	$ 2,400.00	$ 9,600.00
Totals	**Restore Bearing with Angles, Bolts, Blocks and Shims - 2 Locations**									**Total Direct Costs ->**	**$ 56,210.00**
Restore Bearing with Shims - 3 Locations (Combined with Fish Plate Repair Above)											
G2040- Site Development											
	Oak and Galvanized Steel Shims as Needed per Post	3	each	$ 595.00	$ 1,785.00	$ 105.00	$ 315.00	$ 42.00	$ 126.00	$ 742.00	$ 2,226.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	1	day	$ 7,800.00	$ 7,800.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 7,800.00
	Tug - Equipment	1	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 2,400.00	$ 2,400.00	$ 2,400.00
Totals	**Restore Bearing with Shims - 3 Locations (Combined with Fish Plate Repair Above)**									**Total Direct Costs ->**	**$ 12,426.00**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Replacement of crushed/rotated timber pile caps above three timber piles at the inshore platform of Dock C.											
G2040- Site Development											
	Cut Deteriorated Pile Top Allow 1 Foot and Dispose - Non-Hazardous	3	each	$ 600.00	$ 1,800.00	$ 200.00	$ 600.00	$ 48.00	$ 144.00	$ 848.00	$ 2,544.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Timber Block 12"x12"x3'-0"	3	each	$ 446.25	$ 1,338.75	$ 78.75	$ 236.25	$ 31.50	$ 94.50	$ 556.50	$ 1,669.50
	1" Dia 18"L Lag Screw	6	each	$ 42.25	$ 253.50	$ 22.75	$ 136.50	$ 3.90	$ 23.40	$ 68.90	$ 413.40
	Tapered Wood Block Approx 6"x6"x 3'-0" Long. Shop Fabrication Block into Taped Block	6	each	$ 401.63	$ 2,409.75	$ 70.88	$ 425.25	$ 28.35	$ 170.10	$ 500.85	$ 3,005.10
	1" Dia Through Bolt ~16" L with 2 Nuts at Wood Block and Wale	12	each	$ 48.00	$ 576.00	$ 32.00	$ 384.00	$ 4.80	$ 57.60	$ 84.80	$ 1,017.60
	Drill Hole In Pile Cap for 1" Through Bolt	12	each	$ 71.25	$ 855.00	$ 3.75	$ 45.00	$ 4.50	$ 54.00	$ 79.50	$ 954.00
	2-3/8" Toe-Nailed Spike 2 Per Pile	6	each	$ 68.00	$ 408.00	$ 17.00	$ 102.00	$ 5.10	$ 30.60	$ 90.10	$ 540.60
	Stainless Steel Band At Pile	3	each	$ 390.00	$ 1,170.00	$ 210.00	$ 630.00	$ 36.00	$ 108.00	$ 636.00	$ 1,908.00
	Add Epoxy Compound Around Pile at Splash Zone	3	each	$ 975.00	$ 2,925.00	$ 525.00	$ 1,575.00	$ 90.00	$ 270.00	$ 1,590.00	$ 4,770.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	4	day	$ 7,800.00	$ 31,200.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 31,200.00
	Tug - Equipment	4	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 9,600.00	$ 2,400.00	$ 9,600.00
Totals	**Replacement of crushed/rotated timber pile caps above three timber piles at the inshore platform of Dock C.**									**Total Direct Costs ->**	**$ 57,622.20**

G- Sitework - Routine Repairs

Timber Block - Repair 21 Piles - Moderate to Major

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
G2040- Site Development											
	Cut Deteriorated Pile Top 24" to 60" Depending on Pile and Dispose - Non-Hazardous	21	each	$ 600.00	$ 12,600.00	$ 200.00	$ 4,200.00	$ 48.00	$ 1,008.00	$ 848.00	$ 17,808.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Timber Block 12"x12"x3'-0"	21	each	$ 446.25	$ 9,371.25	$ 78.75	$ 1,653.75	$ 31.50	$ 661.50	$ 556.50	$ 11,686.50
	6x6x3/8x6" Angle with 2 Each 1" Holes	42	each	$ 413.00	$ 17,346.00	$ 287.00	$ 12,054.00	$ 42.00	$ 1,764.00	$ 742.00	$ 31,164.00
	1" Dia 18"L Lag Screw	42	each	$ 42.25	$ 1,774.50	$ 22.75	$ 955.50	$ 3.90	$ 163.80	$ 68.90	$ 2,893.80
	1" Dia Through Bolt ~16" L with 2 Nuts at Pile	21	each	$ 48.00	$ 1,008.00	$ 32.00	$ 672.00	$ 4.80	$ 100.80	$ 84.80	$ 1,780.80
	Drill Hole In Pile for 1" Through Bolt	21	each	$ 71.25	$ 1,496.25	$ 3.75	$ 78.75	$ 4.50	$ 94.50	$ 79.50	$ 1,669.50
	Tapered Wood Block Approx 8"x8"x 3'-0" Long. Shop Fabrication Block into Taped Block	42	each	$ 401.63	$ 16,868.25	$ 70.88	$ 2,976.75	$ 28.35	$ 1,190.70	$ 500.85	$ 21,035.70
	1" Dia Through Bolt ~16" L with 2 Nuts at Wood Block and Wale	84	each	$ 48.00	$ 4,032.00	$ 32.00	$ 2,688.00	$ 4.80	$ 403.20	$ 84.80	$ 7,123.20
	Drill Hole In Wale for 1" Through Bolt	84	each	$ 71.25	$ 5,985.00	$ 3.75	$ 315.00	$ 4.50	$ 378.00	$ 79.50	$ 6,678.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	23	day	$ 7,800.00	$ 179,400.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 179,400.00
	Tug - Equipment	23	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 55,200.00	$ 2,400.00	$ 55,200.00
Totals	Timber Block - Repair 21 Piles - Moderate to Major									Total Direct Costs ->	$ 336,439.50

Timber Post with Scab Plates and 1" Through Bolt at Wave Screen - Repair 21 timber piles - Moderate to Major

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
G2040- Site Development											
	Cut Deteriorated Pile Top 24" to 60" Depending on Pile and Dispose - Non-Hazardous	21	each	$ 600.00	$ 12,600.00	$ 200.00	$ 4,200.00	$ 48.00	$ 1,008.00	$ 848.00	$ 17,808.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Dock Spike 1/2" Dia, 2 Per Post	42	each	$ 76.50	$ 3,213.00	$ 8.50	$ 357.00	$ 5.10	$ 214.20	$ 90.10	$ 3,784.20
	Timber Post 12"x12"x up to 5'-0"	21	each	$ 552.50	$ 11,602.50	$ 97.50	$ 2,047.50	$ 39.00	$ 819.00	$ 689.00	$ 14,469.00

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
	Timber Scab Plate 6"x12"x up to 9'-0" with 1" Bolt Approx 18 Each	42	each	$ 1,160.00	$ 48,720.00	$ 290.00	$ 12,180.00	$ 17.40	$ 730.80	$ 1,467.40	$ 61,630.80
	1" Dia Through Bolt ~18" L with 2 Nuts at Pile	378	each	$ 60.00	$ 22,680.00	$ 40.00	$ 15,120.00	$ 6.00	$ 2,268.00	$ 106.00	$ 40,068.00
	Drill Hole In Pile for 1" Through Bolt	378	each	$ 71.25	$ 26,932.50	$ 3.75	$ 1,417.50	$ 4.50	$ 1,701.00	$ 79.50	$ 30,051.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	40	day	$ 7,800.00	$ 312,000.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 312,000.00
	Tug - Equipment	40	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 96,000.00	$ 2,400.00	$ 96,000.00
Totals	Timber Post with Scab Plates and 1" Through Bolt at Wave Screen - Repair 21 timber piles - Moderate to Major									Total Direct Costs ->	$ 575,811.00
	Replacement of moderately corroded connection hardware along the wave screens with Fish Plates/Bolts. 21 Locations										
G2040- Site Development											
	Dap Pile in 4 Locations for New Large Fish (Scab) Plate	84	each	$ 1,140.00	$ 95,760.00	$ 60.00	$ 5,040.00	$ 72.00	$ 6,048.00	$ 1,272.00	$ 106,848.00
	All Wood is Treated, All Steel is Galvanized and Fabricated off Site, All Hardware Is Galvanized and All Items Lists are Installed. This is to Shorten Descriptions										
	Timber Fish (Scab) Plate 6"x8"x 6'-0" L	84	each	$ 800.00	$ 67,200.00	$ 200.00	$ 16,800.00	$ 12.00	$ 1,008.00	$ 1,012.00	$ 85,008.00
	1" Dia Bolt ~20" L with Nut and Washer	168	each	$ 105.00	$ 17,640.00	$ 35.00	$ 5,880.00	$ 8.40	$ 1,411.20	$ 148.40	$ 24,931.20
	Drill Hole In Pile for 1" Bolt	168	each	$ 70.50	$ 11,844.00	$ 4.50	$ 756.00	$ 4.50	$ 756.00	$ 79.50	$ 13,356.00
	Tug Crew to Support Work - Marine Crew - 2 Tug Operators, 2 Longshoreman - 4 Person Crew, 10 Hour Day	61	day	$ 7,800.00	$ 475,800.00	$ -	$ -	$ -	$ -	$ 7,800.00	$ 475,800.00
	Tug - Equipment	61	day	$ -	$ -	$ -	$ -	$ 2,400.00	$ 146,400.00	$ 2,400.00	$ 146,400.00
Totals	Replacement of moderately corroded connection hardware along the wave screens with Fish Plates/Bolts. 21 Locations									Total Direct Costs ->	$ 852,343.20
										Total Direct Costs ->	$ 2,353,115

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Concept Design Report

Document no: W3Y17302–REP–03
Version: R01

Port of Seattle

Salmon Bay Marina Docks A–C Roof Safety
March 20, 2025

Jacobs

Concept Design Report

Client name:	Port of Seattle		
Project name:	Salmon Bay Marina Docks A–C Roof Safety		
Document no:	W3Y17302–REP–03	**Project no:**	W3Y17302
Version:	R01	**Project manager:**	Aldo Ferrufino
Date:	March 20, 2025	**Prepared by:**	Discipline Leads

Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
R00	October 21, 2024	First Issuance	Amir Lotfi Connie Kuney–Pitts Curtis Smith Jack Campbell	Vu Phan Kent Soelberg John De Luca Gareth Rowe	Philippa Carter Richard Hills John De Luca	Aldo Ferrufino
R01	March 20, 2025	Second Issuance	Amir Lotfi Connie Kuney–Pitts Curtis Smith Jack Campbell	Vu Phan Kent Soelberg John De Luca	Philippa Carter Richard Hills	Aldo Ferrufino

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Contents

Appendices

Tables

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List of Acronyms

Description	Acronym
Alaskan Cedar	AC
American Concrete Institute	ACI
Americans with Disabilities Act	ADA
Americans with Disabilities Act Guidelines	ADAG
American Institute of Steel	AISC
American Society of Civil Engineers	ASCE
Best Management Practices	BMPs
Conceptual Basis of Design	BoD
Corps of Engineers	COE
Demand Capacity	DC
Department of Natural Resources	DNR
Floating On–Water Residences	FOWRs
Gallons Per Minute	gpm
International Building Code	IBC
Hollow Structural Sections	HSS
Pounds	lbs.
Kilopound	Kip
Manual of Practice	MOP
Mean Lower Low Water	MLLW
National Design Specification	NDS
National Electrical Code	NEC
National Fire Protection Association	NFPA
Ordinary High Water	OHW
Pounds per Square Foot	PSF
Pounds per Square Inch	psi
Salmon Bay Marina	SaBM
2021 Seattle Building Code	SBC
Seattle Department of Construction and Inspection	SDCI
2021Seattle Existing Building Code	SEBC
Sustainable Environmental Framework	SEF
Square foot	sf
Shoreline Management Act	SMA
Seattle Municipal Code	SMC
United Facilities Criteria	UFC
Urban Maritime	UM
Washington Department of Natural Resources	WADNR
Washington Industrial Safety and Health Act	WISHA

1 Introduction

1.1 Description of Facility

Salmon Bay Marina (SaBM), originally built in 1961, was acquired by the Port of Seattle in 2018. Situated between the Ballard Locks (approximately 3,500 feet away) and the Ballard Bridge (about 1,400 feet away), it is located on the north side of Seattle along the south shore of the Lake Washington Ship Canal, northwest of Fishermen's Terminal (refer to Figure 4). The marina spans five Docks (A–E) with a total of 181 slips. The scope of this study includes Docks A–C only (refer to Figure 1), which currently offer c.132 slips (refer to Figure 2) and c.26,000 square feet of covered moorage. The marina accommodates recreational boats, floating on–water residences (FOWRs), and liveaboards; the liveaboards have moorage agreements and are not considered tenants. Existing utilities include domestic water and electrical supply, as well as a manual dry standpipe system for fire protection. The existing telephone or cable TV wiring are understood to no longer be active.

The current marina structure consists of timber walkways and a timber–supported roof, all supported by continuous creosote timber piles.

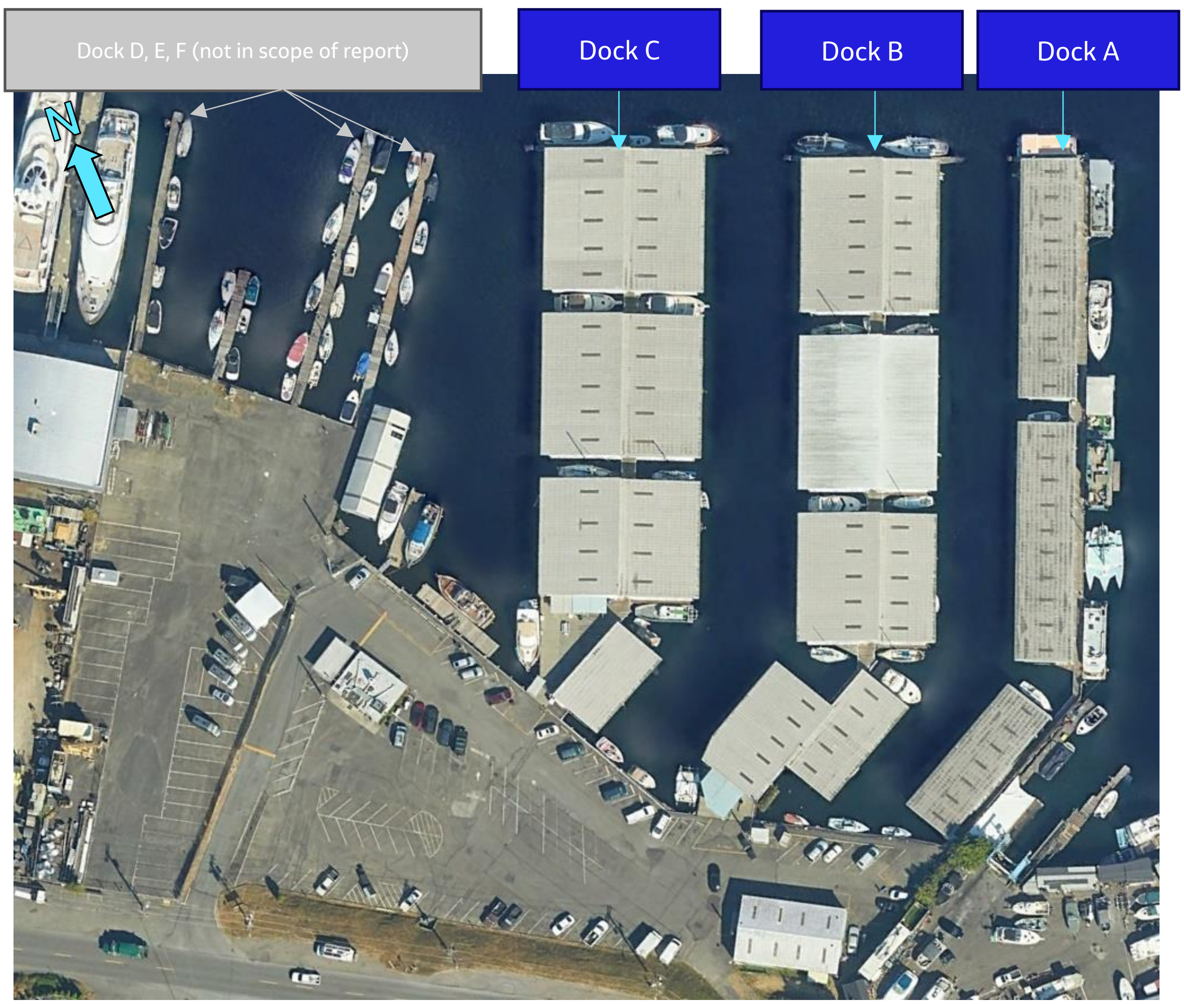

Figure 1 – Plan View showing Dock A, B, and C at Salmon Bay Marina (SaBM)

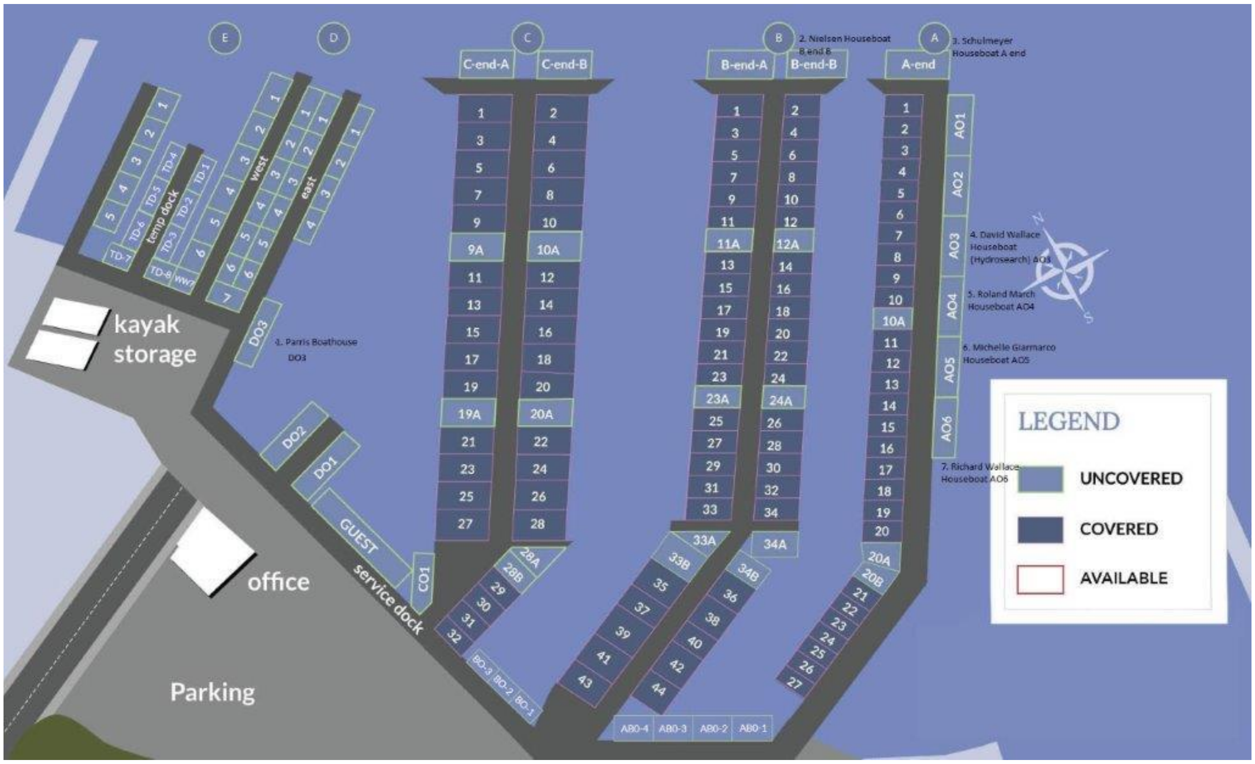

Figure 2 – SaBM Slip Information, as provided by the Port on 8-14-2024.

The key cross-sectional elements of the existing covered moorage are shown in Figure 3.

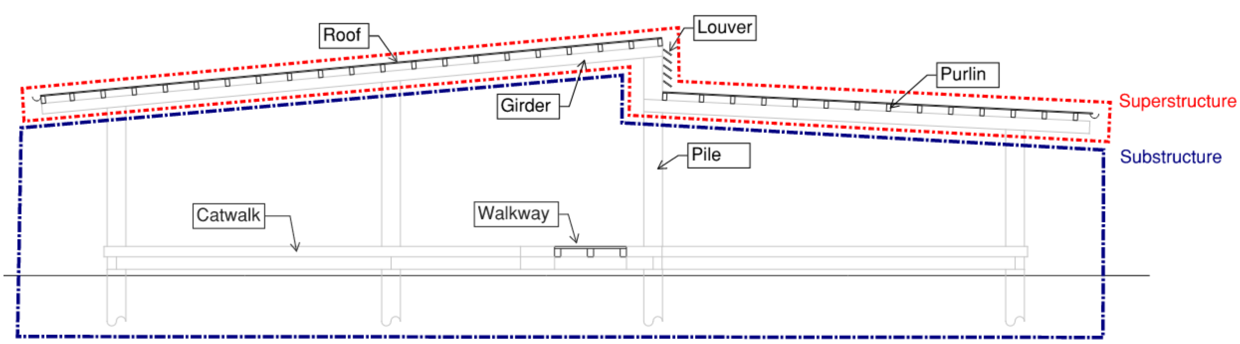

Figure 3 – Cross-Sectional Elements of the Existing Covered Moorage of Dock A-C

1.2 Project Location

A Vicinity Map of the project site is provided in Figure 4.

Figure 4 – Project Vicinity Map

1.3 Project Objective

Based on the studies undertaken to date, the two main objectives are to (i) address roof safety issues and (ii) fire suppression safety. The Port is concerned about the condition of the existing deteriorated roof structure, which is leaking and rusting, and creates a safety barrier to perform maintenance or repair. In addition, the current roof structure does not contain a fire suppression system, which poses fire safety, compliance, life safety, and liability risks. The Port is also concerned about access and maintenance issues, especially because the existing electrical infrastructure located within the roof is very difficult to access.

The Port is undertaking a feasibility assessment to support development of the concept design for two options: 1. Roof Replacement, and 2. Permanent Roof Removal. The feasibility assessment includes the respective technical and code considerations for these options. The outcome of this concept design effort will help inform the path forward to be selected by the Port.

1.4 Purpose of Document

The purpose of this concept design document is to present the concept design including the design, the drawing package, the Class 3 cost estimate, and project schedule of the following two options for Docks A–C of SaBM:

- Option 1: Roof Replacement
- Option 2: Permanent Roof Removal

The contents and assumptions outlined in this document are accurate as of the report's development date and may be subject to modification as project requirements evolve. The purpose of this report is to document the technical details and design considerations for both options at conceptual design. The information presented is intended to provide a clear understanding of the design concepts.

This document should be read in conjunction with the latest conceptual Basis of Design document (W3Y17302-REP-02_Rev3), which outlines the codes, standard, guidelines, and assumptions used for the concept design. This concept design report builds on the information presented in the feasibility assessment documents (W3Y17302-REP-01_Rev3) which presented the regulatory parameters, technical parameters, the scope summary, the Class 4 cost estimate, the project schedule, and the schematic drawings.

1.5 Previous Studies Summary

This section provides an overview of the previous studies undertaken by the Port and more recently by Jacobs for SaBM. It highlights key findings and conclusions from studies, offering a foundational understanding of the marina's current condition and structural integrity. This summary serves as a critical reference point for the feasibility assessment.

1.5.1 Previous Port Studies

An approved master use permit (3012950-LU) for site improvements (never acted upon and has since lapsed) was included in the Port's purchase of SaBM in 2018. Studies undertaken as part of the due diligence effort included a dive investigation by Echelon Engineering Inc and a pre–purchase general assessment by the Port.

In 2019, Cornerstone Architectural Group, in partnership with PSM Consulting Engineers, provided a limited visual assessment of the existing metal roof system on portions of Docks A, B, and C for the intention of skylight installations. Cornerstone's assessment determined the roof system has failed due to outdated design, lack of maintenance, and damage from overloading of snow or persons walking on the roof. Cornerstone did not recommend installing skylights in the existing roof system "due to the potential for life safety issues during any construction work and general safety for the occupants & general public."

Since 2019, the Port has undertaken further studies relevant to Docks A–C:

- SaBM Covered Moorage Docks A, B, & C – Roof Structure Condition Assessment, Port of Seattle (2022). This report summarizes findings from a site visit of Docks A, B, and C at SaBM conducted in September 2022. In general, findings included that *"roof girders and joists"* were reported in *"Good condition." "Occasional signs of splitting and warping were observed in the girder members"* ... *"Moderate weathering can also be seen at the ends of the girders where they are more exposed to rain and sun but does not appear to affect the primary spans of the girders."*

  The following deficiencies were found and summarized in the report:

  - *"No code–compliant lateral system is evident for either a wind or seismic event. At the roof level, only cantilevered piles support incidental lateral loads."*
  - *"Girder members (generally E–W) range from 100% to 180% of their design capacity."*
  - *"Joists members (generally N–S) range from 100% to 150% of their design capacity."*
  - *"Thru–bolt connections from large double–girder members to the piles are inadequate."*
  - *"Where girders rest on top of existing piles, no visible connection can be seen."*

  The report recommends that the existing metal roof is well past its service life and needs repair or replacement. The report also presents recommendations of connection upgrades and possible solutions to address the failing roof panels.

- Salmon Bay Marina Evaluation for Improvements, Port of Seattle (2022). This report considers four options: 1) reconfiguration of Docks A–C, 2) roof repair, 3) roof replacement, and 4)

permanent roof removal. This report references the structural deficiencies and findings as per the previous referenced bullet point and highlights the risk from fire due to lack of sprinkler system.

- Salmon Bay Marina Electrical Condition Assessment Report, Port of Seattle (2023). This report includes an electrical condition assessment of moorage Docks A, B, C, D, and E as well as upland assets. A detailed breakdown of the existing electrical equipment and quantity at each dock is provided in the report, which outlines the specific type of equipment and its corresponding quantity at each dock as follows:
  - Dock A: Three (3) wall mounted panels and one (1) deck mounted transformer.
  - Dock B: Six (6) wall mounted panels, two (2) wall-mounted disconnects, one (1) rafter mounted transformer and one (1) deck mounted transformer.
  - Dock C: Six (6) wall mounted panels, two (2) wall-mounted disconnects, one (1) rafter mounted transformer and one (1) deck mounted transformer.

  The report provides a visual assessment of electrical equipment and indicates issues requiring attention. The report concludes, *"In general Dock A, B, C exhibit similar conditions, and major electrical equipment appears to have been installed in or around 2004 and in good condition. Overhead lighting is in poor condition, Engineering was told not all fixtures are functional. Some electrical equipment and shorepower pedestals exhibit damaged supports."*

1.5.2 Jacobs Studies

To date, Jacobs has undertaken a site visit visual assessment and a routine underwater pile inspection of Docks A–C at SaBM. The key observations and findings are presented in the following sections.

1.5.2.1 Routine Pile Inspection (2024)

Jacobs performed a routine pile inspection of SaBM Docks A–C on behalf of the Port. The full report (Refer to Appendix A of Baseline Condition Assessment Report (W3Y17302-TNE-03_Rev1), Jacobs 2024) provides the complete methodology, findings, and repair recommendations, with an associated cost estimate of the recommended repairs (Refer to Appendix B of Baseline Condition Assessment Report (W3Y17302-TNE-03_Rev1), Jacobs 2024). The findings are summarized below, with the supplementary pile deficiency plans in Appendix F.

The inspection was carried out between February 20th and February 22nd, 2024. The primary purpose of the inspection was to assess the general overall condition of the timber piles, assign condition assessment ratings, catalog information of all defects, and assign recommended actions, where applicable. Upon completion of the inspection, a condition assessment rating was assigned to each element group, including the timber piles supporting the docks and walkway.

The timber piles are in Fair condition, with 387 of the 445 inspected timber piles exhibiting only minor deterioration. The timber piles supporting the walkways and superstructure at Docks A, B, and C exhibit minor deterioration typical to piles in a freshwater environment, characterized by a softening of the exterior 0.25 in. of timber below water and minor checking up to 0.25 in. above water.

A total of 43 timber plumb and batter piles support the offshore wave screens located at the north end of each dock. Moderate to advanced deterioration was observed at 21 of these timber piles: including reduced bearing at the pile/post interface and corrosion of the steel fishplate and/or connection hardware. Severe deterioration was also observed at an additional 8 wave screen piles: including loss of bearing at the pile/post interface, severe corrosion of the fishplates and connection hardware, and failure of the bolted timber batter pile connection.

Advanced deterioration was also observed at the 27 timber piles supporting the inshore–most platform at Dock C, primarily due to fungal rot. Section loss up to 35 percent was observed at 15 timber piles, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional two timber piles. The presence of fungal rot at both the top of pile and bottom of pile cap resulted in reduced bearing at 6 pile locations. The most severe cases of bearing loss were accompanied by crushing and rotation of the lower 12 in. by 12 in. timber cap.

A total of 27 timber piles support the timber walkway running the length of timber sheet pile bulkhead between Dock A and Dock C. The inshore timber piles exhibit minor fungal rot above and below water. Section loss up to 35 percent was observed at one timber pile, section loss between 35 and 50 percent was observed at two timber piles, and section loss greater than 50 percent was observed at an additional five timber piles. The timber piles with severe section loss exhibited other severe deterioration, including splitting and breakage within the top 54 in. of pile.

Recommended priority repairs include:

I. Repair of nine timber piles with severe section loss supporting the walkway along the bulkhead and at the inshore platform at Dock C (see Figure 5 and Figure 6 showing the current condition):

Table 1 - Severe section loss in piles supporting the walkway and pile repair details references

Structure	Bent	Row	Deterioration Length (in.)	Pile Repair	Top Connection
Bulkhead	3	-	60	Timber post w/timber fish plates (see Figure 7)	Section H
Bulkhead	4	-	24		Section H
Bulkhead	10	-	24		Section H
Bulkhead	17	-	36		Section H
Bulkhead	23	-	36		Section H
Dock C	4	A.5	30		Section B
Dock C	5	A.5	6	12" x 12" timber block (see Figure 7)	Section B
Dock C	5.5	C	12		Section B
Dock B	Wavescreen	-A.25	24	Timber post w/timber fish plates (see Figure 7)	1 " dia. thru bolt

Figure 5 – Photos of bulkhead connections showing section loss (due to fungal rot)

Figure 6 - Photo of Dock C connection showing section loss (due to fungal rot)

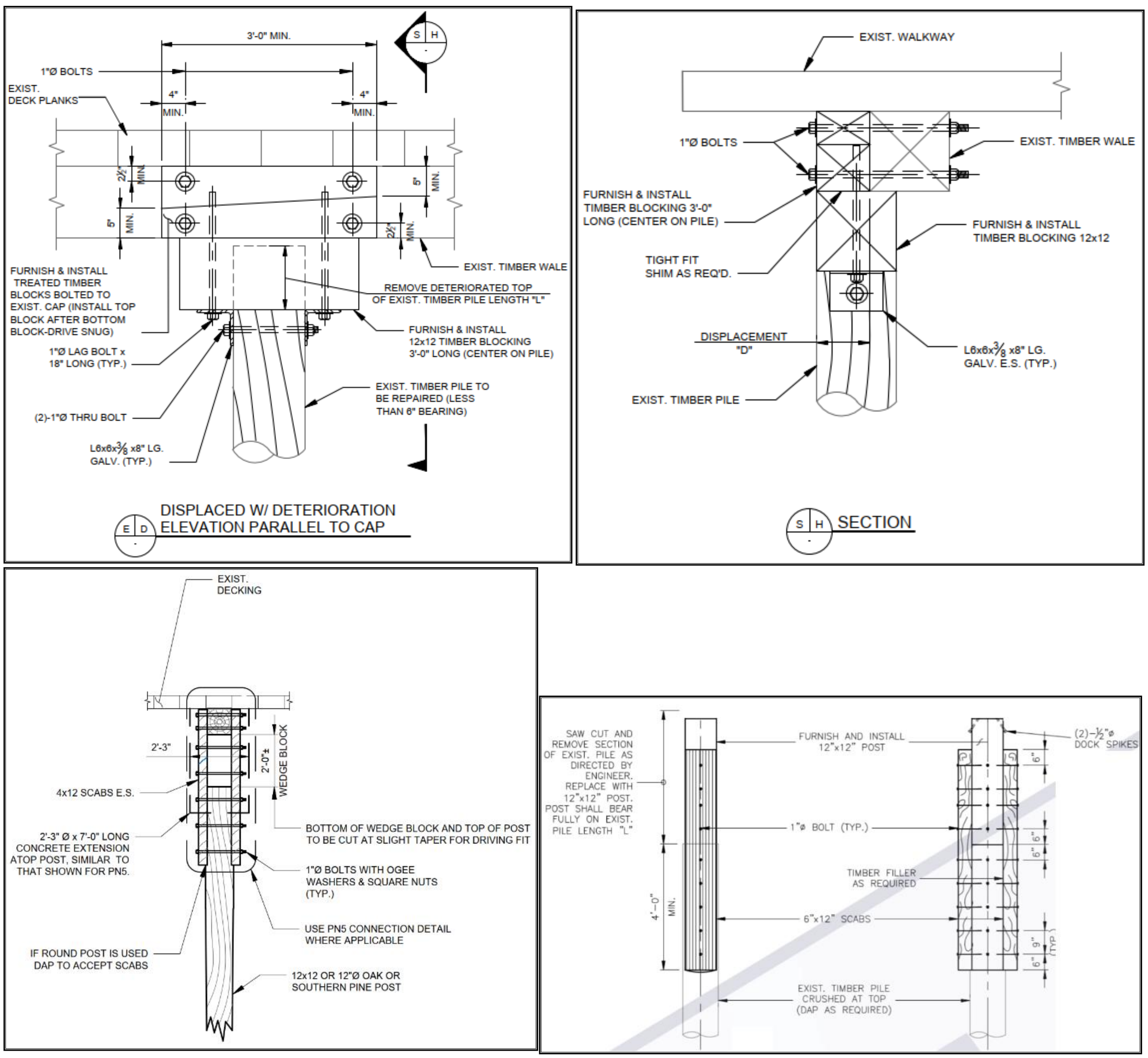

Figure 7 - Schematic for timber post with timber fish plates and 1" dia. galvanized thru-bolt repair detail

II. Replacement of severely corroded connection hardware at six locations along the wave screen (see Figure 8 showing the current condition):

Table 2 - Severely corroded connection hardware repair details

Structure	Bent	Row	Repair
Dock B	Wavescreen	A'.5	Furnish and install 1 " dia. bolt, and install new timber fish plates (see Figure 9)
Dock B	Wavescreen	A'.25	
Dock B	Wavescreen	A.3	
Dock B	Wavescreen	B.2 BAT	
Dock B	Wavescreen	C.3	
Dock B	Wavescreen	C.9	

Figure 8 – Photos of severely corroded connection hardware at the wave screens.

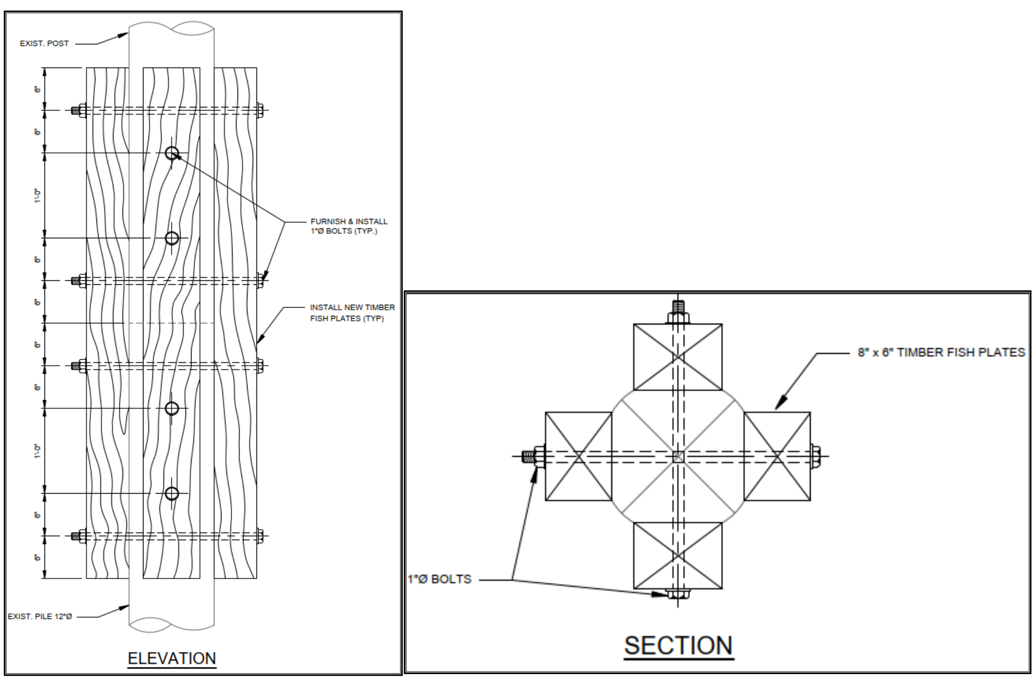

Figure 9 – Schematic for severely corroded connection hardware repair details

III. Restoration of bearing at the pile/post interface at six locations along the wave screens (see Figure 10 showing the current condition):

Table 3 – Restoration of bearing at the pile/post interface details

Structure	Bent	Row	Repair
Dock B	Wavescreen	A'.5	To receive new fishplate repair (above), -only installation of Shims (see Figure 11)
Dock B	Wavescreen	A.3 BAT	Restoration of bearing (see Figure 11)
Dock B	Wavescreen	B.2	To receive new fishplate repair (above), -only installation of Shims (see Figure 11)
Dock B	Wavescreen	C.3	
Dock B	Wavescreen	C.9	
Dock B	Wavescreen	D.25 BAT	Restoration of bearing (see Figure 11)

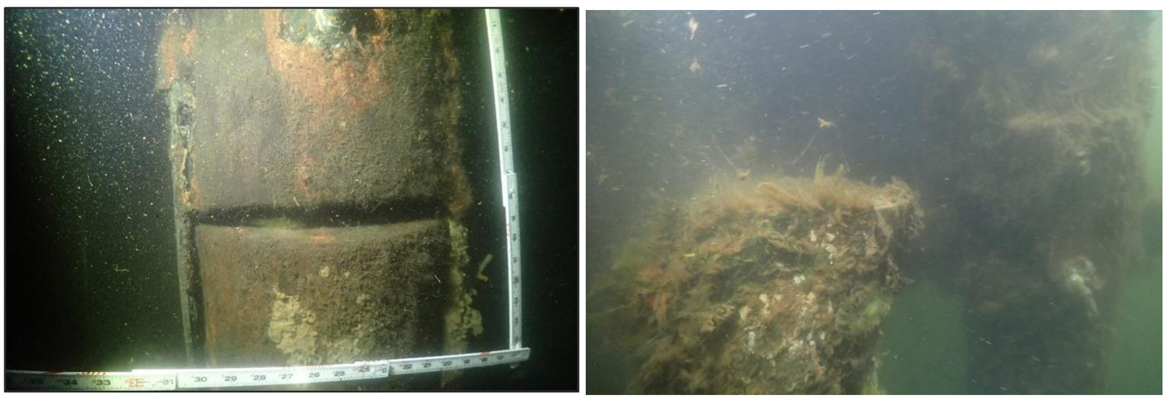

Figure 10 - Photos of the pile/post interface at the wave screens

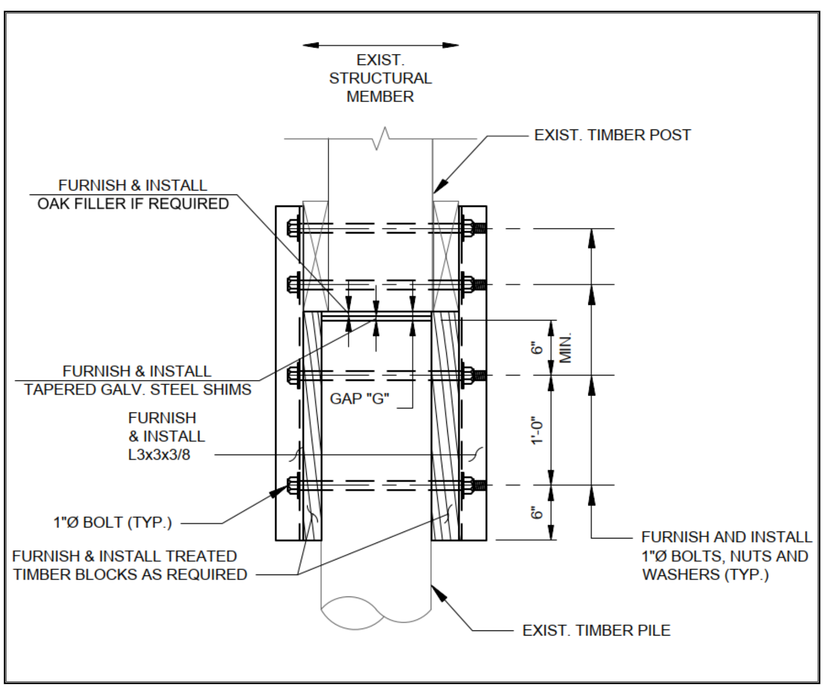

Figure 11 – Schematic for restoration of bearing at the pile/post interface detail

IV. Replacement of crushed/rotating timber pile caps above three timber piles under the inshore platform at Dock C (see Figure 12 showing the current condition, and see Figure 13 for the repair schematic)).

Figure 12 – Photos of the timber pile caps at the inshore platform of Dock C

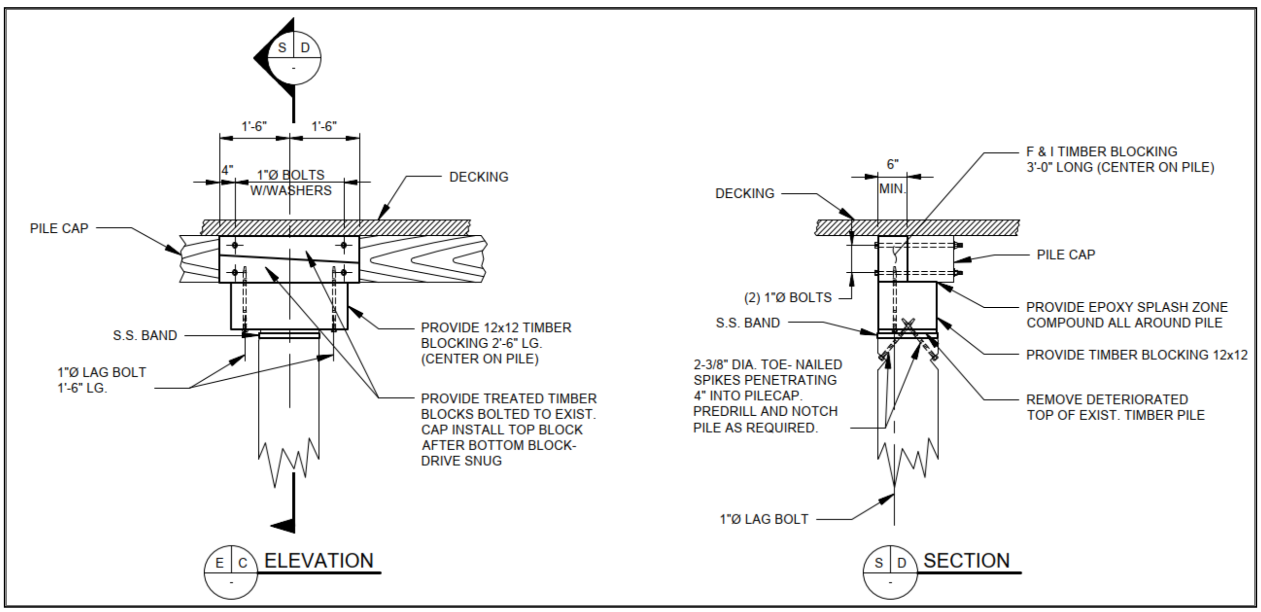

Figure 13 - Schematic for replacement of crushed/rotated timber pile caps above timber piles

V. Recommended routine repairs include repair of 21 timber piles with moderate to major section loss along the bulkhead and at the inshore platform at Dock C (see Figure 14) and replacement of moderately corroded connection hardware at 21 locations along the wave screens (see Figure 15).

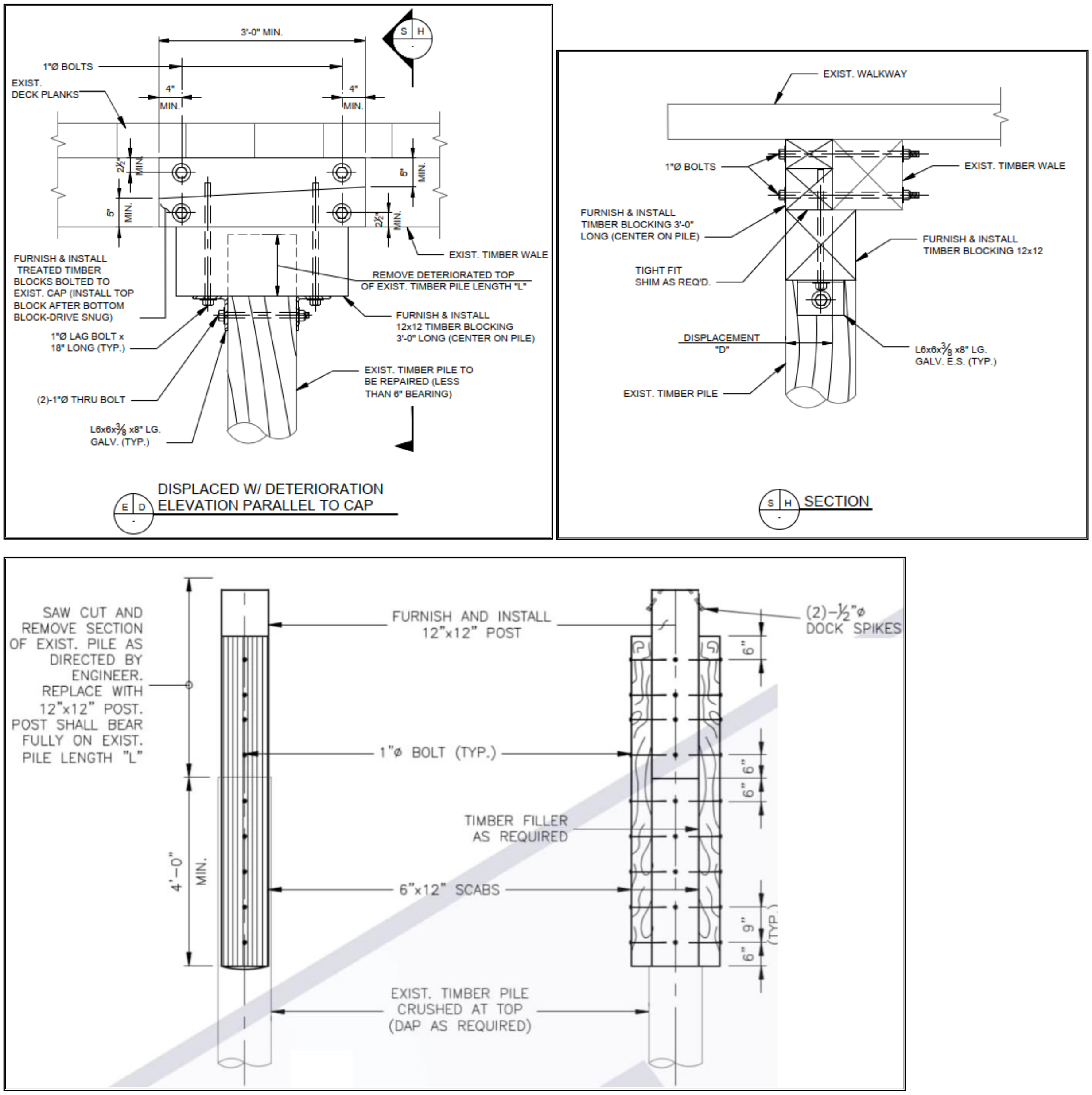

Figure 14 - Schematic for post and timber block installation repairs

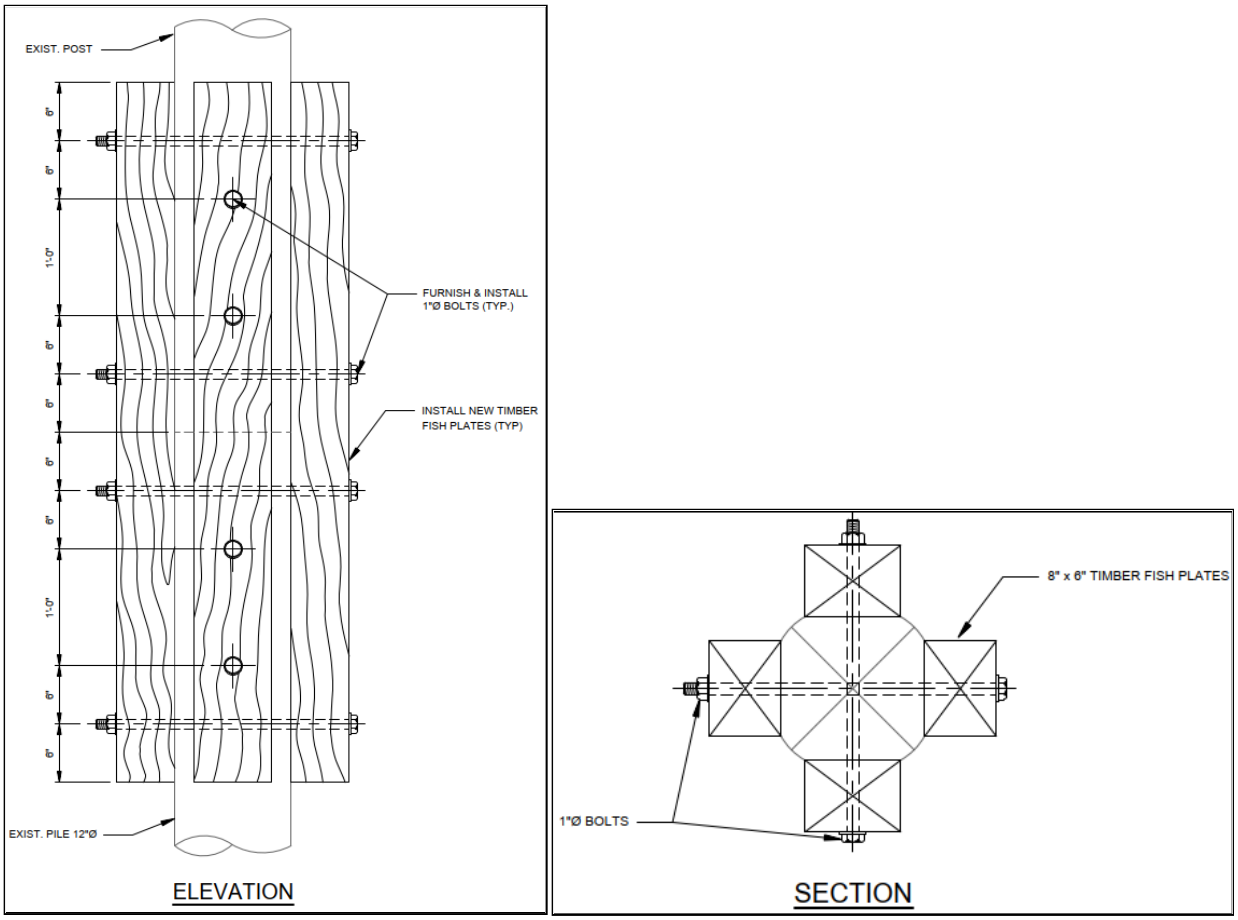

Figure 15 - Schematic for replacement of moderately corroded connection hardware repairs

Priority level actions are required to maintain the structure in a safe operating condition and/or prevent the discovered condition from continuing to a point where future repairs will be significantly more costly. Unless noted otherwise, priority level actions should be implemented within one to three years depending on the severity of the condition. Routine level actions indicate tasks that should be undertaken as part of a scheduled maintenance program or other scheduled project. Postponing recommended Routine level actions will not compromise the stability of the structure. Unless noted otherwise, Routine level actions that consist of rehabilitation should be implemented within one year after the completion of the next scheduled Routine Level inspection.

It is also recommended that the piles at SaBM be reinspected within 5 years, in accordance with ASCE Waterfront Facilities Inspection and Assessment guidelines (ASCE MOP 130).

1.5.2.2 Visual Condition Assessment

To support both the feasibility study and conceptual design of SaBM Docks A–C Roof Safety Project, the project team discipline leads undertook a visual site inspection on Wednesday April 17th 2024. This visual site inspection included the roof structures of Docks A to C and included the following disciplines: Structural, Architectural, Electrical, and Fire Safety.

1.5.2.2.1 Structural

The roof structure (superstructure) consists of metal roofing material sitting on timber purlins that are supported by timber girders which in turn are supported by creosote–treated timber piles. The typical existing girder–to–pile connections consist of a girder bearing on a pier, with no visible positive hardware–based anchorage. A second girder–to–pile connection has parallel timber girders on either side of the pile connected with a thru–bolt. There are no significant lateral bracing elements, lateral forces are resisted by the piles acting as cantilevers extending out of the soil.

Overall, the timbers are in good condition for their age and exposure to the elements. The roofing material and supports do not appear to be adequate for any significant live loading, which limits access for maintenance work that can be done on the roof.

There are locations, especially at the exposed girder ends or at locations of roof leaks where water intrusion is occurring. Some girders have large horizontal splitting and others are twisting intermittently throughout the three docks. Some timber piles exposed to the weather are showing signs of the creosote leaching out of them.

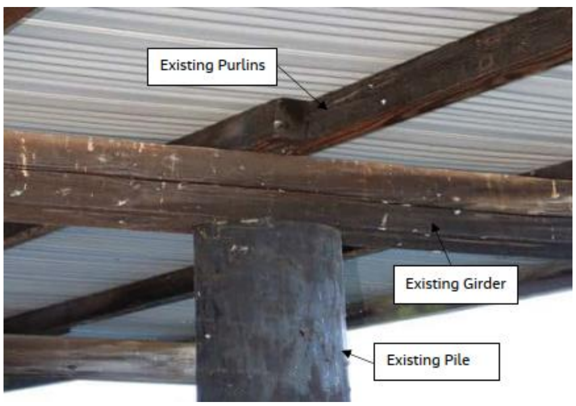

Figure 16 – Typical Gravity Connection

Figure 17 – Example of Twisting Members

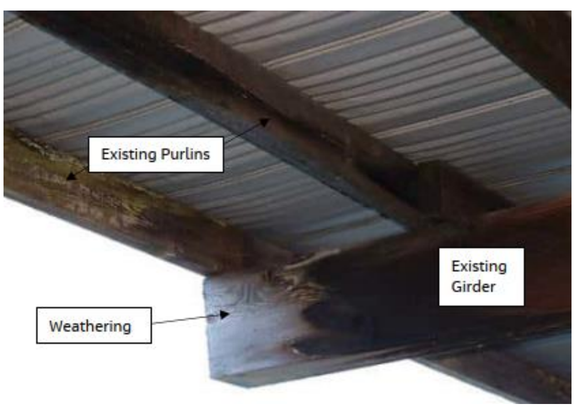

Figure 18 – Example of Weathering at Exposed Ends of a Girder

Figure 19 – Example of Large Horizontal Checks in a Girder

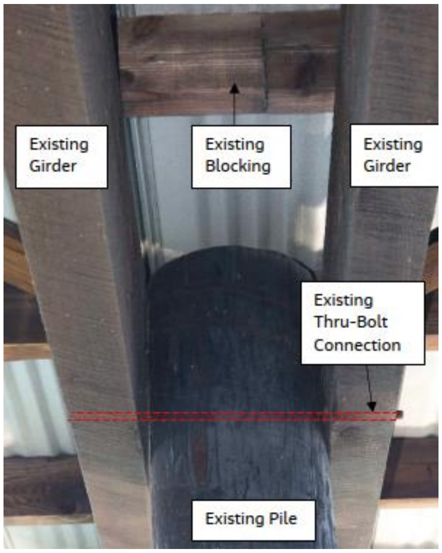

Figure 20 – Example of the Thru–Bolt Girder–to–Pile Connection.

Figure 21 – Example of Creosote Leaching Out of Timber Pile due to Sun Exposure.

1.5.2.2.2 Architectural

Although a weather resisting treatment or membrane appears to have been added following the investigation memo by Cornerstone Architectural Group dated May 1, 2019, many of the issues noted in that memo still appear to exist in the roofs, namely;

i) Fastener connection failure,

ii) Failed attempted sealant repair at fasteners,

iii) Severe roof deflection which leads to ponding water between each purlin,

iv) Light gauge metal panels appear to be sagging in some areas between the framing members,

v) 5. 36–inch spaced purlins (insufficient for metal roof of this type),

vi) Attempted misguided repairs (sealant of various types, should be tested for asbestos)

vii) Possible water damage at failed fasteners.

The roof seems to have received sealing treatment to the topside of the roof and appears to have served only to conceal these issues by covering them.

The skylights that were installed do not add much usable natural light into the covered moorage and have exacerbated the leaking of the roofs. The typical condition of the space is exemplified by the existing light fixture and the worn–out wood louver at the roof clerestory, which is in poor condition due to the difficulty of safely accessing the roof areas for routine maintenance, hindering regular upkeep and repair.

1.5.2.2.3 Electrical

Dock A's electrical distribution equipment is comprised of two 480–240-volt transformers, one 120/240-volt distribution panelboard and three 120/240-volt branch circuit panelboards. All panelboards, disconnects, transformers and shorepower pedestals are rated for outdoor use. All conduits feeding each

transformer and panelboard, as well as all branch circuits serving the shorepower pedestals are fed from below deck.

Dock B's electrical distribution equipment is comprised of two 480–240-volt transformers, two 120/240-volt distribution panelboards, and four 120/240-volt branch circuit panelboards. All panelboards, disconnects, transformers and shorepower pedestals are rated for outdoor use, other than Transformer T4 which is missing one weather shield. All conduits feeding each transformer and panelboard, as well as all branch circuits serving the shorepower pedestals are fed from below deck, with one exception: Transformer T4 has been installed in the roof's rafters. While transformers do not need much routine maintenance, its location ~10' above the deck does pose a challenge to Port maintenance personnel should any work need to be performed on the transformer. No separately derived ground conductor could be observed from this transformer.

Dock C's electrical distribution equipment is comprised of two 480–240-volt transformers, two 120/240-volt distribution panelboards, and four 120/240-volt branch circuit panelboards. All panelboards, disconnects, transformers and shorepower pedestals are rated for outdoor use, other than Transformer T6 which is missing one weather shield. All conduits feeding each transformer and panelboard, as well as all branch circuits serving the shorepower pedestals are fed from below deck, with one exception: Transformer T6 has been installed in the roof's rafters. While transformers do not need much routine maintenance, its location ~10' above the deck does pose a challenge to Port maintenance personnel should any work need to be performed on the transformer. No separately derived ground conductor could be observed from this transformer.

A majority of the luminaires on each of the docks were observed to be mounted to the roof support beams. The power conduits and wiring serving these luminaires were in turn routed along the roof support beams to the nearest panelboard.

While the initial distribution of communications cabling (phone, cable tv) is distributed below the deck, a majority of the local distribution of cabling to each slip is routed through the roof's support beams. Individual satellite dishes were observed to be mounted atop the roof and distributed down through the roof support beams to local slips. The existing telephone or cable TV wiring are understood to no longer be active.

Figure 22 – Typical Hanging Transformer Suspended from Roof Structure (only at Dock B and Dock C)

Figure 23 – Typical Water and Power Hookups at Boat Slips

1.5.2.2.4 Fire Protection

Each of the three piers are provided with an independent 4–inch dry standpipe, and 2–½ inch fire hose valve connections spaced intermittently along the length of each pier. A freestanding fire department connection, with two, 2–½ inch hose connections, is mounted at the entrance to each pier for fire department use. The existing fire protection system is shown in Figure 24.

Fire hydrants for fire department use are located along W Commodore Way, approximately 250 feet from the most remote pier, as approved by the city of Seattle Fire Department. Each pier is provided with fire extinguishers spaced intermittently along the length of each pier, with their locations identified by required signage, mounted above fire extinguisher cabinets.

Figure 24 – Existing Fire Protection System

2 Applicable Codes, Standards, and Regulations

This section presents the applicable codes for each of the disciplines as detailed in Table 1.

The latest adopted version (as of June 2024) of the listed codes, standards and guidelines have been used in this Feasibility Assessment. This is with the exception of the 2021 Seattle Codes that were in draft until their adoption on 15th November 2024, and includes both the 2021 Seattle Building Code (SBC) and 2021 Seattle Existing Building Code (SEBC).

Table 4 – Applicable Codes, Standards, and Regulations for all disciplines

Discipline	Code, Standard and/or Regulation
Structural	• 2021 Seattle Existing Building Code (SEBC) • 2021 Seattle Building Code (SBC) • International Code Council, International Building Code (IBC), 2021 • American Society of Civil Engineers (ASCE) 7–16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures • American Wood Council National Design Specification (NDS) for Wood Construction 2018/NDS Supplement 2018 • US Army Corps of Engineers, United Facilities Criteria (UFC) Design: Piers and Wharves 4-152-01, 2017 • International Code Council, California Building Code, Chapter 31F - Marine Oil Terminal Engineering & Maintenance Standards (MOTEMS), 2019 • American Society of Civil Engineers (ASCE) 61-14 Seismic Design of Piers and Wharves, 2014 • American Society of Civil Engineers (ASCE) 41-17 Seismic Evaluation and Retrofit of Existing Buildings, 2017 • American Concrete Institute (ACI) 318-14 Building Code Requirements for Structural Concrete, 2014 • American Institute of Steel (AISC) 360-16 Specifications for Structural Steel Buildings, 2016 • Occupational Safety and Health Administration (OSHA) Standard, Section 1926.501 and 1926.502 • American Society of Civil Engineering (ASCE) Manuals and Reports on Engineering Practice (MOP) Number 50 - Planning and Design Guidelines for Small Craft Harbors, Third Edition, 2020
Architecture	• 2021 Seattle Building Code (SBC) • 2021 Seattle Existing Building Code (SEBC) • 2010 Americans with Disabilities Act (ADA) standards for accessible design • 2003 United States Access Board, accessible boating facilities • OSHA Compliance Requirements and Washington Industrial Safety and Health Act (WISHA) • State Shoreline Management Act (SMA) of 1971 • Seattle Municipal Code Chapter 23.60A - City of Seattle Shoreline Master Program (SMP)

	• Washington State Hydraulic Code (Chapter 77.55 RCW and WAC 220-660)
Fire Protection	• 2021 Seattle Building Code (SBC) • 2021 Seattle Fire Code • 2022 National Fire Protection Association (NFPA) 13, Standard for the Installation of Sprinkler Systems • 2019 National Fire Protection Association (NFPA) 14, Standard for the Installation of Standpipes and Hose Systems • 2022 National Fire Protection Association (NFPA) 20, Standard for the Installation of Stationary Pumps for Fire Protection • 2022 National Fire Protection Association (NFPA) 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances • Seattle Electrical Code, 2023 • 2023 National Fire Protection Association (NFPA) 70: National Electrical Code 2023 with Washington Administrative Code and Seattle Electrical Code amendments • 2022 National Fire Protection Association (NFPA) 72, National Fire Alarm and Signaling Code
Electrical	• Seattle Electrical Code, 202323.60A Seattle Shoreline Master Program Regulations - Artificial night lighting requirements • Seattle Energy Code 2018 (Note: National Electrical Code 2023 has been adopted by the State and has been adopted by the City on 11/15/2024 with amendments.)
Shoreline and Land Use	• Land Use Code – SMC Title 23 • Seattle Shoreline Master Program – SMC Chapter 23.60A • SMC 23.60A.502 Shoreline use table for Urban Maritime (UM) • SMC 2360A.504 Uses allowed overwater in UM • SMC 23.60A.122.E Development nonconforming to development standards • SMC 23.60A.152 General development standards • SMC 23.60A.158 Standards for mitigation sequencing • SMC 23.60A.200 Standards for marinas, commercial and recreational • SMC 23.60A.187 Standards for piers and floats and overwater structures • Environmental Protection and Historic Preservation – SMC Title 25 • SMC 23.60A.156 Standards for environmentally critical areas in the Shoreline District

3 Concept Design

This section presents the concept design for both options for Docks A–C of SaBM:

- Option 1: Roof Replacement
- Option 2: Permanent Roof Removal

3.1 Structural

3.1.1 Structural Code Requirements

Since SaBM is an existing structure, all options must first consider the 2021 Seattle Existing Building Code (SEBC). The SEBC identifies the structural requirements for each option which inform the applicable design criteria from either the SEBC or the SBC. Per SEBC Section 604, both design concepts are considered "Level 3 Alterations" since the work area exceeds 50% of the building area. Section 30, "Structural Requirements for All Compliance Methods", apply for Level 3 Alterations. The following subsections from 304 apply:

> *304.1.3 Existing structural elements carrying gravity loads – Any existing gravity load–carrying structural element for which an alteration causes an increase in design gravity load of more than 5% shall be strengthened, supplemented, replaced, or otherwise altered as needed to carry the increased gravity load required by the IBC for new structures…*
>
> *304.1.4 Existing structural elements carrying lateral load – Where the alteration increases design lateral loads in accordance with Section 1609 or 1613 of the IBC, or where the alteration results in a prohibited structural irregularity as defined in ASCE 7, or where the alteration decreases the capacity of any existing lateral load–carrying structural element, the structure of the altered building or structure shall be shown to meeting the requirements of Sections 1609 and 1613 of IBC… Exception: Any existing lateral load–carrying structural element whose* [Demand-Capacity (DC)] *ratio with the alteration considered is not more than 10% greater than its DC ratio with the alteration ignored shall be permitted to remain unaltered.*

In summary, if the alteration increases the DC ratio of an existing structural element by less than 5% under gravity loads, or by less than 10% under lateral loads, the element can remain unaltered. If these DC ratios increase by more than these limits then it shall require further evaluation to determine structural code adequacy. Any new structural elements must be designed for current SBC and IBC design loads.

The SEBC defines "Substantial Alteration" as a "remodeling or an addition that substantially extends the useful physical or economic life of the building or a significant portion of the building, other than typical tenant remodeling" as determined by the code per Section 311. In accordance with the SEBC, if a project is classified as a *"substantial alteration"* a seismic evaluation report specifying the building's seismic deficiencies and proposed measures to provide an acceptable degree of seismic safety must be prepared.

3.1.2 Considerations / Assumptions

The vertical datum used on the 1961 Covered Moorage Permit Drawings is not listed but it states that the lake elevation is 21.8'. This matches the US Army Corps of Engineers historical Ordinary High Water (OHW) elevation for Lake Washington. The official Lake Washington water levels are measured at the Ballard Locks using the Corps of Engineers (COE) datum. Based on this information, it is assumed that the existing drawings use COE as the vertical datum. The conceptual design uses NAVD88 as the vertical datum.

The existing drawings show three test piles that extend 25 ft, 50 ft, and 58 ft below the water surface which places the pile tips at approximately –7.22 ft, –31.72 ft, and –39.72 ft (Refer to Appendix B of

Seismic and Other Lateral Analysis Tehnical Memo in Appendix C). The datum used for these elevations is NAVD 88.

No site–specific geotechnical data for SaBM is currently available. All preliminary analysis has been performed using the available data provided from Fisherman's Terminal, a site located approximately 2,000 ft southeast of Salmon Bay. The Fishermen's Terminal Marine Innovation Center Revised Geotechnical Engineering Report dated 11/17/2022 by Landau Associates identifies the presence of liquifiable soils at depths up to –24 ft (Refer to Appendix A of Seismic and Other Lateral Analysis Tehnical Memo in Appendix C).

The berthing and mooring demands have been evaluated as an impact load on the pile in lieu of berthing and mooring specific demands based on vessel geometry, speed, draft, angle of impact, energy dissipation mechanism, and mooring line properties. A concentrated impact load of 10,000 pounds applied to the exterior piles accounts for possible berthing or moorage design loads associated with vessels anticipated in the boat slip area.

3.1.3 Structural Concept Designs

3.1.3.1 Option 1 – Roof Replacement

3.1.3.1.1 Conceptual Analysis

Table 5 - Overview of Analysis Findings

Structural Members	D/C Ratios	Recommendations
Girders	Greater than 1.00 – due to bending	Replacement due to existing girders being overstressed for required loads.
Purlins	Less than 1.00	Replacement due to likelihood of damage during removal phase and to ensure the structural integrity of the new superstructure.
Piles	Greater than 1.00	Replacement due to existing piles being overstressed based on available geotechnical information from a nearby site.
Walkways & Catwalks	Less than 1.00	Replacement due to likelihood of damage during removal phase and to meet SMC 23.60A.187 requirements.

A conceptual analysis on the existing structure was performed to determine if the existing materials can support the new roof dead and live loads or if it triggers the requirements of Section 304 of the SEBC.

A representative girder was simplified as a simply supported beam and all loads converted to a uniformly distributed line load. The result of this analysis showed a significant number of existing girders have demand–capacity (DC) ratios above 1.00 (with some above 1.75). The visual site inspection also showed a significant number of the existing girders are warped which reduces capacity further. This requires that all girders be replaced.

Similar to the girder, a representative purlin was simplified as a simply supported beam with all loads converted to a uniformly distributed line load. The results show that the purlins can support the new roof dead and live loads, with DC ratios less than 1.00. However, there is a strong likelihood that the existing

purlins will be damaged during the demolition phase, so it is recommended to replace the purlins with new material. This will also ensure the structural integrity of the new superstructure by having all new materials. Since all material for the superstructure will be new, current IBC and SBC requirements apply.

Based on the SEBC's definition of "substantial alteration" this option triggers the seismic evaluation report requirement. For this concept design, preliminary seismic and lateral load analyses have been performed on the substructure; however, a more comprehensive seismic analysis should be done using site specific geotechnical data. The results show that the existing timber piles are overstressed with DC ratio above 3.00. Refer to the "Seismic and Other Lateral Analysis" Technical Memorandum Sections 3-5 in Appendix C for details on the analyses performed. New piles are required to support the structure. Any elements attached to the existing piles will also need to be replaced, including the walkways, due to the likelihood of damage during removal. At this stage, it is assumed that the docks will have the same footprint and pile layout.

Based on the finding stated above, the design will require new materials for all major structural components including the superstructure (roof decking, purlins, and girders), substructure (piles), and walkways. These elements are designed for current IBC and SBC loads. The following section describes the design for each of these elements, with Figure 4 illustrating the defined limits for this study.

3.1.3.1.2 Superstructure

The analysis process for the new materials is similar to the analysis done on the existing members. The superstructure member (girders and purlins) is modeled as a simply supported member. The main loads considered for the superstructure design were dead, live, wind, and snow. Since maintenance workers will access this roof, the design live loads, per Table 1607.1 of the SBC, are a concentrated live load of 300 pounds and a uniformly distributed load of 20 psf. Discrete anchorage loads of 5,000 pounds in any direction (as required by OSHA for fall protection) also apply to the structure. Wind loading was considered under ASCE's "components and cladding" loads on an open building. Since it is an open building, the roof was designed for wind pushing upward on the roof as well as downward. The snow load was assumed to be a balanced snow load for this stage of design and was based on ground snow load of 25 psf per Section 1608 of the SBC. Rain loads are not considered due to the sloped roof.

The materials considered for the purlins and girders included timber, steel, and composite plastic. Timber is the preferred material because it provides the strength, durability, and construction flexibility (ease of fabrication and handling) desired for this application. Timber also provides the most like-for-like replacement. Steel is less desirable in this application because of higher costs (fabrication and installation) and of the significant upkeep demands of maintaining corrosion protection. Fiberglass and plastics have lower strength capacity and are more prone to long-term deflections than timber, which means larger sections would be required to carry the same load.

The purlin design considered treated Douglas Fir and Alaskan Cedar sawn lumber. Treated Douglas Fir is common in construction. Alaskan Cedar has a slightly reduced capacity compared to Douglas Fir, but it also is more naturally resistant to the elements and does not require preservation treatment or coatings, although the Port can choose to specify the use of a sealant to limit discoloration. For the purlin design, Alaskan Cedar, No. 2 grade was used. The purlin design determined that 2 inch x12 inch at 2 feet on center were required to support the new loads.

The girder design considered both sawn lumber (Alaskan Cedar) and marine grade glue laminated (glulam) timber. It was determined that the glulam timber provides more structural capacity at smaller sizes compared to the sawn lumber. Tension lamination is required on both the top and bottom of the glulam to withstand the uplift loads caused by the wind as well as the gravity loads. An important requirement for the glulam beam is that it must be able to withstand the marine environment. The glulam shall be treated with preservatives applied through a vacuum pressure impregnation, enabling it to

withstand any mildew, mold, or other issues caused by the moist environment. These members will typically see occasional water due to rain or melted snow since they are suspended in the air by the piles. For the girder design, a pressure treated glulam beam with a stress class of 20F-V13 AC/AC (Alaskan Cedar) was used, requiring 10 ¾ inches x 18 inches members to support the demands.

Deflections for both the purlins and girders were checked for the applicable service loads defined in Table 1604.3 of SBC but were determined not to control the design. Bending stress was the controlling design check.

Per SMC 23.60A.122.E.1.d, walls are prohibited. All curtain walls will be removed and not replaced to comply with this code. However, the weather curtains that are suspended from the roof girders will be included to help protect the boats. Weather curtains will be supported by light timber framing spanning between piles.

3.1.3.1.3 Substructure

Lateral forces associated with the walkway framing elements are resisted directly by the pile to which the framing is connected.

Based on the recommendations from the Seismic and Other Lateral Analysis Technical Memo as presented in Appendix C, new piles were designed based on the loads caused by the lateral spreading. The pile layout is assumed to remain the same at this stage of the design. The existing piles will need to be removed and disposed of in a proper manner for creosote treated piles. Pile demolition should follow Washington Department of Natural Resources (WADNR) Best Management Practices (BMPs) for derelict creosote pile removal and disposal.

The materials considered for the new piles included coated steel pipe piles and precast concrete piles. The piles may need to be driven into rock to provide sufficient pile fixity, bearing, and pullout strength under seismic lateral spreading. Steel is recommended because it is better able to penetrate the glacial soils than concrete or timber. Precast concrete piles have the potential to be more cost effective upfront, but they are limited by available lengths and drivability.

The existing piles are currently 8-inch diameter timber piles with approximate embedment depths between 17’ to 30’. Conceptual pile design determined that 18-inch diameter x 3/8-inch-thick exterior Hollow Structural Section (HSS) piles (exposed to berthing loads) and 12-inch diameter x 3/8-inch thick interior HSS piles would support the current design loads. The increased embedment depth range would be between 27’ to 37’ for the new piles to remain stable during a seismic event. The pile thickness is designed to have some sacrificial section in the event corrosion occurs. The steel pile would also be galvanized and coated with three layers of an epoxy resin topcoat along the splash zone to delay onset of corrosion.

3.1.3.1.4 Walkways and Catwalks

Figure 25 illustrates the two different walkway elements – walkway and catwalk – found at the marina. Walkways may be considered an exit way and per Table 1607.1 of the SBC, require a 100 psf live load (twice the original design live load). The catwalks that run parallel to the boat slips are not considered exit ways, so the live load is taken as a “catwalk” live load of 40 psf from SBC Table 1607.1. It should be noted that the exit way live loads may be conservative for the location and purpose of the site, subject to review and confirmation by the building official.

Per SMC 23.60A.187, the piers must incorporate light transmitting features where feasible, thus coated steel grating panels are considered for the walkway decking to allow light through to the water where possible. At this point of design, the intent is to replace the walkways and catwalks using roughly the same footprint. The framing material considered is Alaskan Cedar to match with the superstructure elements.

The exit way loads on the walkway required Alaskan Cedar No 1 6-inch x 16 inch girders on either side of the piles. The girders support the walkway purlins are Alaskan Cedar No 2 2-inch x 12 inch purlins at 12 inches spacing. The girders supporting the catwalks are Alaskan Cedar No 1 6-inch x 16 inch girders on either side of the piles and the purlin are Alaska Cedar No 2 2-inch x 12 inch at 48 inches on center.

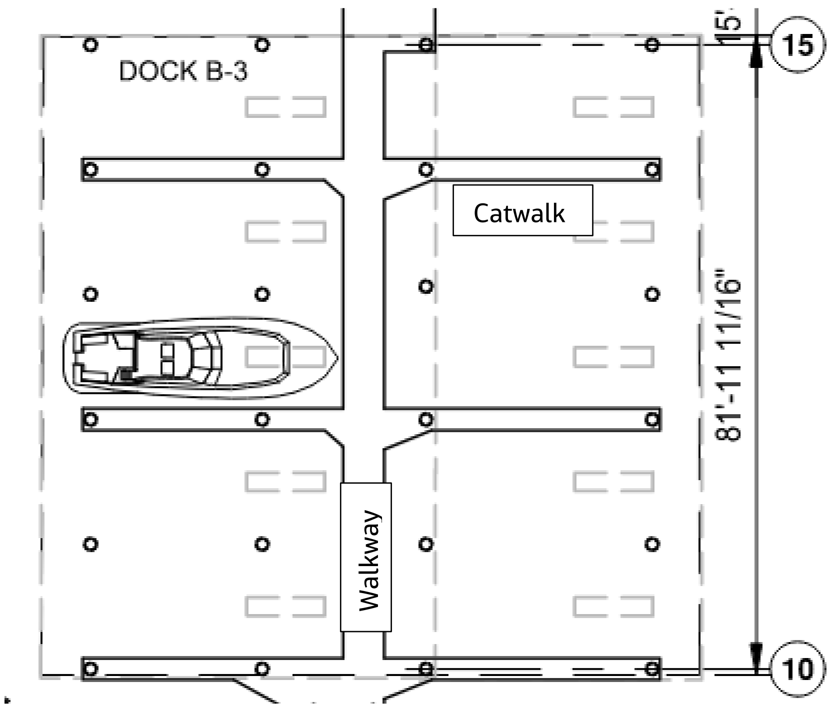

Figure 25 – Definitions of Walkway Elements

3.1.3.2 Option 2 – Permanent Roof Removal

Option 2 still must comply with the SEBC but there is significantly less analysis that is necessary, as long as it is not considered a substantial alteration as determined by a code official. This design assumes that the removal of the roof does not extend the useful physical or economic life of the building, per the definition of "substantial alteration," which aligns with the feedback obtained by the Port from the City of Seattle. However, as this is somewhat subjective it is recommended that a pre–submittal conference is undertaken to confirm that a substantial alteration is not triggered.

Without the substantial alteration requirements, no seismic report is triggered. The gravity loads would not increase by more than 5% since there is an overall reduction in loading on the piles so SEBC Section 304.1.3 is not triggered. Similarly, Section 304.1.4 is not triggered since there is a reduction in the surface area for wind loads to apply to the structure as well as a reduction in the inertial mass mobilized during a seismic event. This would not result in a 10% increase in the DC ratio, so SEBC Section 304.1.4 is not triggered.

In this option, all roof decking, purlins, and girders will be permanently removed. The piles, walkways, and catwalks will remain as-is. It is assumed that the piles will remain at their full height since any demolition would require proper disposal for creosote treated piles. Keeping the piles at their current height would not impact the functionality of the site. Since no work is being performed on the walkways and catwalks, except where ADA slips will be added, no adjustments need to be made since they are structurally sufficient. The utilities will be mounted on stanchions and secured to the walkway framing, which may require some modification, or mounted directly to the existing piles. The existing transformers (T4 and T6)

located at Docks B and C are currently suspended from the roof purlins. These will need to be removed during construction and are assumed to be relocated to the shore (see Section 3.4 for the electrical conceptual design).

3.2 Architecture

3.2.1 Architectural Requirements

The SEBC Section 101.2 outlines the scope of the code. It specifies this code applies to the repair, alteration, change of occupancy, addition to, relocation and maintenance of existing buildings and therefore, it applies to both options.

According to the SEBC Section 301.3, with the approval of the code official, alterations that comply with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building is undergoing a substantial alteration. As outlined in section 3.1, Option 1 (Roof Replacement) is considered as a substantial alternation and would trigger code requirements for new construction, and Option 2 (Permanent Roof Removal) is not considered as a substantial alteration.

3.2.2 Architectural Concept Designs

3.2.2.1 Option1 – Roof Replacement

3.2.2.1.1 Materials

A standing seam metal roof with corrosion resistant finish is proposed for this option with the principal selection criteria based on low maintenance, durability, resistance to corrosion, weathering, and impact resistance. The new roof will match the same footprint as the existing roof. New skylights are resized to facilitate increased light into the covered moorage in line with SMC 23.60A.152 and Washington State Hydraulic Code. New roof slopes are designed to meet the typical manufacturer's minimum standards, with a minimum considered in the design as 0.5 inch:12 inch, with the maximum height of the new roof not exceeding the existing roof heights.

3.2.2.1.2 Occupancy Classification

The SBC considers covered moorage to be occupancy classification Low Hazard Storage S–2. There are no exceptions noted in the code regarding the occupancy of boats, so it is reasonable to assume there is no "live aboard or floating on water residence" impact on the building code, however, this needs to be confirmed by the Seattle Department of Construction and Inspection (SDCI). The SBC also includes covered boat moorage in the Utility and Miscellaneous Group U as an accessory to dwelling unit (R3). Following the definition of dwelling unit as per the code, "A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation." The Miscellaneous Group U does not apply to the marina as the marina is not an accessory use to a dwelling unit (R3). Therefore, Low Hazard Storage S–2 occupancy is recommended for Option 1. This interpretation can be confirmed through pre–submittal conference with the City of Seattle.

3.2.2.1.3 Construction Type Classification

In line with SBC. Section 602.5, buildings are permitted to include exposed heavy–timber construction for columns, beams, girders, arches, trusses, floors, and roof decks. Fire–resistive construction per sections 510 and 713 and Chapter 10 is not required.

3.2.2.1.4 Allowable Area

Allowable Area based on Occupancy and Construction Type is limited to 54,000 square feet (Table 506.2 SBC). Since the largest roofed area in the marina is about 8,766 square feet, the maximum roofed area is within the allowable limits of the Code.

3.2.2.1.5 Accessibility

The 2010 ADA Standards for accessible design applies to new construction and alterations of State and local government facilities and should be considered if there is any "Alteration", with S106.5 defining this as below:

Alteration. A change to a *building* or *facility* that affects or could affect the usability of the *building* or *facility* or portion thereof. *Alterations* include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historic restoration, resurfacing of *circulation paths* or *vehicular ways*, changes or rearrangement of the structural parts or *elements*, and changes or rearrangement in the plan configuration of walls and full-height partitions. Normal maintenance, reroofing, painting or wallpapering, or changes to mechanical and electrical systems are not *alterations* unless they affect the usability of the *building* or *facility*.

Based on Section 3.1.3.1, Option 1 includes the removal and replacement of both the substructure and superstructure, and Option 2 includes the removal of the superstructure including the walls and the lighting (lighting to be installed on bollards - see Section3.4). Based on the above extract from the 2010 ADA Standards, Option 1 would be considered as an "Alteration", and Option 2 is likely considered as an "Alteration" as it includes rearrangement. As a result, both Option 1 and Option 2 should comply to 2010 ADA Standards for accessible design.

Per the earlier 2018 SBC, considering a total of 132 existing boat slips, four of them must be made accessible per the 2018 Seattle Building Code table 1110.4.9.1. The 2021 SBC no longer includes requirements for accessible boat slips. The requirement for four complying accessible boat slip will still apply under 2010 ADA Standards for Accessible Design and U.S. Access Board Guide to the ADA Accessibility Standards.

Requirements and design standards outlined in the 2010 ADA Standards for Accessible Design Chapter 1003 Recreational Boating Facilities include:

- **Accessible Routes:**
  - Accessible routes from accessible parking, public streets and sidewalks shall be provided to the entrance. Accessible route from entrance to accessible features shall also be provided.
- **Boat Slips:**
  - For between 101 to 150 slips: minimum 4 accessible slips.
  - Accessible boat slips need to be dispersed throughout the various available boat slips but can be grouped.
  - Accessible boat slips must have clear pier space at least 60 inches wide and as long as the slip.
  - 60 inches minimum clear space for boat access with lift or transfer device.
  - Edge protection is not required, but if provided, it can be 4 inches high maximum and 2 inches deep maximum at the continuous clear openings.

3.2.2.2 Option 2 – Permanent Roof Removal

Without the roofs, the requirements for allowable area and construction type per the SBC chapters 5 and 6 would no longer be applicable. For Option 2, without the roofs, the existing walls would also be removed.

The SBC and SEBC accessibility requirements outlined in Option 1 will be applicable regardless of whether there are roof structures or not, as the requirements are based on ADA regulations for altered recreational boating facilities. Wayfinding signage will be provided for this option.

3.3 Fire Protection

The existing piers are provided with approved manual dry standpipes, with hose valve connections spaced along the length of each pier. Fire department connections are freestanding mounted at the entrance to each pier.

Fire extinguishers are cabinet mounted on columns along the length of each pier, with locations identified by signage.

3.3.1 Fire Protection Concept Designs

3.3.1.1 Option 1 – Roof Replacement

In accordance with the SBC, Section 429.9, sprinklers must be provided for boat moorings with combustible structures. The existing piers are not provided with sprinkler protection, and dry–pipe sprinkler systems must be added to meet current code requirements. SBC requires boat mooring sprinkler systems to be designed for Extra Hazard Group 2 occupancy at a design density of 0.40 gallons per minute (gpm) over 2,500 sf. Where dry pipe systems are provided, they must account for a concept increase in the design area. As such, the design density for boat moorings must be 0.40 gpm over 3,250 sf with a hose stream demand of 500 gpm.

In structures provided with an automatic suppression system, a fire alarm system must be provided for monitoring of the suppression system.

To support dry–pipe system riser valve assemblies and fire alarm system monitoring, Riser Rooms will need to be provided to house and condition the fire protection equipment. A means for fire alarm system reporting is required, such as phone lines or radio transceiver equipment, to report to a supervising station. Fire alarm system equipment must be interconnected between riser room locations, with supervision permitted by a main fire alarm control panel.

A minimum 6–inch water supply must be provided from the existing underground water main in W Commodore Way and extended into each Riser Room. Dry–pipe system risers must extend onto the piers, with supply mains extending along the length of each pier at the roof level.

The water demand of the most remote pier dry–pipe sprinkler system is estimated to be 2,060 gpm at 62 psi, which includes 500 gpm exterior hose stream demand. Refer to Appendix B of Conceptual Basis of Design Document in Appendix B) for the preliminary sprinkler calculations.

3.3.1.2 Option 2 – Permanent Roof Removal

In accordance with the SBC, Section 429.8, a manual Class I or Class III standpipe system must be provided for piers where the most remote accessible part of the pier exceeds 150 feet from fire department apparatus access.

An approved manual standpipe system is provided on each pier, along with fire extinguishers. No additional fire protection systems are required as part of the removal of the pier roof structures.

3.4 Electrical, Instrumentation and Controls

3.4.1 Electrical, Instrumental & Control Consideration/Assumptions

Per the Port's Electrical Condition Assessment Report from 2023, reference WP#106016 / SABM-M2301, and from visual inspection, the electrical components currently in use were installed approximately 20 years ago. No electrical as-built drawings are known to exist for this project. Most of the electrical distribution is routed below each dock and shorepower pedestals are secured to pilings adjacent to each slip.

3.4.2 Electrical, Instrumental and Controls Concept Designs

3.4.2.1 Option 1 – Roof Replacement

All existing equipment, including but not limited to panelboards, transformers, lighting, conduits, and wiring will need to be removed due to the demolition of the existing structure. Many changes to the Electrical Code have occurred for marine facilities since the equipment installation that will now need to be accommodated as well as the Seattle Shoreline Master Program Regulations regarding allowable light spillage into the neighboring waters.

Distribution equipment including all transformers, panelboards and disconnects shall all be demolished and replaced with new equipment that satisfies all new ground fault and distribution requirements for marine facilities under the current Electrical Code as well as transformer efficiencies that satisfy the Seattle Energy Code. With the acquisition of all new equipment, the electrical design can be tailored to feature a majority of the equipment on the land side, to allow for easier maintenance access and maximize the quantity of leasable slip spaces. Should the Port wish to house this equipment within a structure, an approximate 800 square foot building would need to be constructed.

Shorepower pedestals will need to either be retrofitted with new ground fault protection or replaced with new pedestals that include this protection from the factory. This can be studied further without impacting the design as each option meets the current Electrical Code.

At this stage, all over water equipment including pedestals for the three docks are assumed to be replaced with new and constructed to the latest code requirements.

All lighting will be new to meet the requirements of the Seattle Shoreline Master Program. In order to minimize any possible light spill into the adjacent water per these regulations, it is not feasible to mount lighting either from poles or the roof structure 10 feet above the dock, as light distribution patterns from manufacturers do not allow for that tight of a beam spread. All new lighting shall be from low level bollards to lower the amount of light spill from each individual luminaire.

All communications wiring as of this date is assumed to be inactive by the Port and will not be replaced under this option.

3.4.2.2 Option 2 – Permanent Roof Removal

For this option, all electrical equipment shall remain in place and legacied under existing codes other than the following items currently attached to the roof structure and/or walls:

- 167 kVA transformers T4 and T6 on Docks B and C are suspended from the roof rafters, each will need to be removed to allow for the roof demolition. The transformers could be relocated to the shore, replacing two parking stalls for each transformer, should clear pathways below the deck

remain for the additional conduits necessary for this relocation. Otherwise, new decking would need to be expanded into an existing slip to house the transformers on the deck.

- All dock mounted panelboards and disconnects are mounted to the southern wall of each roof structure building. Should the walls remain intact, no further work is required. As the walls are to be removed, the panelboards and disconnects would need to be removed to allow for the removal of the roof and walls. The panelboards and disconnects can then be re-sited in a safe location on the remaining structure.
- All lighting will be new to meet the requirements of the Seattle Shoreline Master Program. In order to minimize any possible light spill into the adjacent water per these regulations, it is not feasible to mount lighting either from poles or the roof structure 10 feet above the dock, as light distribution patterns from manufacturers do not allow for that tight of a beam spread. All new lighting shall be from low level bollards to lower the amount of light spill from each individual luminaire.
- All communications wiring within each roof structure is mounted to the pilings and beams. All communications wiring as of this date is assumed to be inactive by the Port and will be demolished without replacement under this option.

4 Key Issues and Opportunities

4.1 Key Issues

The below table includes the key issues highlighted from the feasibility assessment pertaining to the code and permitting compliance.

Table 6 – Key Issues

#	Issue	Assumption at this stage	Recommendation
1.	Architectural		
1.1.	The 2021 SBC considers covered moorage to be occupancy classification Low Hazard Storage S–2. There are no exceptions noted in the code regarding the occupancy of boats, so it is reasonable to assume there is no "live aboard or floating on water residence" impact on the building code.	The 2021 SBC also includes covered boat moorage in the Utility and Miscellaneous Group U as an accessory to dwelling unit (R3). Following the definition of dwelling unit as per the code, "A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation." The Miscellaneous Group U does not apply to the marina as the marina is not an accessory use to a dwelling unit (R3). Therefore, Low Hazard Storage S–2 occupancy is recommended for Option –1.	Pre–submittal conference with the City of Seattle, and confirmation with SDCI.
2.	Structural		
2.1.	Substantial Alteration: The SEBC 2021 Section 311 states "For the purpose of this section, substantial alteration or repair means any one of the following, as determined by the code official: Remodeling or an addition that substantially extends the useful physical or economic life of the building or a significant portion of the building, other than typical tenant remodeling...". This is	The roof replacement option is assumed to trigger "substantial alteration." The roof removal option is assumed not to trigger "substantial alteration"	Pre–submittal conference with the City of Seattle.

#	Issue	Assumption at this stage	Recommendation
	open to interpretation and could be considered subjective.		
2.2.	Geotechnical Information: Site specific geotechnical information is not available.	Geotechnical information provided for Fisherman's Terminal used in this study.	Site specific geotechnical investigation.
2.3.	Pile Seismic Sufficiency: Regardless of if the "substantial alteration" is triggered or not for the roof removal option, the existing piles are not seismically sufficient based on the assumed geotechnical data.	If a "substantial alteration" is not triggered, the piles will not be further investigated and shall be left as is.	Port to acknowledge seismic evaluation approach is acceptable.
2.4.	As-Built Information: The existing plans and elevations are based on the 1961 permit drawing information which may or may not reflect current site conditions.	The existing plans and elevations are based on the 1961 permit drawing information.	Undertake a full site survey of the facility to confirm all site elevations and dimensions.
3.	Electrical		
3.1.	Limited information regarding Electrical as-built conditions	The only information provided to date has been the Port's 2023 Electrical Condition Assessment Report, no mention of circuit breaker sizes, conduit sizes, wiring sizes, nor how equipment mentioned in study are interconnected. It is assumed that all equipment was installed under valid Electrical permits and met the Electrical Code at the time of installation.	Port to provide additional as-built information and/or a further study is needed to assess these items.
3.2.	Location of new electrical equipment – Option 1	Assume a new 2000-amp service shall accommodate new electric fire pump as well as all existing loads. Assume no increase in ampacity nor quantities of slip shorepower receptacles as compared to existing.	Will need to find space within parking lot for this equipment (2000-amp switchboard, automatic transfer switch, generator, etc.) should this option continue past concept.
3.3.	Location of new electrical equipment – Option 2	The only equipment identified at this time is the relocated	Discuss whether to place the transformers within existing slips

#	Issue	Assumption at this stage	Recommendation
		transformers on Docks B and C, currently shown relocated to shore/land. Assume no increase in ampacity nor quantities of slip shorepower receptacles as compared to existing.	or relocate to land and place within existing parking stalls at high installed cost should this option continue past concept.
3.4.	Replacement of overwater electrical equipment – Option 1	At this stage, for Option 1, all over water equipment including pedestals for the three docks are assumed to be replaced with new and constructed to the latest code requirements.	The shorepower pedestals will need to either be retrofitted with new ground fault protection or replaced with new pedestals that include this protection from the factory. This can be studied further without impacting the design as each option meets the current Electrical Code.
3.5.	Relocation of Transformers – Option 2	Relocation of the existing Transformers has been assumed at this stage (see item 3.3).	Given the transformer shortages of the past few years salvaging the transformers may be viable, and based on project experience can be done. Before reaching 90% design the transformers should be opened up by Port maintenance and inspected to see if there are any internal issues with corrosion, etc. If they are not in good condition and needed to be refurbished, this would require recertification by a state-accredited testing agency per WAC 296-46B-999, but at that point the transformers should be discarded and replaced. Line item 2 on page 3 of Option 1 Electrical cost estimate lists pricing for new 200 kVA transformers (~$40,000 each), only marginally more expensive than the direct like for like replacement of the existing 167 kVA transformers and would be a suitable ROM. (Pricing does not include tax, mobilization nor general contractor markups.)
3.6.	Dismount and remount of electrical panels, disconnects	If the panelboards were to be disconnected from the branch	Should the panelboards be remounted or replaced and lose

#	Issue	Assumption at this stage	Recommendation
	from covered moorage 'walls' – Option 2	circuits and removed from the existing walls, the branch circuits would likely lose their grandfather status. The current approach assumes to structurally reinforce the panelboards with shoring to allow the panelboards to remain in place while the walls are demolished	their grandfathered status, we would default to using the entirety of page 3 of Option 1 pricing for the recircuiting and upgrading/replacement of the shorepower pedestals, disconnects and panelboard at this stage of the design (~$1.3 million). (Pricing does not include tax, mobilization nor general contractor markups.)
3.7.	Access control equipment	Not included within the current electrical drawings nor pricing.	This appears likely it could be provided independent of roof replacement/removal construction. Discuss whether to add this to the scope after the concept drawings or if it should be handled directly between the Port and security consultant separate from this project.
3.8.	Security cameras	Not included within the current Electrical drawings nor pricing.	This appears likely it could be provided independent of roof replacement/removal construction. Discuss whether to add this to the scope after the concept drawings or if it should be handled directly between the Port and security consultant separate from this project.
3.9.	Wireless networking	Not included within the current Electrical drawings nor pricing.	This appears likely it could be provided independent of roof replacement/removal construction. Discuss whether to add this to the scope after the concept drawings or if it should be handled directly between the Port and wireless consultant separate from this project.
4.	Fire Protection		
4.1.	Unknown condition of 'reliable' power. Fire pump may need to be diesel or provided with emergency generator.	Provide electric pump with emergency generator.	Further study on the existing electrical supply / demand at the site will be needed.
4.2.	Infrastructure to support fire alarm reporting means is unknown.	Assumption is to provide Radio reporting means.	Provide Radio reporting means if available.

#	Issue	Assumption at this stage	Recommendation
4.3.	Routing of sprinkler supply piping to pier from fire pump house may be difficult and intrusive.	Trench sprinkler system risers on shore and provide seismic separation assemblies at the transition from the shore to the pier.	Further study during the next stage of design if this option is selected.
5.	Permitting (refer to W3Y17302–REP–01 REV3 Feasibility Assessment for background details)		
5.1.	Construction of fire pump room and generator may require upgrades to comply with shoreline master program requirements for parking, view corridors and public access	Construction will not trigger upgrades to parking, view corridors or public access.	Pre-submittal conference with the City of Seattle to confirm requirements.
5.2.	Alteration of non-conforming covered moorage.	Proposed alterations will be considered reconfiguration of nonconforming moorage use.	Pre-submittal conference submittal with the City of Seattle to confirm requirements.
5.3.	Mitigation	Mitigation required for both options; pile removal and grated deck installation (Option 1) or roof removal and grated deck installation (Option 2) may be sufficient to offset impacts.	Accelerate coordination with permitting agencies to confirm sufficiency of mitigation or potential for additional requirements.
5.4.	Section 7 consultation timeframe	Formal consultation (minimum 135 days but possibly longer pending NMFS schedule) for Option 1. Possible “no effect” or informal consultation for Option 2.	Early consultation with NMFS and prioritize project details needed for biological evaluation and consultation
5.5.	Available Section 10 permit(s)	The Port’s Comprehensive Routine Maintenance, Repair, and Scientific Sampling permit (Corps File No. NWS–2024–311) will be complete by August 2025, but would only apply to Option 2.	For Option 2, track progress of NWS–2024–311 and determine cut-off date by which the team will pivot to an NWP No. 3, Maintenance, if needed. Prepare for an NWP No. 3 if Option 1 is selected.
5.6.	Section 401 WQC timeframe	The Port assumes that Section 401 will not be triggered by the project. However, if this assumption is incorrect, the water quality certification may take up to 1 year from 30% design if Ecology requires an Individual WQC.	Early consultation with Ecology to confirm requirements

#	Issue	Assumption at this stage	Recommendation
5.7.	Changes to DNR's waterway use authorization contract language can trigger Assistant Attorney General review (+ 6 months)	The Port will need to enter into a new waterway use authorization with DNR. Any new DNR contract language will be amenable to the Port.	Early consultation with DNR to identify and review new contract language and to confirm timeframes for DNR review of selected option.
5.8.	Recreational marina may not meet current code standard.	The recreational marina will meet all current code standards under 23.60A.200.	Recommendation to complete a full code analysis.
6.	Construction Schedule		
6.1.	Concerns about the limited space available for construction.	The current construction schedule assumes that the work is done from the water in a series.	Further investigation be done on possible means and methods to ensure that there is enough space for the different crews to work on the different docks at the same time.

4.2 Key Opportunities

This section summarizes the key opportunities identified that are beyond the scope of this study, but can be further considered by the Port:

- Obtaining credits for removing creosote treated timber piles.
- Redevelopment of the landside area including siting of the new equipment / buildings.
- Further studies with Port's Sustainable Environmental Framework (SEF) to develop a sustainable design strategy for execution.
- Redevelopment could give opportunity to target higher revenue users or revenue models for the marina. For example, accommodating for superyachts.
- Retail, commercial, and digital technology platforms could be developed surrounding the revenue models of the facility.
- Considering the size and characteristics of the facility, it can serve as a pilot for green energy self-generation initiatives..

5 Scope Summary

This section presents an overview of the scope for each option, based on the technical parameters presented in Section 5. For a visual representation and further technical details, refer to the schematic provided in Appendix A.

5.1 Option 1 – Roof Replacement

The key demolition/construction items of Option 1 – Roof Replacement are:

- Remove existing roof structure including walls and all lighting and lighting conduit.
- Remove existing substructure (piles and walkways).
- Construct new substructure, including new piles and new grated deck structure for walkways and catwalks. Noting that the new piles will be increased in length and diameter (see Section 3.1.3.1.3 for further details).
- Construct new timber roof structure, including new purlins, new girders, with metal roof deck cover including some light transmitting areas.
- Construct additional grated deck for the four accessible slips at B Dock.
- Construct new dry–pipe sprinkler systems with nitrogen compressor, a fire alarm system, and on–shore fire pump with a connection to the water supply required.
- Construct fire pump room and generator.
- Construct underground water main from existing waterline to fire pump room.
- Provide three trenched fire riser supplies from the fire pump room to the dry-pipe sprinkler systems on each pier.
- Replace all electrical infrastructure to comply with latest codes.
- Assumed that the Port wish to house this equipment within a structure, an approximate 800 square foot building has been included in the scope.
- Install new lighting via low level bollards to comply with Seattle Shoreline Master Program Regulations.
- All communications wiring as of this date is assumed to be inactive by the Port and will not be replaced under this option.
- Replacement of the potable water system

5.2 Option 2 – Permanent Roof Removal

The key demolition/construction items of Option 2 – Permanent Roof Removal are:

- Remove existing roof structure including walls and all lighting and lighting conduit.
- Construct additional grated decking for the four accessible slips at Dock B.
- Retain existing standpipe system along with the fire extinguishers.
- Relocate two transformers from rafters to shore. On Docks B and C, the existing transformers suspended from the roof rafters will need to be removed during roof demolition.
- Remove and reinstall panelboards and disconnects. Panels and disconnects are removed from existing south wall of each dock and installed/ mounted on new/existing structure at the same location prior to roof removal to limit the impact of upgrading legacy equipment to current codes.
- Install new lighting via low level bollards to comply with Seattle Shoreline Master Program Regulations.
- The existing piles are assumed to remain as–is with no modification such as cutting to reduce their heights.

- All communications wiring within each roof structure is currently mounted to the piles and beams. All communications wiring as of this date is assumed to be inactive by the Port and will be demolished without replacement under this option.

6 Cost Estimate

A Class 3 Cost Estimate has been developed for each option in line with the concept design and scope summary presented in Section 3 and Section 5 respectively.

The estimated cost for the conceptual design of two options is presented in Appendix D and summarized for each of the options in Table 7 and Table 8 below respectively.

Table 7 – Concept Design Cost Breakdown: Option 1 Roof Replacement

Estimate Summary - Option 1 Roof Replacement		
G10- Site Preparation		$1,714,753
Site Demolition & Relocations	$1,714,753	
G20- Site Improvements		$26,606,663
In Water Supply and Logistics Equipment - Tugs, Cranes, Barges and Crews	$15,966,113	
Pile – Galv. Structural Steel with Epoxy Coating at Splash Zone 3/8" Thick	$3,092,936	
Floor Deck	$860,000	
Roof Deck	$2,862,909	
Louver	$210,516	
Roofing	$2,402,214	
Fire Protection Systems	$1,211,975	
G30- Site Plumbing Utilities		$238,000
New Potable Water	$238,000	
G50- Site Electrical Utilities		$2,927,172
Electrical Room Building - Prefab on Slab	$580,000	
Electrical	$2,347,172	
Option 1 Roof Replacement - Base Bid: Total Direct Costs ->		$31,486,588
Scope Contingency	10%	$3,148,659
General Conditions/Mobilization	15%	$5,195,287
Additional Mob/Demob for Fish Window	10%	$3,983,053
Home Office Overhead	6%	$2,628,815
Profit	8%	$3,715,392
Escalation to December, 2029 [to mid-point of construction]	34%	$17,291,371
TOTAL ESTIMATED CONSTRUCTION COST – Option 1 Roof Replacement - BASE Bid		$67,449,165
ADA Dock Area: Total Direct Costs ->		$126,417
ADA Dock Area: TOTAL ESTIMATED CONSTRUCTION COST		$270,805
TOTAL ESTIMATED CONSTRUCTION COST of BASE Bid and Alternative - Option 1 Roof Replacement		$67,719,970

Table 8 – Concept Design Cost Breakdown: Option 2 Roof Removal

Estimate Summary - Option 2 Roof Removal		
G10- Site Preparation		**$1,418,195**
Site Demolition & Relocations	$1,418,195	
G20- Site Improvements		**$3,770,825**
In Water Supply and Logistics Equipment - Tugs, Cranes, Barges and Crews	$3,770,825	
G50- Site Electrical Utilities		**$611,166**
Electrical	$611,166	
Option 2 Roof Removal - Base Bid: Total Direct Costs ->		**$5,800,186**
Scope Contingency	10%	$580,019
General Conditions/Mobilization	15%	$957,031
Home Office Overhead	6%	$440,234
Profit	8%	$622,198
Escalation to December, 2028 [to mid-point of construction]	27%	$2,256,337
TOTAL ESTIMATED CONSTRUCTION COST – Option 2 Roof Removal BASE Bid		**$10,656,004**
ADA Dock Area: Total Direct Costs ->		$141,023
ADA Dock Area: TOTAL ESTIMATED CONSTRUCTION COST		$259,085
TOTAL ESTIMATED CONSTRUCTION COST of BASE Bid and Alternative - Option 2 Roof Removal		**$10,915,089**

Estimate Key Assumptions

The estimate has been developed with the below listed assumptions with the further estimate qualifications as presented in Appendix D:

- The estimates are based on the design team concept design through December, 10 2024, and project schedule March, 13 2025.
- Schedule for Escalation and Fish Window Including all Labor at 5 Days per week at 10 hours per day (5x10) as developed in the project schedule of March, 13 2025.
- This estimate does not include Washington State Sales Tax.
- All soft costs are the owner's responsibility to determine and verify. The Soft costs estimate has been excluded from the construction cost estimate.
- Escalation rate of 6.0% per year is included. Costs are escalated to mid-point of construction of December, 2028.
- An escalation rate above 6.0% per year is not included in the estimate. This is important if general inflation exceeds this rate.
- Estimate is based on AACE 56R-08 - Table 1 "Class 3" with an expected range of -15% to +20%.

Estimate Qualifications

- Summary sheet markups are cumulative, not additive. Percentages are added to the previous subtotal rather than the direct cost subtotal.

- Estimated labor is based on an 8 hour per day 5 days a week. Accelerated schedule overtime work has not been included.
- Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
- Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
- If only 1 or 2 bids are received the bids could be 40% to 100% more than the cost estimate based on empirical experience.
- Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
- Division 0/ Division 1 specifications are presumed to have normal ranges for liquidated damages, construction schedule and terms & conditions. These divisions are typically written after the final estimate. Please contact the cost estimator for a review, if desired.
- Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.
- The construction cost estimate does not include an estimate of owner soft costs such as taxes, A/E fees, owner contingencies and permit fees.
- Construction reserve contingency for change orders is not included in the estimate.
- Any modifications to the plans via addendums and code review for permits will cause cost increases and are not included in this estimate.
- Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.
- Imposition of tariffs and market instability of resources such as fuel, insurance and labor occurring after estimate date are not included.
- Contractors imposing different bidding conditions from plans and specifications on subcontractors are not bidding from the plans and specifications.
- Modifications to the proposed construction schedule and modifying the phasing plans after this estimate will affect construction cost and are not included.
- The estimate includes a reasonable construction escalation that can be determined based on market conditions for up to the next 6 months.
- Since this project has a midpoint of construction further than 6 months, increases in escalation are not included beyond the rate shown in the estimate.
- Any cost estimates provided are on the basis of experience and judgment. Since the consultant has no control over market conditions or bidding procedures, the consultant does not warrant that bids or ultimate construction costs will not vary from these cost estimates.

7 Project Schedule

A level 2 project schedule for each option has been developed in line with the concept design and scope summary presented in Section 3 and Section 5 respectively. These project schedules are presented in Appendix E and summarized in this section along with the key assumptions.

7.1 Option 1 Roof Replacement Schedule Summary

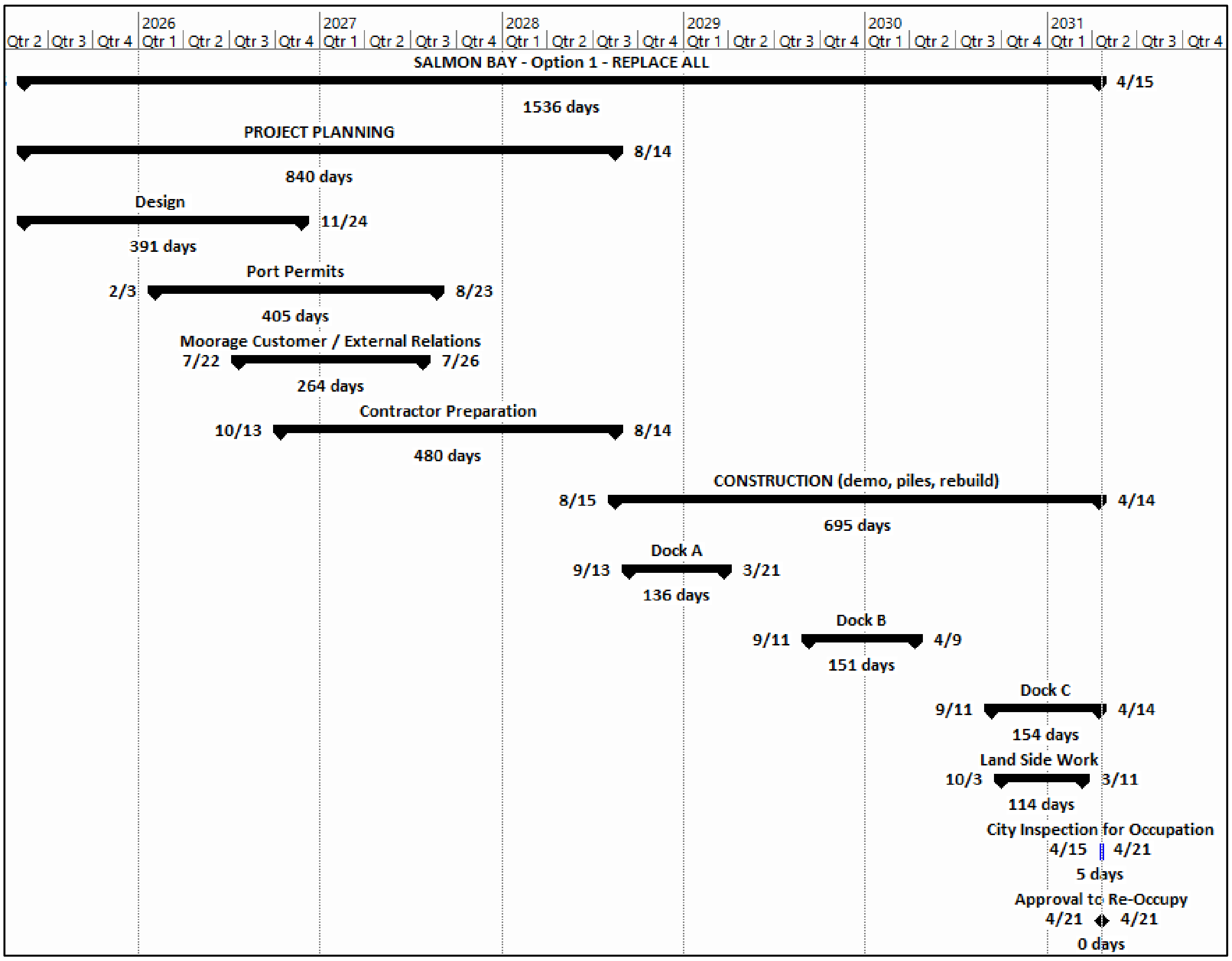

Figure 26 – Option 1 Summarized Schedule – See Appendix E for details

7.2 Option 2 Permanent Roof Removal Schedule Summary

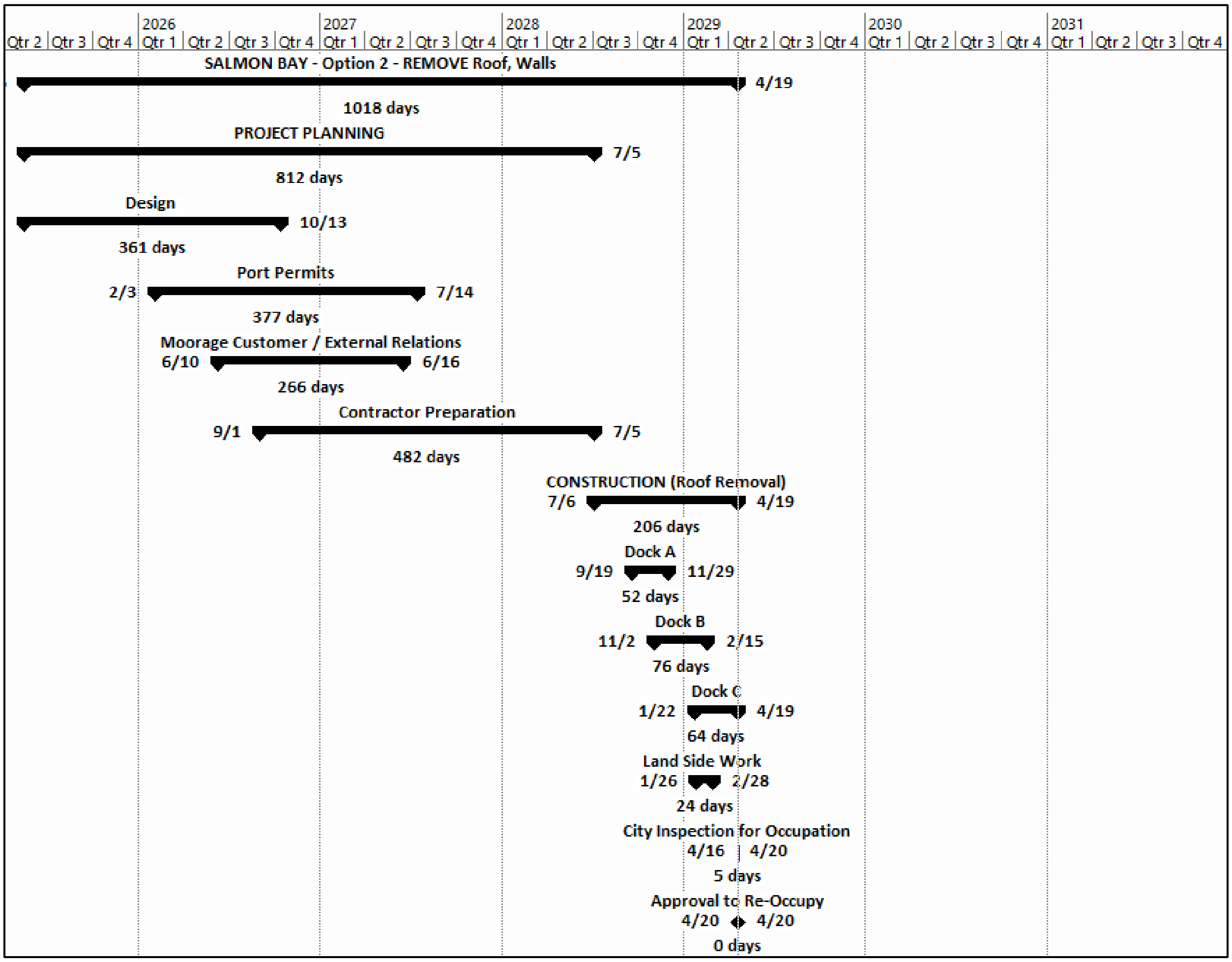

Figure 27 - Option 2 Summarized Schedule – See Appendix E for details

7.3 Key Assumptions

Key assumptions for both options:

General

1) Schedule start has been assumed as mid-May 2025, as agreed with the Port.
2) Schedule has not been adjusted for weather efficiency.
3) Schedule is generally based on week–by–week planning. Cost and schedule may not align perfectly at this stage of planning.
4) Craft headcount is not used to calculate task durations.
5) There will be full moorage customer vacancy at start of construction. Re-occupancy will occur at the end of the project.

Construction

6) The following assumptions have been made regarding the construction sequence:
    a. Schedule is based on a repeated pattern of tasks – by dock A, B, C and then by 1, 2, 3, 4 sub-docks
    b. The work order is A1→ A2 → A3 → B1 → B2 → B3 → B4 → C1 → C2 → C3 → C4. In general series by key task (such as roof removal → roof removal) or by dock, depending on the work window.
    c. Each dock (A, B, C) is assumed to be a stand-alone construction project, and isolated in total, i.e. no people, no boats, no utilities, as a set.
    d. Each area (A1, A2, A3, A4, etc.) is assumed to be a standalone sub–project, ignoring overlap occurring when barges are not needed (cleaning, electrical, etc.).
    e. This is a cookie cutter pattern–based schedule favoring repetitive simplicity over efficiency at this stage of planning.
    f. Schedule patterns are consistent, except for the very small sub-docks that have some shortened durations.
    g. Maintaining overall schedule repeating patterns dominates over adjusting day by day schedule details to compensate for the different sub-dock sizes.
    h. It is not possible to perfectly meet all these sequencing priorities in order and still maintain craft efficiency. Some work gaps will occur, and some overlaps will occur. It will be left to the contractor to manage craft and resources to minimize any inefficiencies.
7) Value engineering opportunities that have not been assumed in this schedule but can be explored in the next phase and could include:
    a. Land-based cranes for work near shore.
    b. Alternative delivery methods.
    c. General contractor's phasing means and methods.
8) Certain unknowns are not considered, such as hazardous remediation.

Allowed Work Windows

9) Allowed work windows are defined by the in and over water work windows, as described below:
    a. It has been assumed that a Tribal Agreement will be in place, allowing in-water work to take place from June 16 to December 1.

b. The in and over water work requirements result in all schedule tasks being labeled as "IN" water, "OVER" water, or "LAND" (or blank.). These are noted in text column "Cat." on the schedule.
c. The in water allowed work window is most restrictive and occurs from October 1 through April 15.
d. Over-water work assumes year-round access when scaffolding/netting is in place. The construction netting is used for over water debris containment. Installing and removing these nets is classified as in water.
e. Water debris booms are used for in water debris containment.
f. The items labeled "LAND" or are left blank on the schedule have no in or over water work limitation.

<u>Permitting and Lead Times</u>

10) Permitting durations and interlinkages have been assumed based on previous experience. These durations can vary and are dependent on third parties.
11) The lead time is a general blanket of time for the general material procurement, it has not been developed based on the individual components and materials of the project. Leadtime will not be the critical path.
12) Long lead items are not assumed to impact the schedule and have not been included in the schedule at this stage.

Key assumptions for Option 1 only:

1) Work is divided into three specific tasks – demo, piles, rebuild.
2) A specific work crew is assigned to each of these tasks throughout the project.
3) There is a total of four barges assumed for this schedule:
    a) The demo crew has an assigned barge supporting them, and another barge is used to haul away debris.
    b) The pile crew has equipment assigned to them specifically for removing old and installing new piles
    c) The rebuild crew has an assigned barge supporting them.
4) The three crews focus only on their specific work task. Demo only, piles only, and rebuild only.
5) Work for each crew proceeds in sequential order A, B, C docks, and 1,2, 3, 4 sub-docks as noted above. However, the sequential demo, piles, and rebuild tasks somewhat override the project sequential order to maintain their workflow and reduce standby time when possible.
6) There are seven sequencing levels, in general order of priority:
    a) Allowed Work Window1 →aww2 → aww3 → aww4 → etc.
    b) Docks A → B → C
    c) Sub-docks 1 → 2 → 3 → 4
    d) Demo → Piles → Rebuild
    e) Demo 1 → Demo 2 → Demo 3 → Demo 4
    f) Piles 1 → Piles 2 → Piles 3 → Piles 4
    g) Rebuild 1 → Rebuild 2 → Rebuild 3 → Rebuild 4
7) The critical path will generally follow the A, B, C and 1, 2, 3, 4 sequencing but with small variations to maximize the demo, piles, rebuild task logic efficiency

Key assumptions for Option 2 only:

1) One demolition work crew and one barge work sequentially in series through the project. If there are additional barge teams and working fronts, then the project time could be shortened.
2) The critical path is keeping one barge busy supporting the work crew with one additional barge used to haul away debris.
3) Work for each crew proceeds in sequential order A, B, C docks, and 1,2, 3, 4 sub-docks as noted above. However, the sequential demo tasks somewhat override the project sequential order to maintain their workflow and reduce standby time when possible.
4) There are 4 sequencing levels, in general order of priority:
    a. Allowed Work Window1 → aww2 → aww3 → aww4 → etc.
    b. Docks A → B → C→
    c. Sub-docks 1 → 2 → 3 → 4 →
    d. Demo 1 → Demo 2 → Demo 3 → Demo 4
5) The critical path will generally follow the A, B, C and 1, 2, 3, 4 sequencing but with small variations to maximize the demo task logic efficiency.
6) Piles exposed after roof / wall removal are left in place, i.e., not cut off to reduce costs at this stage.

8 References

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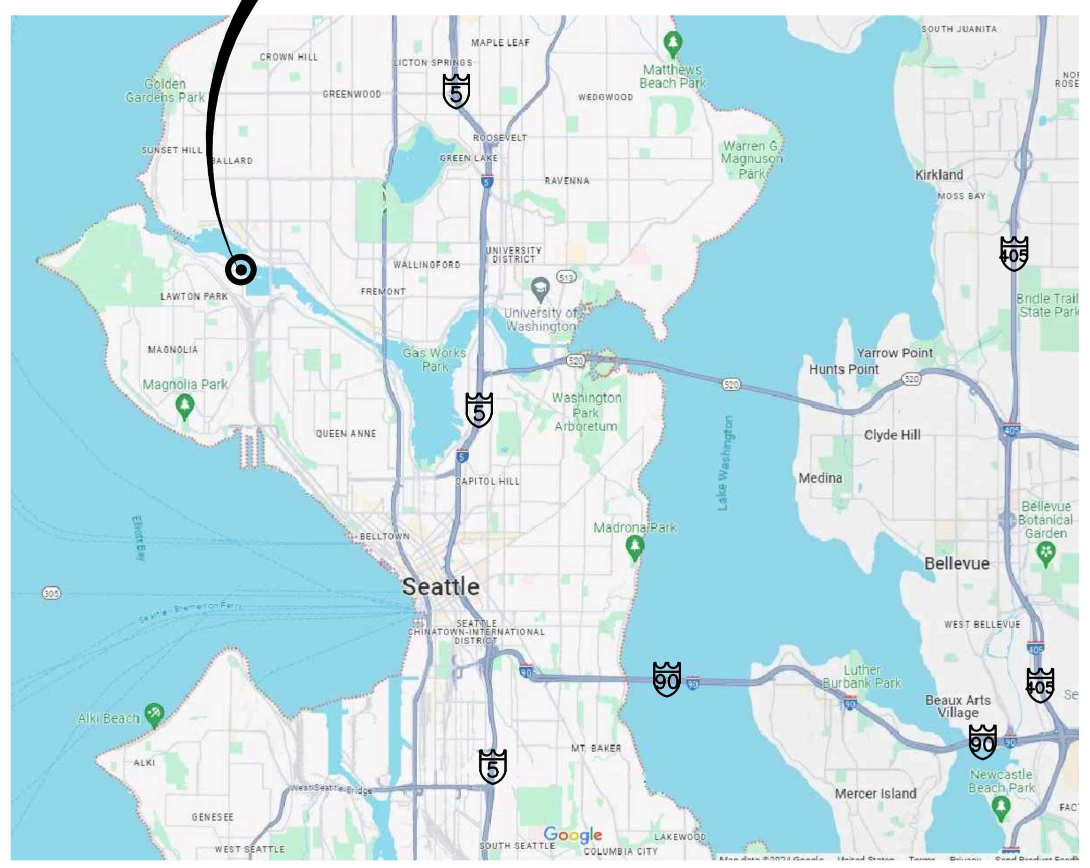
Appendix A. Concept Drawing Package

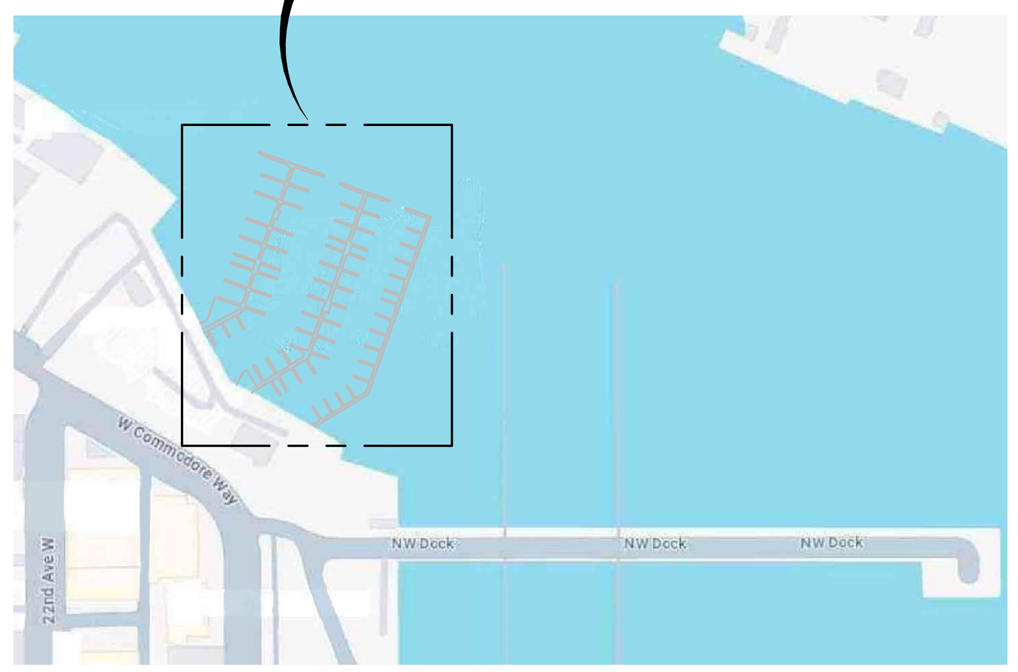
VICINITY MAP

PROJECT SITE
SALMON BAY MARINA



LOCATION MAP

PROJECT SITE
SALMON BAY MARINA



CODE CRITERIA

ARCHITECTURAL CODES:
DRAFT 2021 SEATTLE BUILDING CODE (SBC).
DRAFT 2021 SEATTLE EXISTING CODE (SEBC).
2010 AMERICANS WITH DISABILITIES ACT (ADA) STANDARDS FOR ACCESSIBLE DESIGN.
2003 UNITED STATES ACCESS BOARD.
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) COMPLIANCE REQUIREMENTS.

STRUCTURAL CODES:
DRAFT 2021 SEATTLE BUILDING CODE (SBC).
DRAFT 2021 SEATTLE EXISTING CODE (SEBC).
2021 INTERNATIONAL BUILDING CODE.
ASCE 7-16 MINIMUM DESIGN LOADS AND ASSOCIATED CRITERIA FOR BUILDINGS AND OTHER STRUCTURES.
2018 AMERICAN WOOD COUNCIL NATIONAL DESIGN STANDARD (NDS).
ASCE 41-17 SEISMIC EVALUATION AND RETROFIT OF EXISTING BUILDINGS.
2017 ASCE 61-14 SEISMIC EVALUATION & RETROFIT OF EXISTING BUILDINGS.
ASCE 50 PLANNING & DESIGN GUIDELINES FOR SMALL CRAFT HARBORS

FIRE SAFETY CODES:
2021 SEATTLE BUILDING CODE.
2021 SEATTLE FIRE CODE.
2021 SEATTLE ELECTRICAL CODE.
2022 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 13.
2022 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 14.
2022 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 20.
2022 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 24.
2022 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 72.

ELECTRICAL CODES:
2023 SEATTLE ELECTRICAL CODE.
2018 SEATTLE ENERGY CODE.
23.60A SEATTLE SHORELINE MASTER PROGRAM REGULATIONS-ARTIFICIAL NIGHT LIGHTING REQUIREMENTS.

SHORELINE AND LAND USE:
LAND USE CODE SMC TITLE 23.
2024 CITY OF SEATTLE SHORELINE MASTER PROGRAM.
SMC 23.60A.502 SHORELINE USE TABLE FOR UM.
SMC 23.60A.122.E DEVELOPMENT NONCONFORMING TO DEVELOPMENT STANDARDS.
SMC 23.60A.152 GENERAL DEVELOPMENT STANDARDS.
SMC 23.60A.158 STANDARDS FOR MITIGATION SEQUENCING.
SMC 23.60A.200 STANDARDS FOR MARINAS, COMMERCIAL AND RECREATIONAL.
SMC 23.60A.187 STANDARDS FOR PIERS AND FLOATS AND OVERWATER STRUCTURES.
ENVIRONMENTAL PROTECTION AND PRESERVATION-SMC TITLE 25.

CODE REVIEW CRITERIA

OCCUPANCY GROUP:	LOW-HAZARD STORAGE, GROUP S-2
OCCUPANCY USE:	COVERED BOAT MOORAGE
OCCUPANT LOAD:	TABLE 1004.5 THE OCCUPANT LOAD WAS CALCULATED BASED ON FACTOR OF 300 SF/OCC ACCESSORY STORAGE AREAS
CONSTRUCTION TYPE:	TYPE VB-FULLY SPRINKLERED (OPT1)
ALLOWABLE HEIGHT:	TABLE 504.3 S-2 OCCUPANCY ALLOWED: 4 STORIES MAXIMUM 70 FEET ACTUAL: 1 STORY
ALLOWABLE AREA:	TABLE 506.2 S-2 OCCUPANCY ALLOWABLE 1 STORY: 84,000 SQ. FT.
ACTUAL AREA:	DOCK A: 14,164 SQ. FT. DOCK B: 29,904 SQ. FT. DOCK C: 26,592 SQ. FT. PUMP ROOM: (OPT 1) 220 SQ. FT. ELECTRICAL BULDG. (OPT1) 800 SQ. FT. TOTAL AREA: 71,680 SQ. FT.
FIRE SUPPRESSION:	DRY PIPE SYSTEM UNDER THE ROOF

SCOPE OF WORK SUMMARY

BRIEFLY AND WITHOUT FORCE OR EFFECT UPON THE CONTRACT DOCUMENTS, THE WORK OF THIS CONTRACT CAN BE SUMMARIZED AS FOLLOWS:

1. ARCHITECTURAL:
2. STRUCTURAL:
3. FIRE PROTECTION:
4. ELECTRICAL:

DRAWING NUMBER KEY

SPECIFIC PLAN AREA
0 - GENERAL
1 - OVERALL
2 - DOCK A
3 - DOCK B
4 - DOCK C
5 - DETAILS

GENERAL USE OR OPTION #
0 - GENERAL
1 - OPTION 1
2 - OPTION 2
3 - ALL OPTIONS

DISCIPLINE CODE

TYPE OF DRAWING
0 - GENERAL, NOTES, LEGENDS
1 - PLAN VIEWS
2 - ELEVATIONS
3 - SECTIONS
4 - DETAILS
5 - DIAGRAMS

SEQUENTIAL NUMBER WITHIN TYPE

A x x . x x

DRAWING INDEX

NO.	DISCIPLINE
	GENERAL
G00.01	COVER SHEET
G31.11	EXISTING SITE PLAN
G32.31	EXISTING DOCK A TYPICAL SECTION
G33.31	EXISTING DOCK B TYPICAL SECTION
G34.31	EXISTING DOCK C TYPICAL SECTION
D12.31	DEMOLITION DOCK A SECTION - OPTION 1
D13.31	DEMOLITION DOCK B SECTION - OPTION 1
D14.31	DEMOLITION DOCK C SECTION - OPTION 1
D22.31	DEMOLITION DOCK A SECTION - OPTION 2
D23.31	DEMOLITION DOCK B SECTION - OPTION 2
D24.31	DEMOLITION DOCK C SECTION - OPTION 2
	ARCHITECTURAL
A11.11	OVERALL DOCK PLAN - OPTION 1
A11.12	OVERALL ROOF PLAN - OPTION 1
A12.11	ENLARGED DOCK A - OPTION 1
A12.21	DOCK A-1 ELEVATIONS - OPTION 1
A12.31	DOCK A-1 TYPICAL SECTION - OPTION 1
A13.11	ENLARGED DOCK B - OPTION 1
A13.21	DOCK B-1 ELEVATIONS - OPTION 1
A13.31	DOCK B-1 TYPICAL SECTION - OPTION 1
A14.11	ENLARGED DOCK C - OPTION 1
A14.21	DOCK C-1 ELEVATIONS - OPTION 1
A14.31	DOCK C-1 TYPICAL SECTION - OPTION 1
A21.11	OVERALL DOCK PLAN - OPTION 2
A22.11	ENLARGED DOCK A - OPTION 2
A23.11	ENLARGED DOCK B - OPTION 2
A24.11	ENLARGED DOCK C - OPTION 2
	STRUCTURAL
S11.11	GROUND LEVEL PLAN - OPTION 1
S11.12	OVERALL ROOF FRAMING PLAN - OPTION 1
S12.11	DOCK A FRAMING PLAN - OPTION 1
S12.31	DOCK A SECTION - OPTION 1
S13.11	DOCK B FRAMING PLAN - OPTION 1
S13.31	DOCK B SECTION - OPTION 1
S14.11	DOCK C FRAMING PLAN - OPTION 1
S15.31	DOCK C SECTION - OPTION 1
S15.41	SUPERSTRUCTURE DETAILS - OPTION 1
S15.42	SUPERSTRUCTURE DETAILS - OPTION 1
S15.43	SUBSTRUCTURE DETAILS - OPTION 1
S21.11	GROUND LEVEL PLAN - OPTION 2
S21.12	OVERALL ROOF FRAMING PLAN - OPTION 2
S22.11	DOCK A ROOF FRAMING PLAN - OPTION 2
S22.31	DOCK A SECTION - OPTION 2
S23.11	DOCK B ROOF FRAMING PLAN - OPTION 2
S23.31	DOCK B SECTION - OPTION 2
S24.11	DOCK C ROOF FRAMING PLAN - OPTION 2
S24.31	DOCK C SECTION - OPTION 2

NO.	DISCIPLINE
	ELECTRICAL
E00.01	ELECTRICAL SYMBOLS AND ABBREVIATIONS
DE11.11	DEMOLITION PLAN - OPTION 1
DE21.11	DEMOLITION PLAN - OPTION 2
E11.11	ELECTRICAL PLAN - OPTION 1
E21.11	ELECTRICAL PLAN - OPTION 2
DE10.51	DEMOLITION ONE-LINE DIAGRAM - OPTION 1
DE10.52	DEMOLITION ONE-LINE DIAGRAM DOCKS A, B, & C - OPTION 1
E10.53	CONSTRUCTION ONE-LINE DIAGRAM - OPTION 1
DE20.54	DEMOLITION ONE-LINE DIAGRAM - OPTION 2
E20.55	ONE-LINE DIAGRAM DOCKS A, B, & c - OPTION 2
	FIRE PROTECTION
FP01.11	SITE PLAN

ABBREVIATIONS

#	NUMBER
@	AT
℄	CENTER LINE
⌀	DIAMETER
∟	ANGLE
A.B.	ANCHOR BOLT
ABV.	ABOVE
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISH FLOOR
ALUM.	ALUMINUM
APPROX.	APPROXIMATE
ARCH.	ARCHITECTURAL
A.S.T.M.	AMERICAN SOCIETY FOR TESTING MATERIALS
BD.	BOARD
BITUM.	BITUMINOUS
BLDG.	BUILDING
B.M.	BENCHMARK
B.O.	BOTTOM OF
BOT.	BOTTOM
B.P.	BASE PLATE
BRG.	BEARING
BTWN.	BETWEEN
CER.	CERAMIC
C.J.	CONSTRUCTION JOINT
CLG.	CEILING
CLR.	CLEAR
CMU	CONCRETE MASONRY UNIT
COL.	COLUMN
CONC.	CONCRETE
CONT.	CONTINUOUS
CONST.	CONSTRUCTION
COORD.	COORDINATE
C.T.J.	CONTRACTION JOINT
DBL.	DOUBLE
DEPT	DEPARTMENT
DET.	DETAIL
DIA.	DIAMETER
DTL.	DETAIL
DWGS.	DRAWINGS
D.B.A.	DEFORMED BAR ANCHOR
EA.	EACH
E.F.	EACH FACE
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEV.	ELEVATION
EQ.	EQUAL
E.S.	EACH SIDE
E.W.	EACH WAY
EXIST.	EXISTING
EXPAN.	EXPANSION
EXT.	EXTERIOR
E.W.C.	ELECTRIC WATER COOLER
F.S.C.	FAMILY SUPPORT CENTER
F.D.	FLOOR DRAIN
FDN.	FOUNDATION
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
F.F.	FINISH FLOOR
FIN.	FINISH
FLR.	FLOOR
FT.	FEET
FTG.	FOOTING
F.R.F.	FRAGMENT RETENTION FILM
GA.	GAGE/GAUGE
GAL.	GALLON
GALV.	GALVANIZED
G.C.	GENERAL CONTRACTOR
GFCI	GOVERNMENT FURNISHED CONTRACTOR INSTALLED
GFGI	GOVERNMENT FURNISHED GOVERNMENT INSTALLED
GPM	GALLONS PER MINUTE
GND.	GROUND
GOVT.	GOVERNMENT
GWB.	GYPSUM WALL BOARD
GYP. BD.	GYPSUM WALL BOARD
H.A.F.B.	HILL AIR FORCE BASE
HC.	HANDICAPPED
HDW.	HARDWARE
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
HR.	HOUR
H.S.A.	HEADED STUD ANCHOR
HT.	HEIGHT
HVAC	HEATING/VENTILATION/ AIR CONDITIONING
HYD	HYDRANT
I.D.	INSIDE DIAMETER
I.F.	INSIDE FACE
IN.	INCHES
INFO.	INFORMATION
INSUL.	INSULATION
LAV.	LAVATORY
LT.	LIGHT
LT. WT.	LIGHT WEIGHT
MAINT.	MAINTENANCE
MANUF.	MANUFACTURER
MAX.	MAXIMUM
MAT.	MATERIAL
M.C.J.	MASONRY CONTROL JOINT
MECH.	MECHANICAL
MFR.	MANUFACTURER
MIN.	MINIMUM
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
MTL.	METAL
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
O.F.	OUTSIDE FACE
O.H.	OVERHEAD
OHD	OVERHEAD DOOR
OPP.	OPPOSITE
PART.	PARTITION
P.C.F.	POUNDS PER CUBIC FOOT
PERP.	PERPENDICULAR
PL. LAM.	PLASTIC LAMINATE
P.L.F.	POUNDS PER LINEAL FOOT
PNTD.	PAINTED
PROT.	PROTECTION
P.S.F.	POUNDS PER SQUARE FOOT
P.S.I.	POUNDS PER SQUARE INCH
QTY.	QUANTITY
R.D.	ROOF DRAIN
RAD.	RADIUS
REINF.	REINFORCED
REQ'D	REQUIRED
RM.	ROOM
R.O.	ROUGH OPENING
SCHED.	SCHEDULE
SHR.	SHOWER
SHT.	SHEET
SIM.	SIMILAR
SQ.	SQUARE
SPEC.	SPECIFICATION
ST	STEEL
STC	SOUND TRANSMISSION COEF
STD.	STANDARD
STR.	STRUCTURAL
SUPER.	SUPERVISER
SUSP.	SUSPENDED
T	TEMPERED GLASS
THRU	THROUGH
T.O.	TOP OF
T.O.A.	TOP OF ASPHALT
T.O.C.	TOP OF CURB
T.O.F.	TOP OF FOOTING
T.O.S.	TOP OF SLAB OR SIDEWALK
T.O.W.	TOP OF WALL
TYP.	TYPICAL
TV	TELEVISION
U.N.O.	UNLESS NOTED OTHERWISE
VCR	VIDEO CASSETTE RECORDER
VCT	VINYL COMPOSITION TILE
VERT.	VERTICAL
VEST.	VESTIBULE
VNR.	VENEER
W/	WITH
WD.	WOOD

GRAPHIC SYMBOLS

1
A
GRID LINES

DETAIL SYMBOL
DETAIL NUMBER
SHEET WHERE DETAIL IS DRAWN

BUILDING/WALL SECTION SYMBOL
SECTION REFERENCE
SHEET WHERE SECTION IS DRAWN

A
B
D
C
ELEVATION SYMBOL
ELEVATION IDENTIFICATION
SHEET WHERE ELEVATION IS DRAWN

100'-0" A.F.F
96'-0"
ELEVATION CONTROL POINT
OR DATUM POINT

NAME
12
ROOM NUMBER

1
FINISH FLOOR

1
DOOR NUMBER

1
WINDOW TYPE

1
KEYNOTE

1
REVISION

MATERIALS/LEGEND

HAZARDOUS MATERIALS

LEAD AND/OR ASBESTOS MAY BE PRESENT ON SITE. IF ENCOUNTERED, CONTACT PROJECT MANAGER IMMEDIATELY.

CONCRETE MANSONRY UNIT
FACE BRICK
CONCRETE (POURED IN PLACE)
GYPSUM BOARD OR SETTING BEDS
INSULATION (BATT & BLANKET)
INSULATION (RIGID/SEMI-RIGID)
PLYWOOD
CONTINUOUS ROUGH WOOD
BLOCKING, ROUGH WOOD
METAL (LARGE SCALE)
GRAVEL
EARTH
QUARRY/CERAMIC TILE

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE NONE	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR	COVER SHEET AND DRAWING INDEX	G00.01	

CONCEPT DESIGN SUBMITTAL

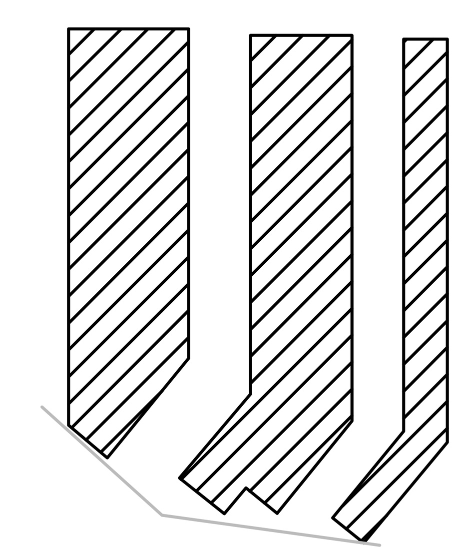
GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON DRAWING C.10 OVERALL SITE PLAN FROM PROJECT SALMON BAY MARINA MASTER USE PERMIT DATED 06-22-2012, AND FT-SALMON BAY BASEMAP-3-20-24 CAD FILE, AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.

SHEET KEYNOTES

1. EXISTING DECK
2. OUTLINE OF THE EXISTING ROOF ABOVE

EXISTING SITE PLAN
1/32" = 1'-0"



KEYPLAN

N

0 32 64 96
1"= 32'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A-C ROOF SAFETY

DESIGNED BY	A. LOFTI
DRAWN BY	R. CATHERS
CHECKED BY	J. DELUCA
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

EXISTING SITE PLAN

SCALE 1/32"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO.
G31.11

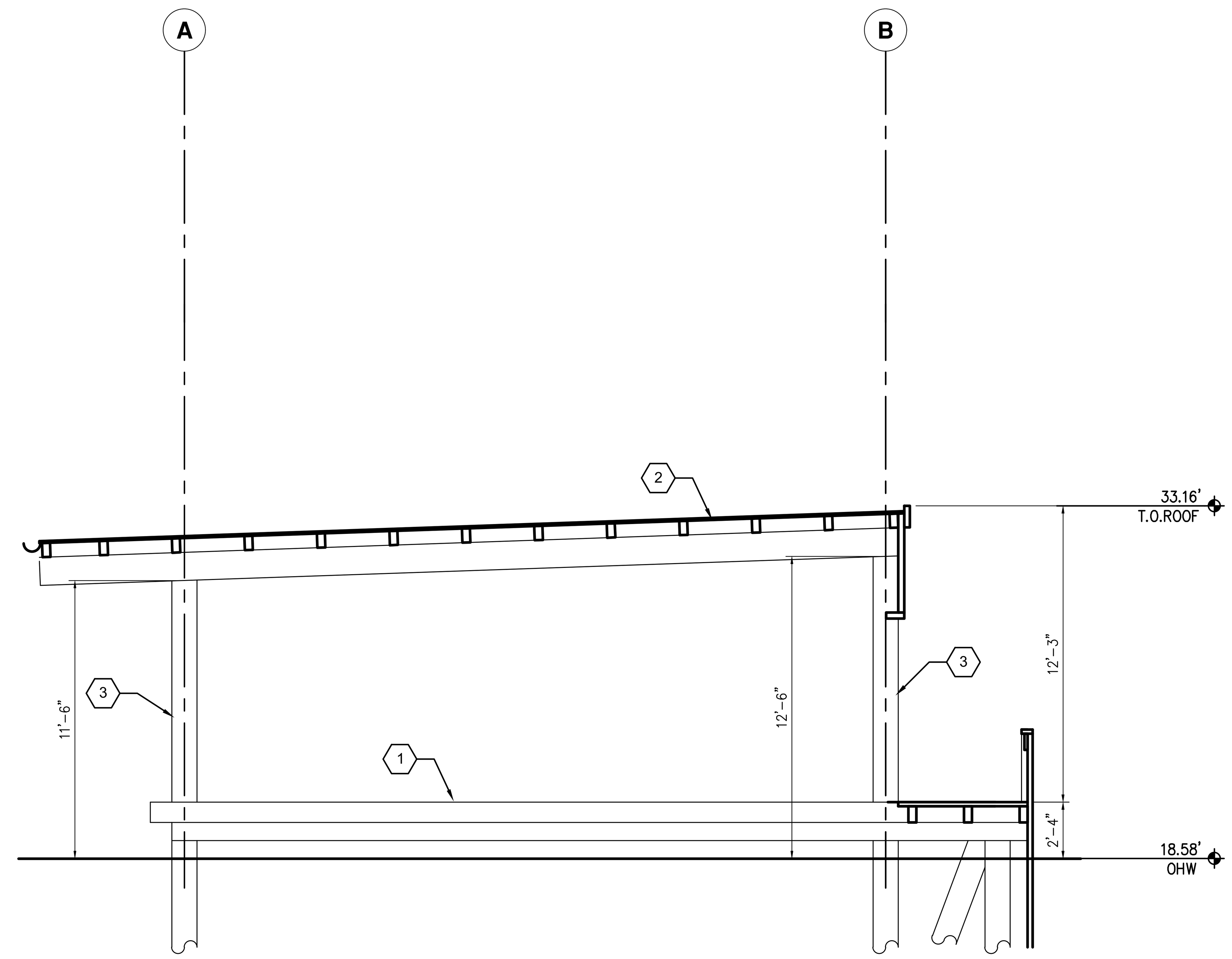
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. EXISTING DECK
2. EXISTING ROOF
3. EXISTING STRUCTURE



A EXISTING DOCK A TYPICAL SECTION

1/4"=1'-0"
G31.11

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1/4"=1'-0"	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A-C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	EXISTING DOCK A TYPICAL SECTION	G32.31	

CONCEPT DESIGN SUBMITTAL

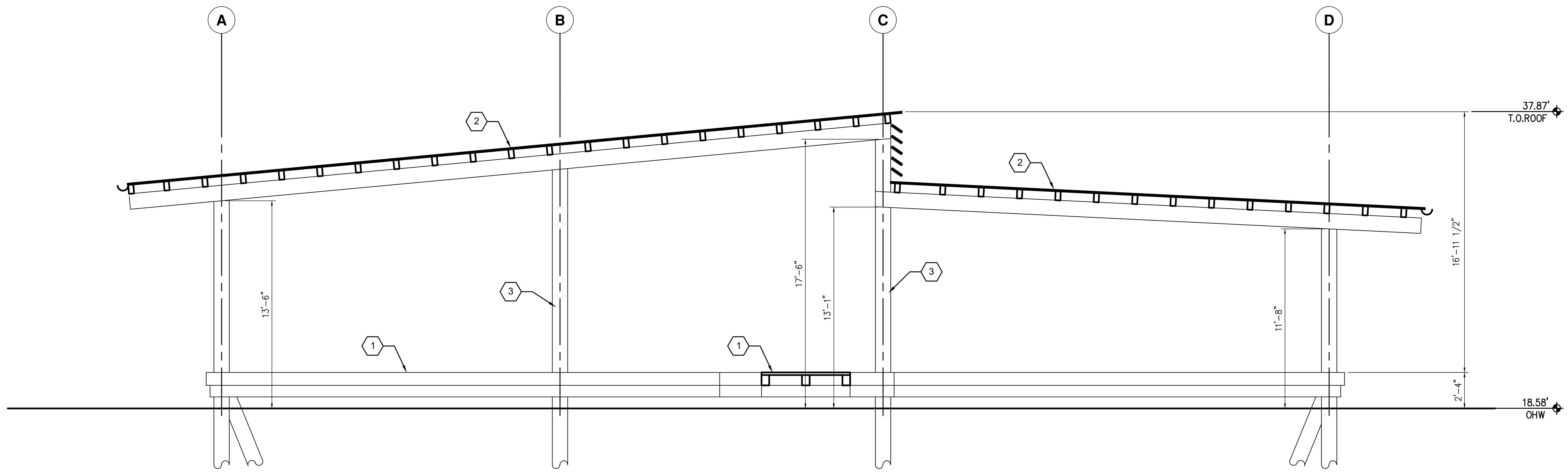
GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.

VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. EXISTING DECK
2. EXISTING ROOF
3. EXISTING STRUCTURE



A EXISTING DOCK B TYPICAL SECTION

1/4"=1'-0"

G31.11

0 4 8 12

1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1/4"=1'-0"	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	EXISTING DOCK B TYPICAL SECTION	G33.31	

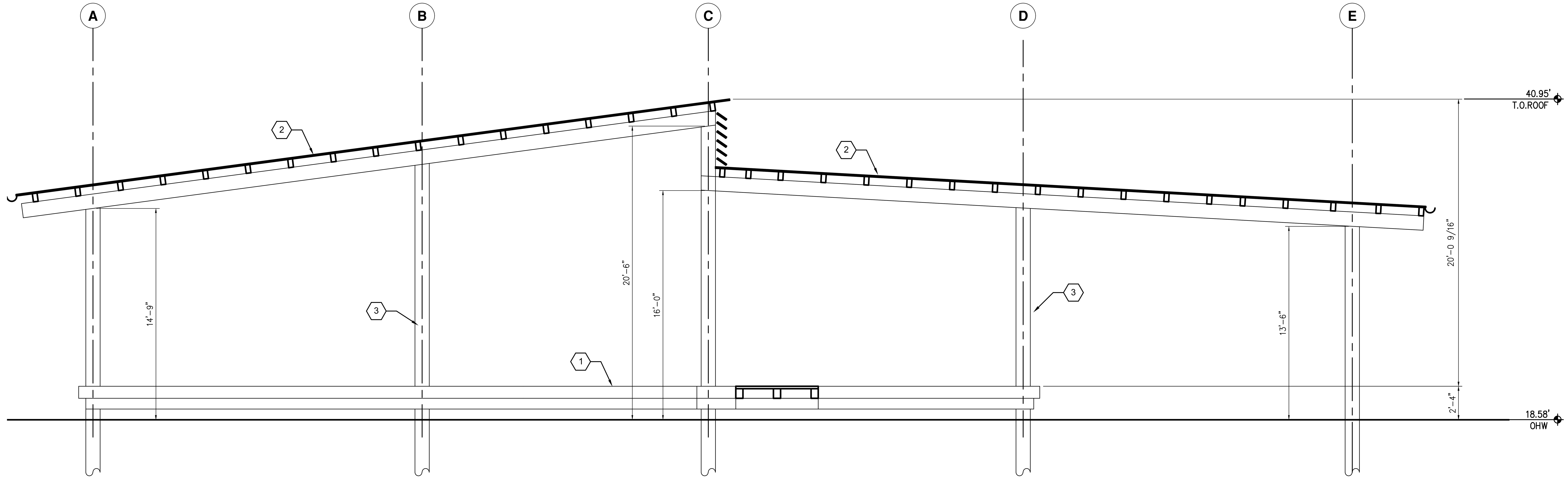
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. EXISTING DECK
2. EXISTING ROOF
3. EXISTING STRUCTURE



A **EXISTING DOCK C TYPICAL SECTION**
1/4"=1'-0"
G31.11

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

EXISTING DOCK C TYPICAL SECTION

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO.
G34.31

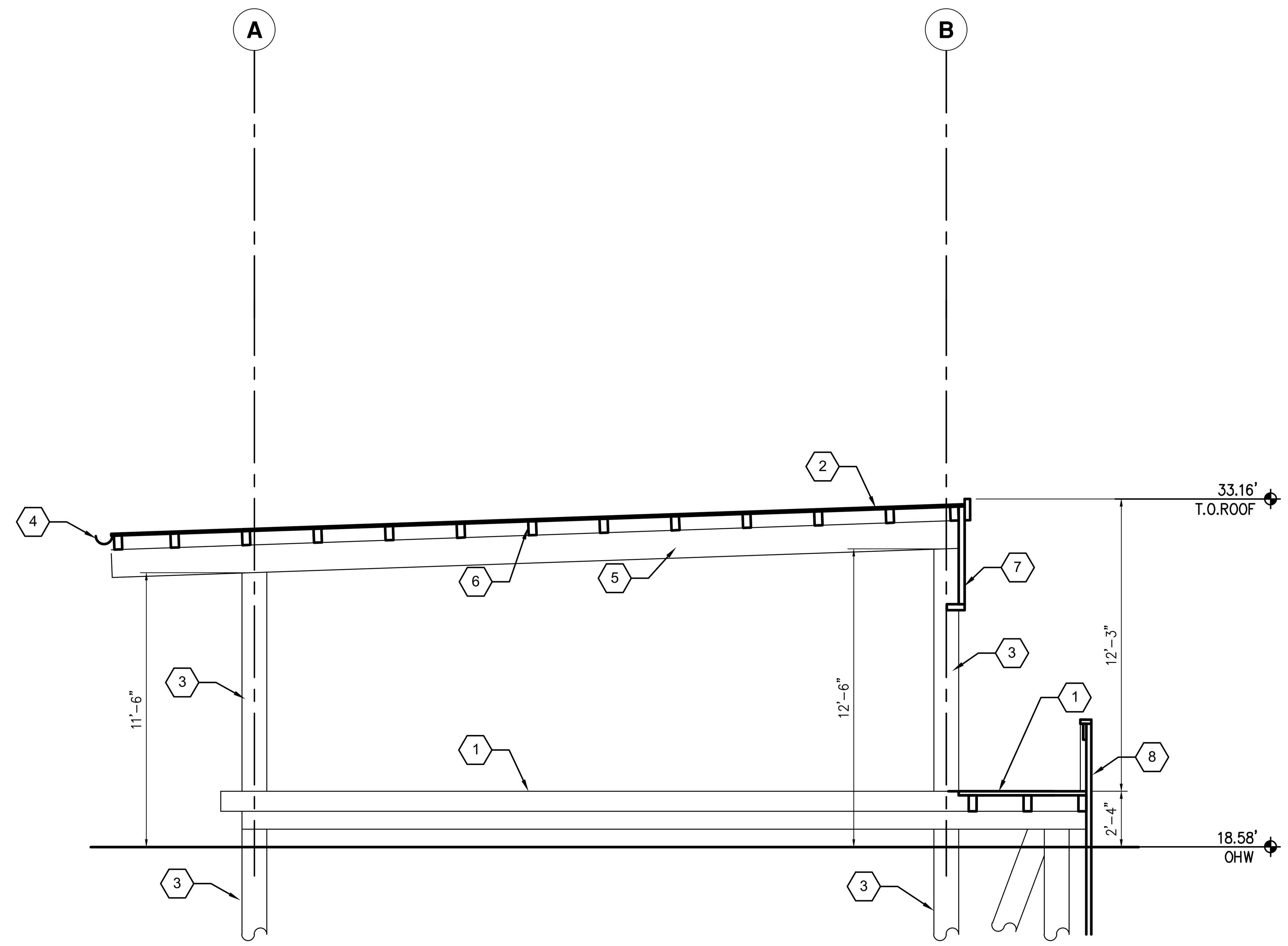
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. REMOVE EXISTING DECK
2. REMOVE EXISTING ROOF
3. REMOVE EXISTING SUBSTRUCTURE
4. REMOVE EXISTING GUTTER, TYPICAL
5. REMOVE EXISTING GIRDER, TYPICAL
6. REMOVE EXISTING PURLIN, TYPICAL
7. REMOVE EXISTING WEATHER CURTAIN
8. REMOVE EXISTING EDGE WALL



A DEMOLITION DOCK A TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)
1/4"=1'-0"
D12.11

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION DOCK A TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. D12.31

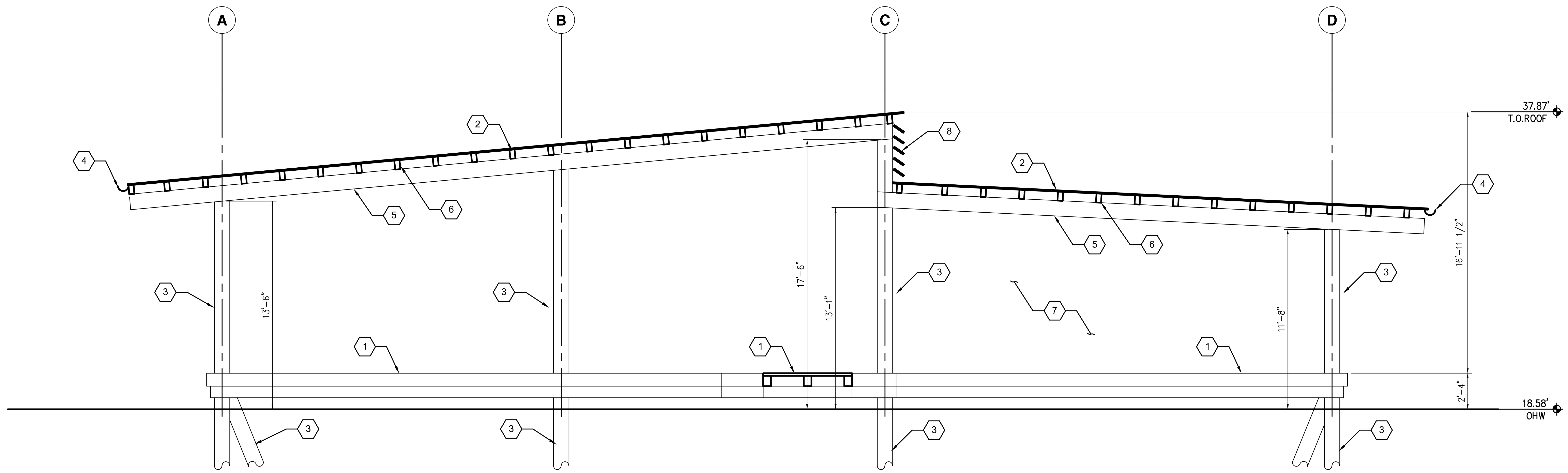
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. REMOVE EXISTING DECK
2. REMOVE EXISTING ROOF
3. REMOVE EXISTING SUBSTRUCTURE
4. REMOVE EXISTING GUTTER, TYPICAL
5. REMOVE EXISTING GIRDER, TYPICAL
6. REMOVE EXISTING PURLIN, TYPICAL
7. REMOVE EXISTING END WALLS BEYOND, TYPICAL
8. REMOVE EXISTING LOUVERS AND FRAMES



A DEMOLITION DOCK B TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)
1/4"=1'-0"
D13.11

0 4 8 12
1"= 4'
GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES
SALMON BAY MARINA
SALMON BAY MARINA DOCKS A–C ROOF SAFETY
DEMOLITION DOCK B TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO.
D13.31

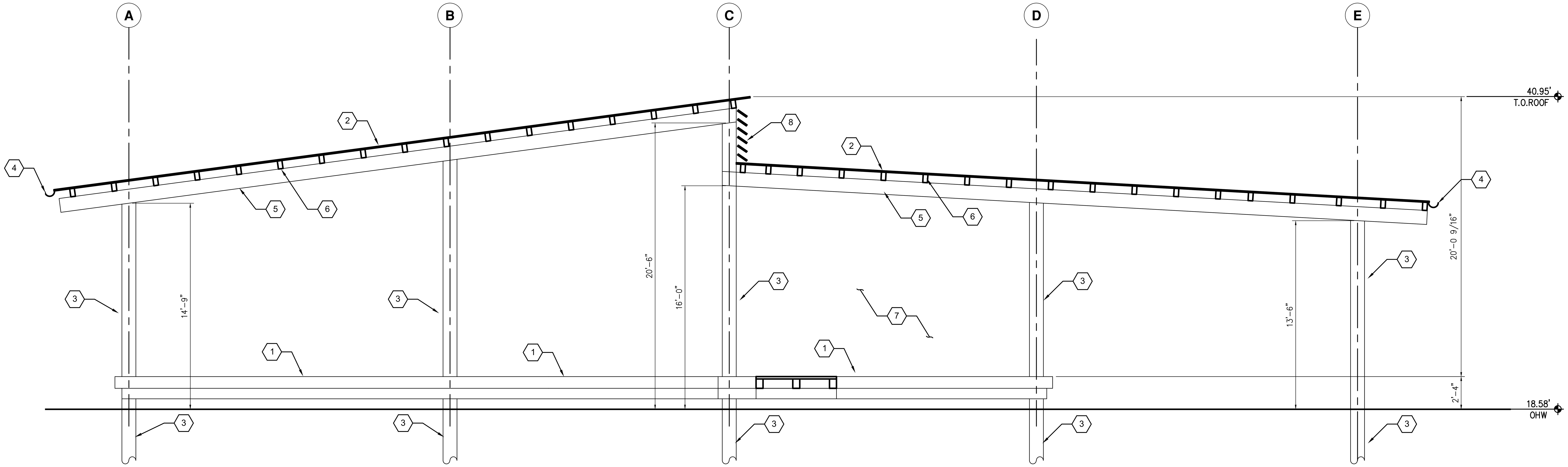
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. REMOVE EXISTING DECK
2. REMOVE EXISTING ROOF
3. REMOVE EXISTING SUBSTRUCTURE
4. REMOVE EXISTING GUTTER, TYPICAL
5. REMOVE EXISTING GIRDER, TYPICAL
6. REMOVE EXISTING PURLIN, TYPICAL
7. REMOVE EXISTING END WALLS BEYOND, TYPICAL
8. REMOVE EXISTING EDGE WALL



A DEMOLITION DOCK C TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

1/4"=1'-0"

D14.11

0 4 8 12

1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION DOCK C TYPICAL SECTION
(OPTION 1 ROOF REPLACEMENT)

SCALE 1/4"=1'-0"

DATE OCTOBER 2024

REVISION

DRAWING NO.

D14.31

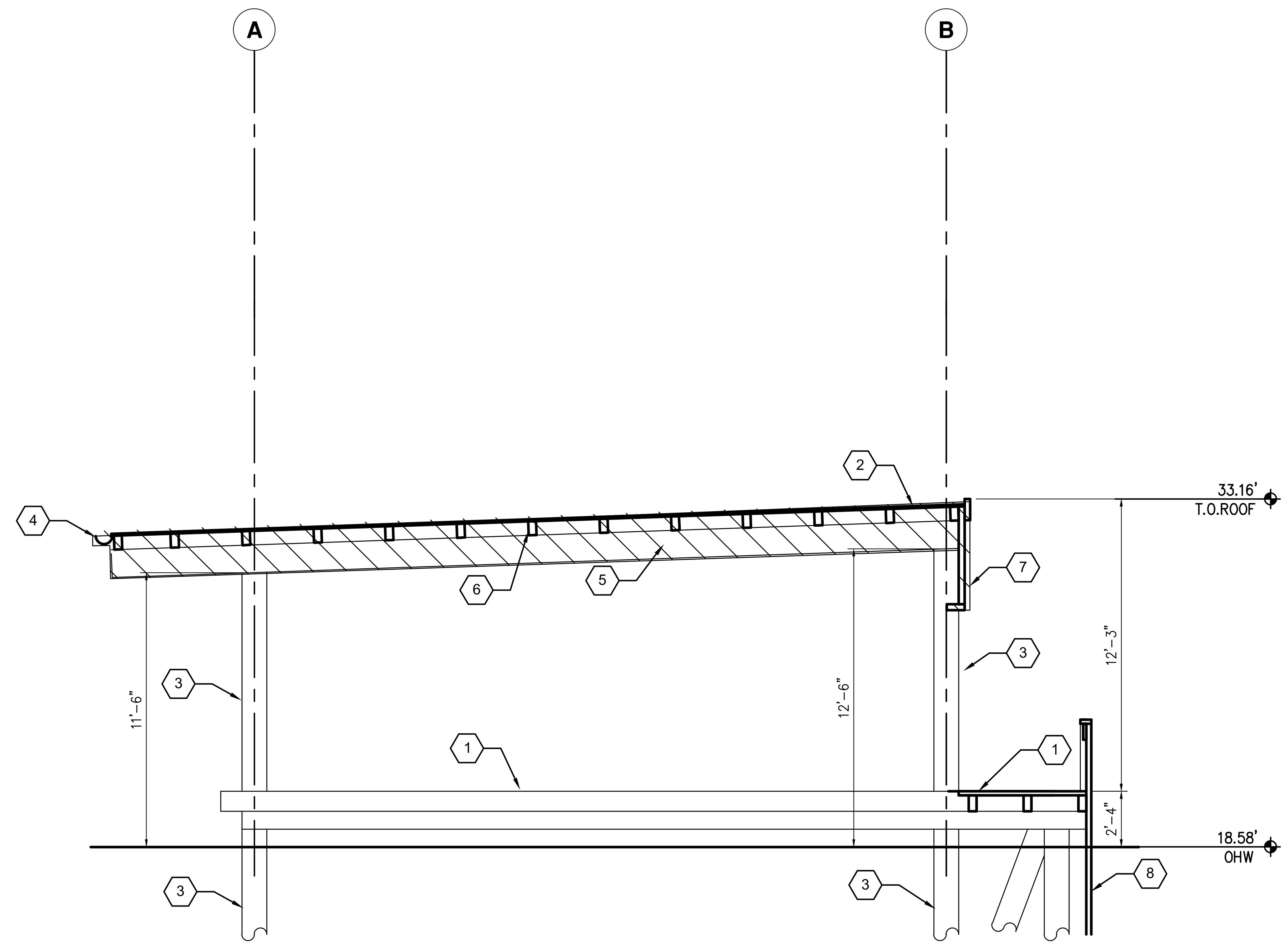
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. EXISTING DECK TO REMAIN
2. REMOVE EXISTING ROOF
3. EXISTING SUBSTRUCTURE TO REMAIN
4. REMOVE EXISTING GUTTER, TYPICAL
5. REMOVE EXISTING GIRDER, TYPICAL
6. REMOVE EXISTING PURLIN, TYPICAL
7. REMOVE EXISTING WEATHER CURTAIN
8. EXISTING EDGE WALL TO REMAIN



A DEMOLITION DOCK A TYPICAL SECTION (OPTION 2 ROOF REMOVAL)

1/4"=1'-0"

D22.11

LEGEND

EXTENT OF DEMOLITION

0 4 8 12

1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION DOCK A TYPICAL SECTION (OPTION 2 ROOF REMOVAL)

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. D22.31

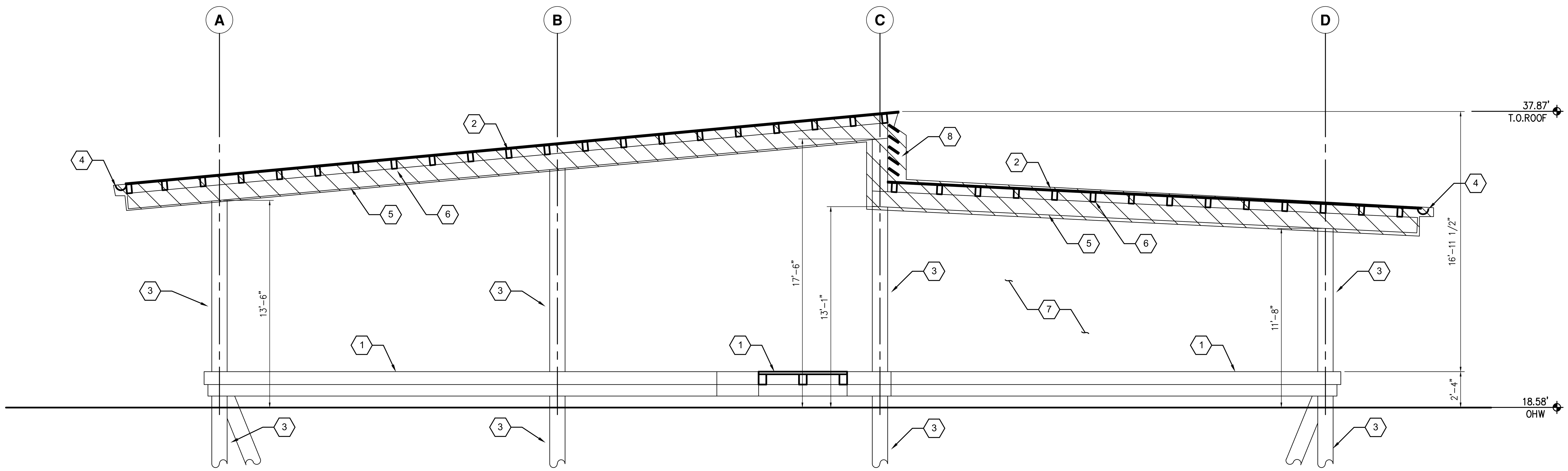
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. EXISTING DECK TO REMAIN
2. REMOVE EXISTING ROOF
3. EXISTING SUBSTRUCTURE TO REMAIN
4. REMOVE EXISTING GUTTER, TYPICAL
5. REMOVE EXISTING GIRDER, TYPICAL
6. REMOVE EXISTING PURLIN, TYPICAL
7. REMOVE EXISTING END WALLS BEYOND, TYPICAL
8. REMOVE EXISTING LOUVERS AND FRAMES



A DEMOLITION DOCK B TYPICAL SECTION (OPTION 2 ROOF REMOVAL)
1/4"=1'-0"
D23.11

LEGEND

EXTENT OF DEMOLITION

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION DOCK B TYPICAL SECTION (OPTION 2 ROOF REMOVAL)

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. D23.31

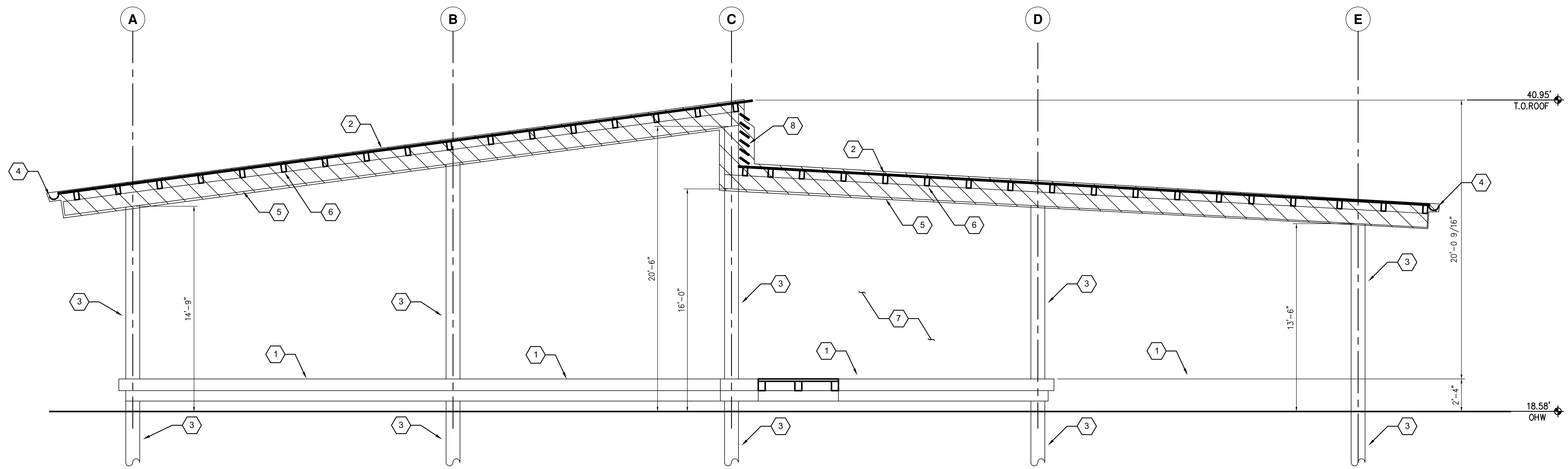
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. THE BACKGROUND DRAWING IS BASED ON THE 1960 COVERED MOORAGE PERMIT DRAWING SET AND MAY NOT REFLECT THE CURRENT SITE MEASUREMENTS.
2. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. REMOVE EXISTING DECK
2. REMOVE EXISTING ROOF
3. REMOVE EXISTING SUBSTRUCTURE
4. REMOVE EXISTING GUTTER, TYPICAL
5. REMOVE EXISTING GIRDER, TYPICAL
6. REMOVE EXISTING PURLIN, TYPICAL
7. REMOVE EXISTING END WALLS BEYOND, TYPICAL
8. REMOVE EXISTING EDGE WALL



A DEMOLITION DOCK C TYPICAL SECTION (OPTION 2 ROOF REMOVAL

1/4"=1'-0"

D24.11

LEGEND

EXTENT OF DEMOLITION

0 4 8 12

1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION DOCK C TYPICAL SECTION (OPTION 2 ROOF REMOVAL)

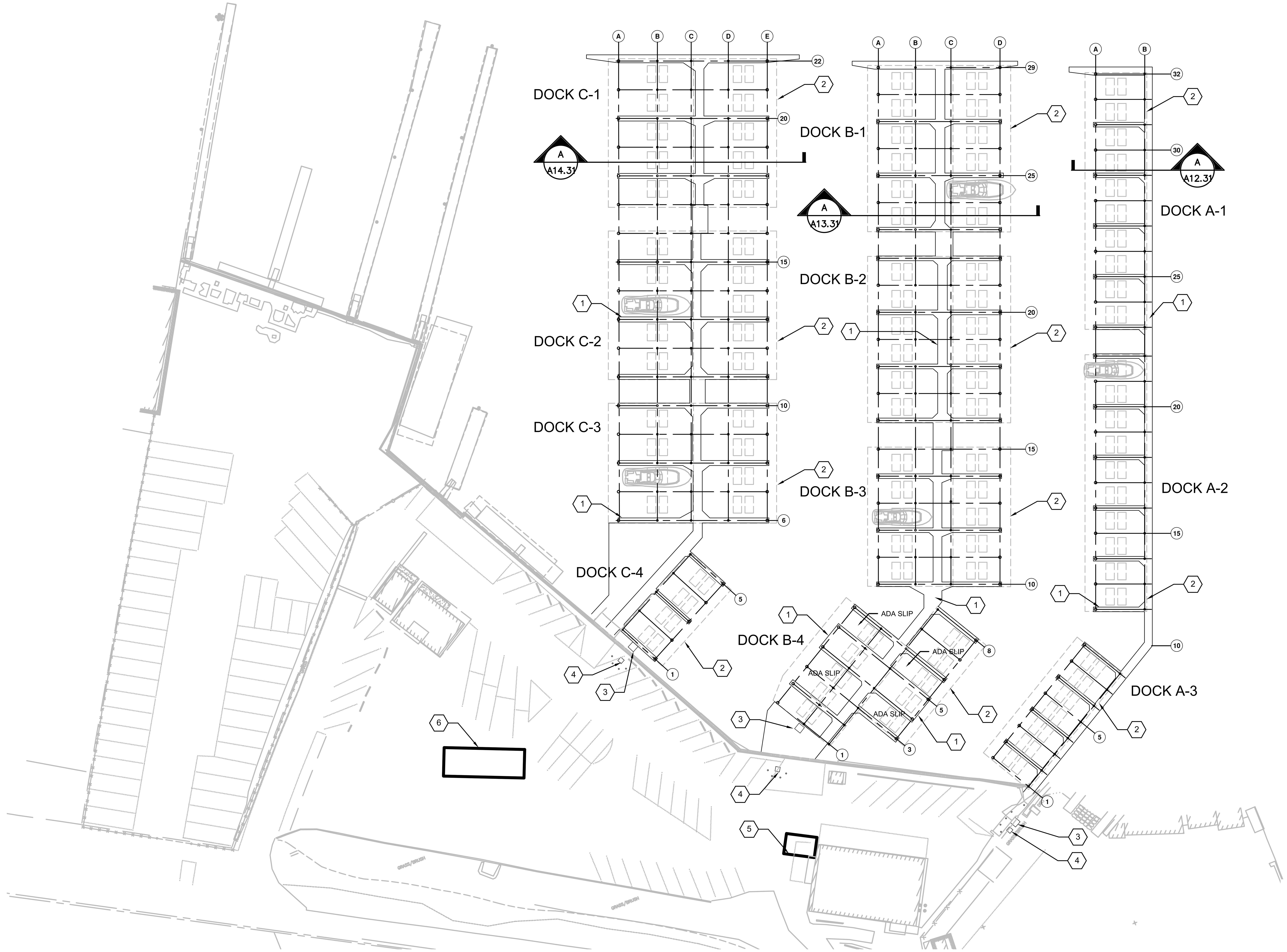
SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION

DRAWING NO.
D24.31

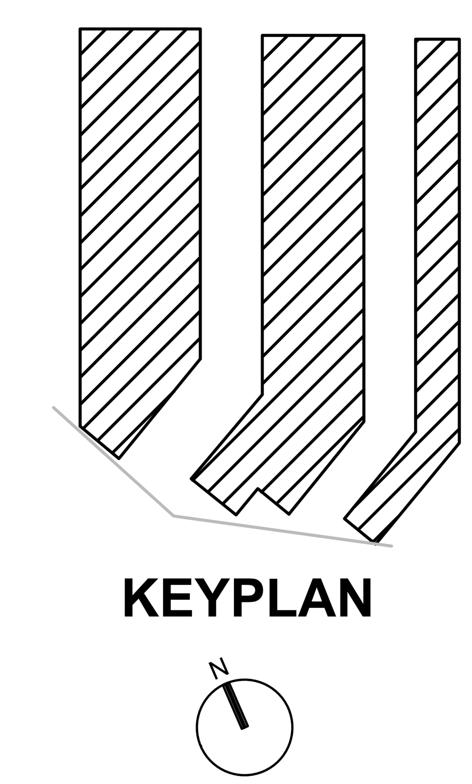
CONCEPT DESIGN SUBMITTAL

SHEET KEYNOTES

1. NEW DECK
2. OUTLINE OF THE NEW ROOF ABOVE
3. PROPOSED ELECTRICAL TRANSFORMER LOCATION
4. PROPOSED SHOREPOWER DISCONNECT
5. NEW PUMP ROOM
6. NEW BUILDING FOR HOUSING ELECTRICAL EQUIPMENT



OVERALL DOCK PLAN (OPTION 1 ROOF REPLACEMENT)
1/32" = 1'-0"



KEYPLAN

0 32 64 96
1"= 32'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

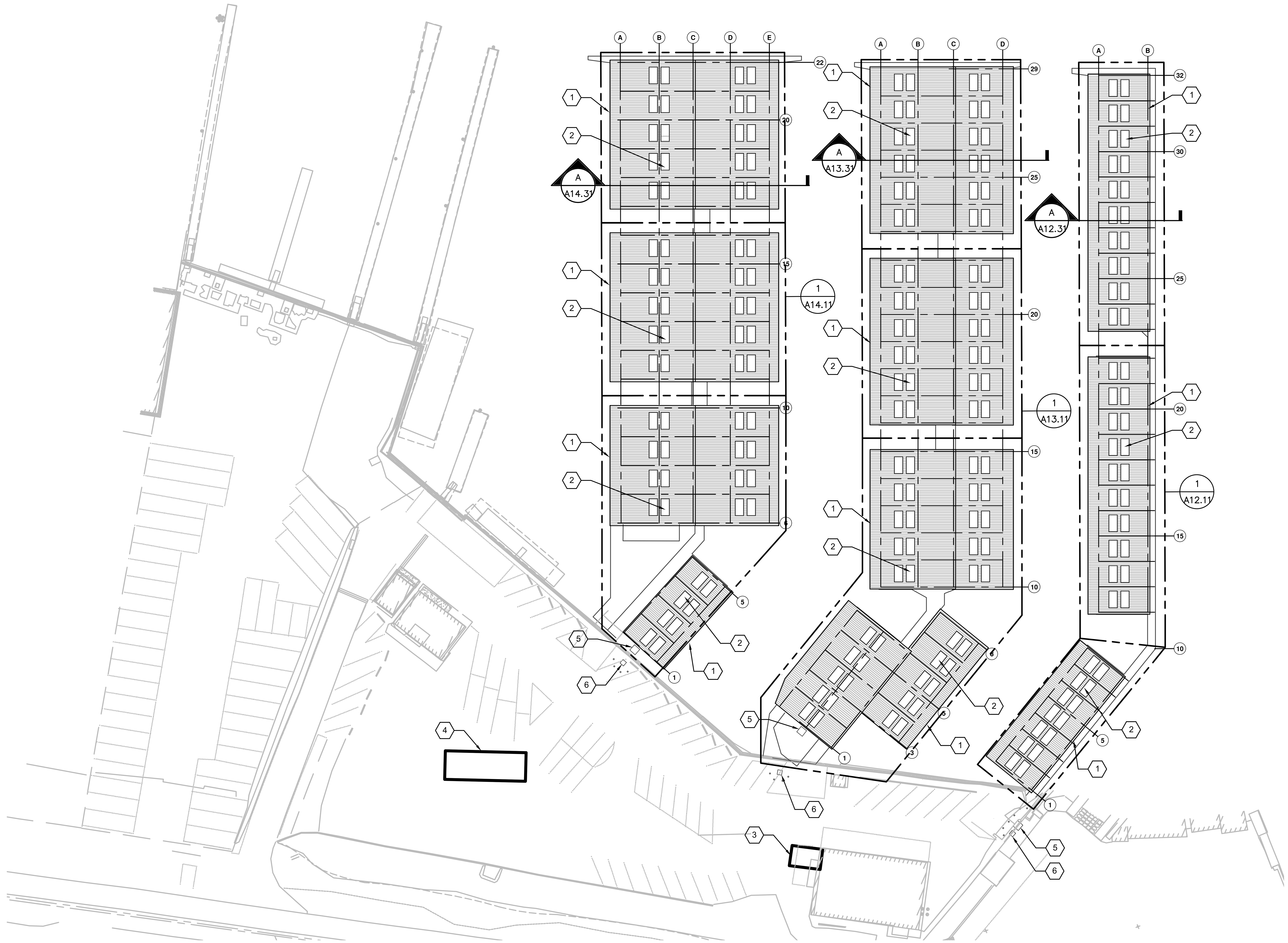
SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1/32"=1'-0"	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A-C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	OVERALL DOCK PLAN (OPTION 1 ROOF REPLACEMENT)	A11.11	

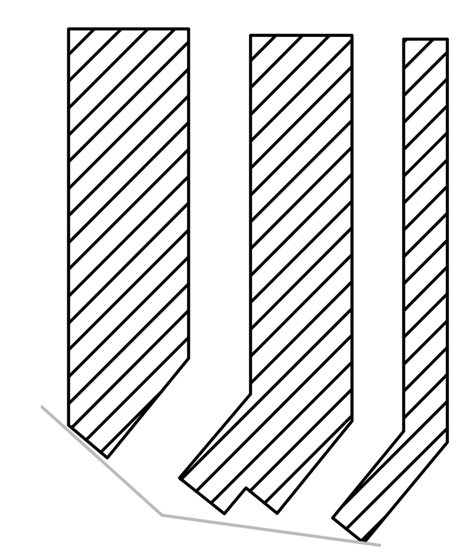
CONCEPT DESIGN SUBMITTAL

SHEET KEYNOTES

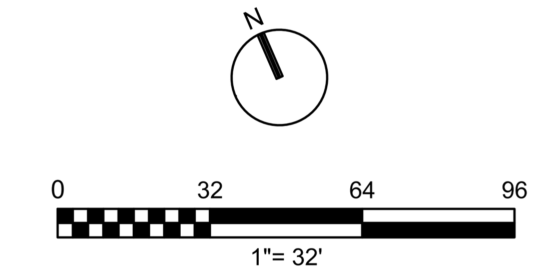
1. NEW STANDING SEAM METAL ROOF
2. NEW SKYLIGHT LOCATION
3. NEW PUMP ROOM
4. NEW BUILDING FOR HOUSING ELECTRICAL EQUIPMENT
5. PROPOSED ELECTRICAL TRANSFORMER LOCATION
6. PROPOSED SHOREPOWER DISCONNECT



OVERALL ROOF PLAN (OPTION 1 ROOF REPLACEMENT)
1/32" = 1'-0"



KEYPLAN



GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A-C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

OVERALL ROOF PLAN
(OPTION 1 ROOF REPLACEMENT)

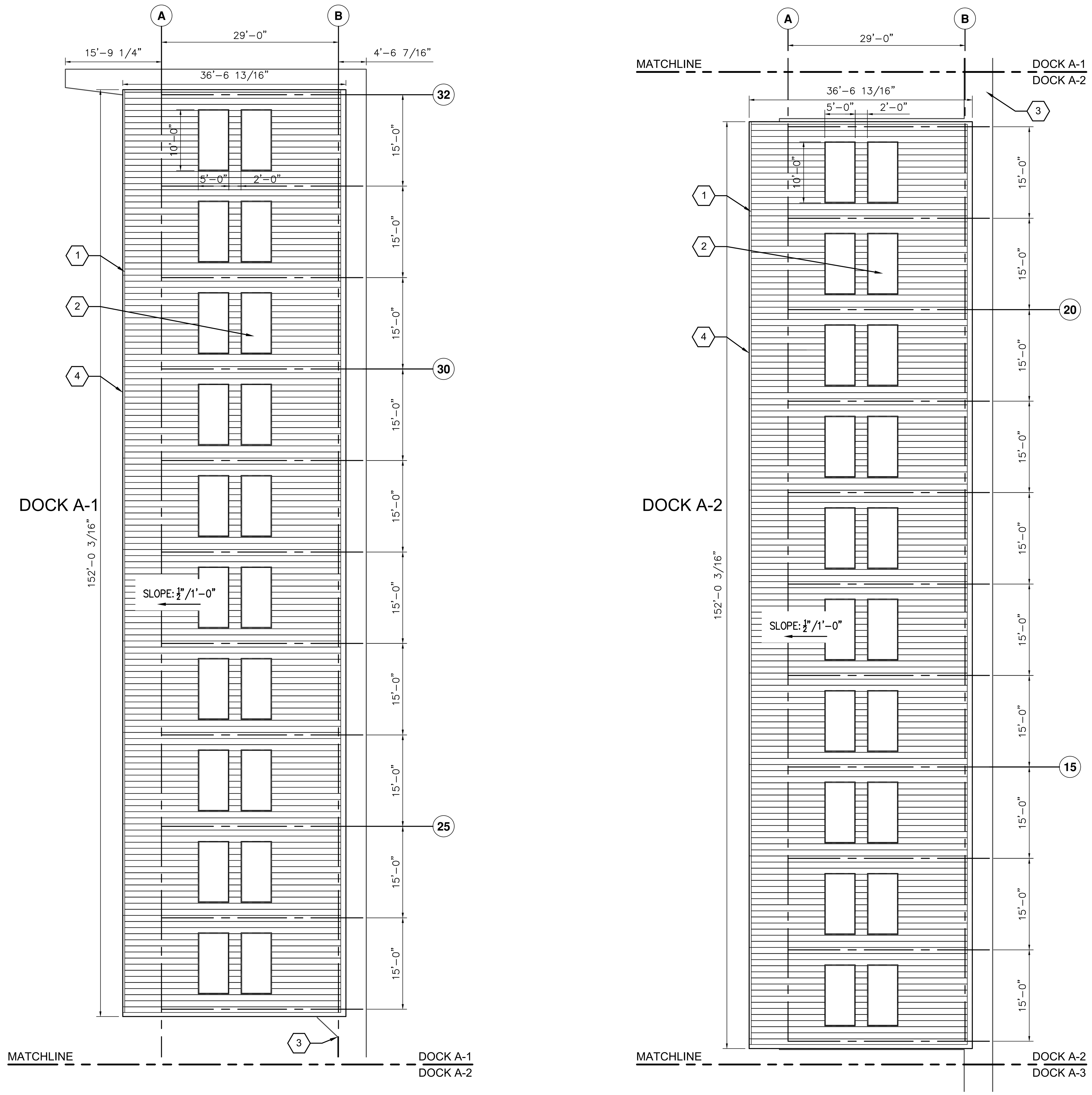
SCALE 1/32"=1'-0"
DATE OCTOBER 2024
REVISION

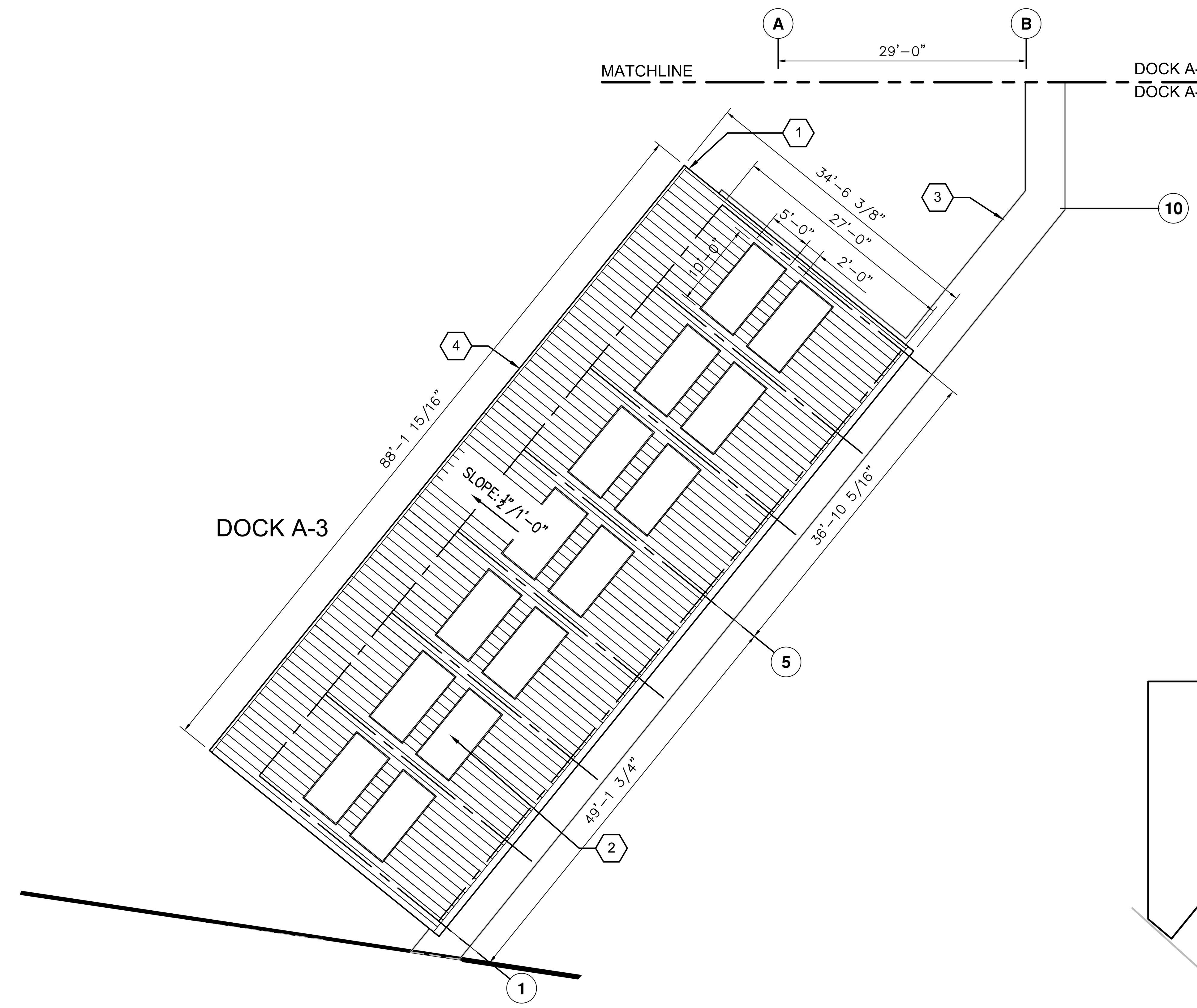
DRAWING NO.
A11.12

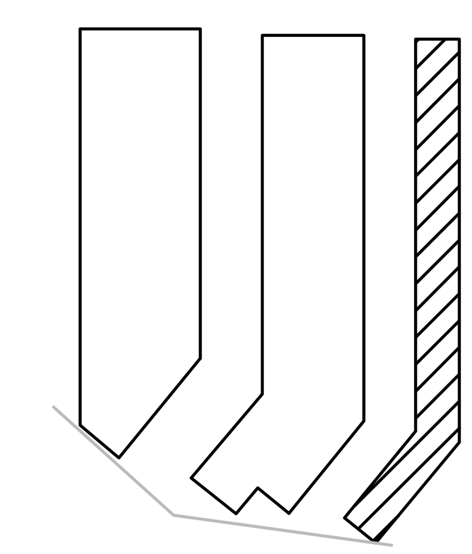
CONCEPT DESIGN SUBMITTAL

SHEET KEYNOTES

1. NEW STANDING METAL SEAM ROOF
2. NEW SKYLIGHT
3. NEW DECK
4. GUTTER







KEYPLAN

0 12 24 36

3/32" = 1'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

ENLARGED DOCK A ROOF PLAN (OPTION 1 ROOF REPLACEMENT)

3/32" = 1'-0"

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1" = 12'	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A-C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	ENLARGED DOCK A ROOF PLAN (OPTION 1 ROOF REPLACEMENT)	A12.11	

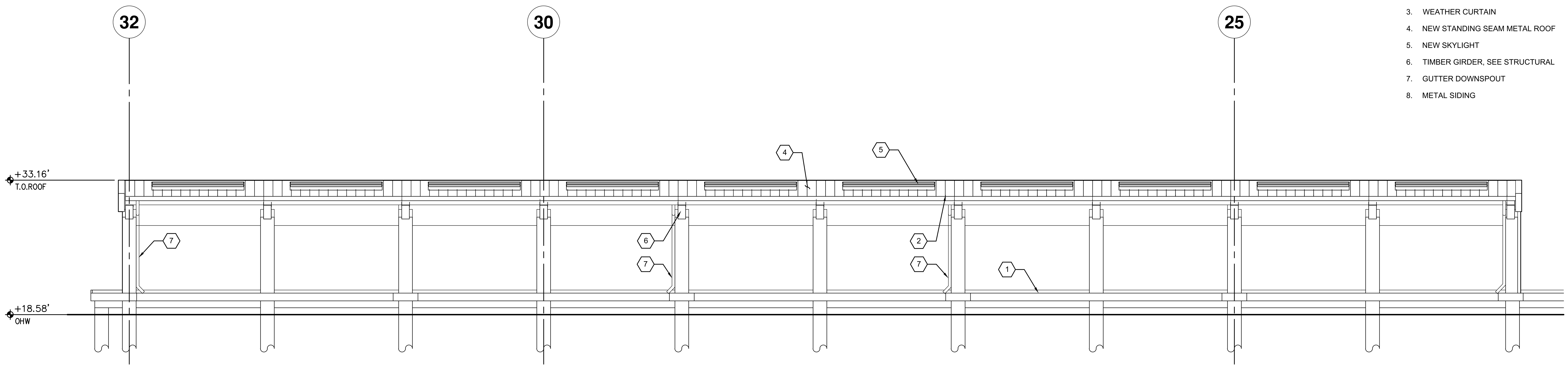
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

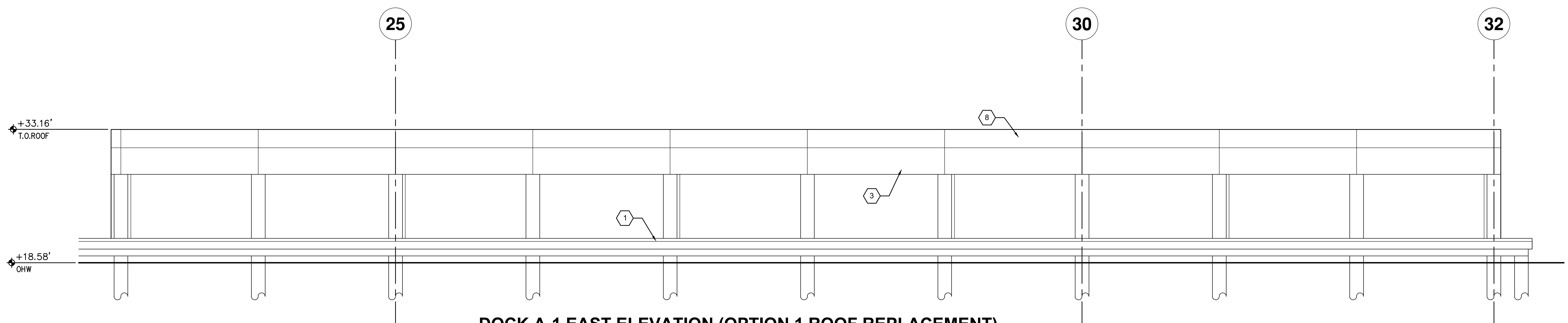
1. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. NEW DECK
2. GUTTER, TYPICAL
3. WEATHER CURTAIN
4. NEW STANDING SEAM METAL ROOF
5. NEW SKYLIGHT
6. TIMBER GIRDER, SEE STRUCTURAL
7. GUTTER DOWNSPOUT
8. METAL SIDING



DOCK A-1 WEST ELEVATION (OPTION 1 ROOF REPLACEMENT)
3/16" = 1'-0"



DOCK A-1 EAST ELEVATION (OPTION 1 ROOF REPLACEMENT)
3/16" = 1'-0"

0 6 12 18
1"= 6'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK A ELEVATIONS
(OPTION 1 ROOF REPLACEMENT)

SCALE 3/16"=1'-0"
DATE OCTOBER 2024
REVISION

DRAWING NO.
A12.21

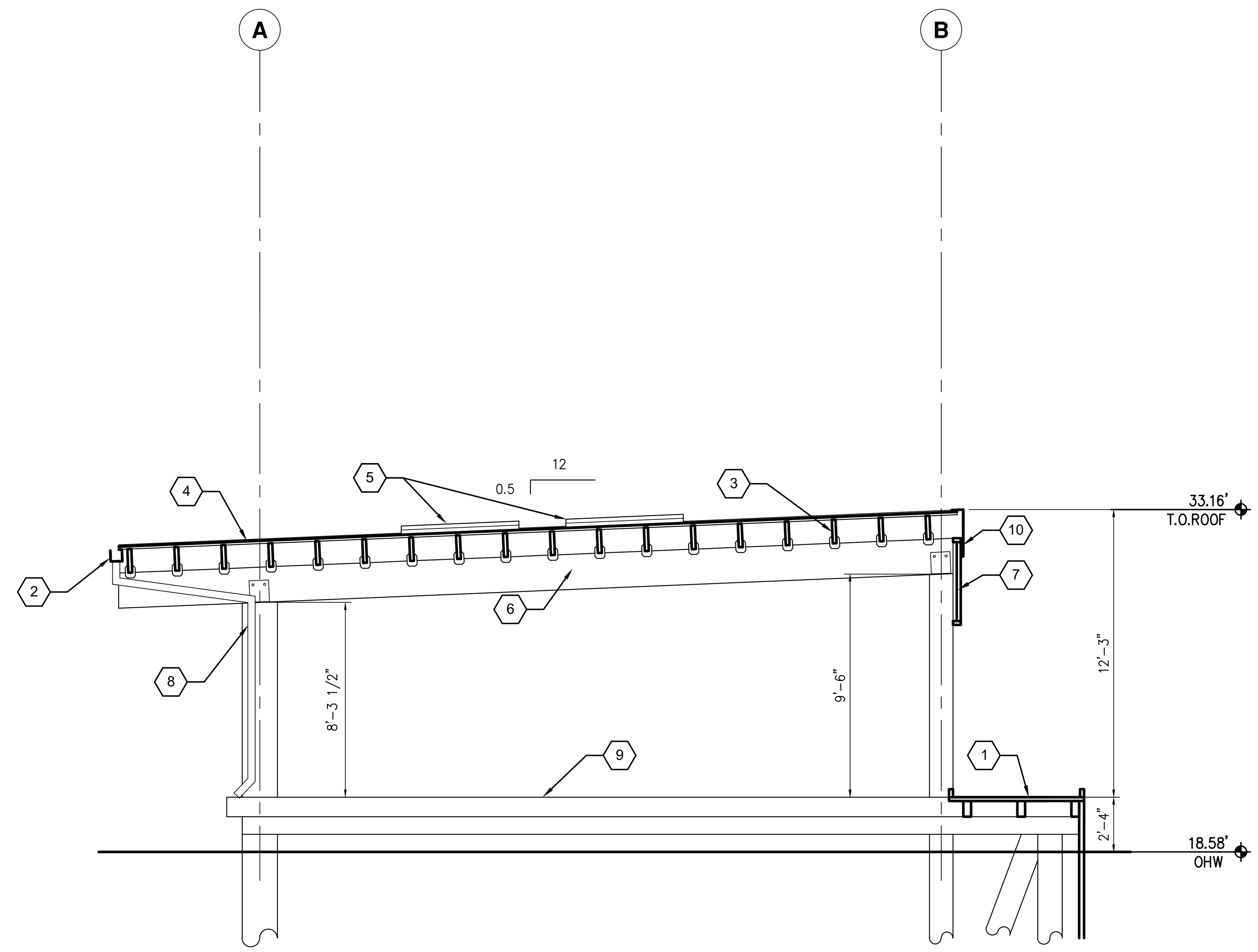
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. VERTICAL DATUM IS BASED ON NAVD 88

SHEET KEYNOTES

1. NEW DECK
2. GUTTER, TYPICAL
3. TIMBER PURLIN, SEE STRUCTURAL
4. NEW STANDING SEAM METAL ROOF
5. NEW SKYLIGHT
6. TIMBER GIRDER, SEE STRUCTURAL
7. WEATHER CURTAIN
8. GUTTER DOWNSPOUT
9. NEW DECK BEYOND
10. METAL SIDING



DOCK A TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)
1/4" = 1'-0"

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A-C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

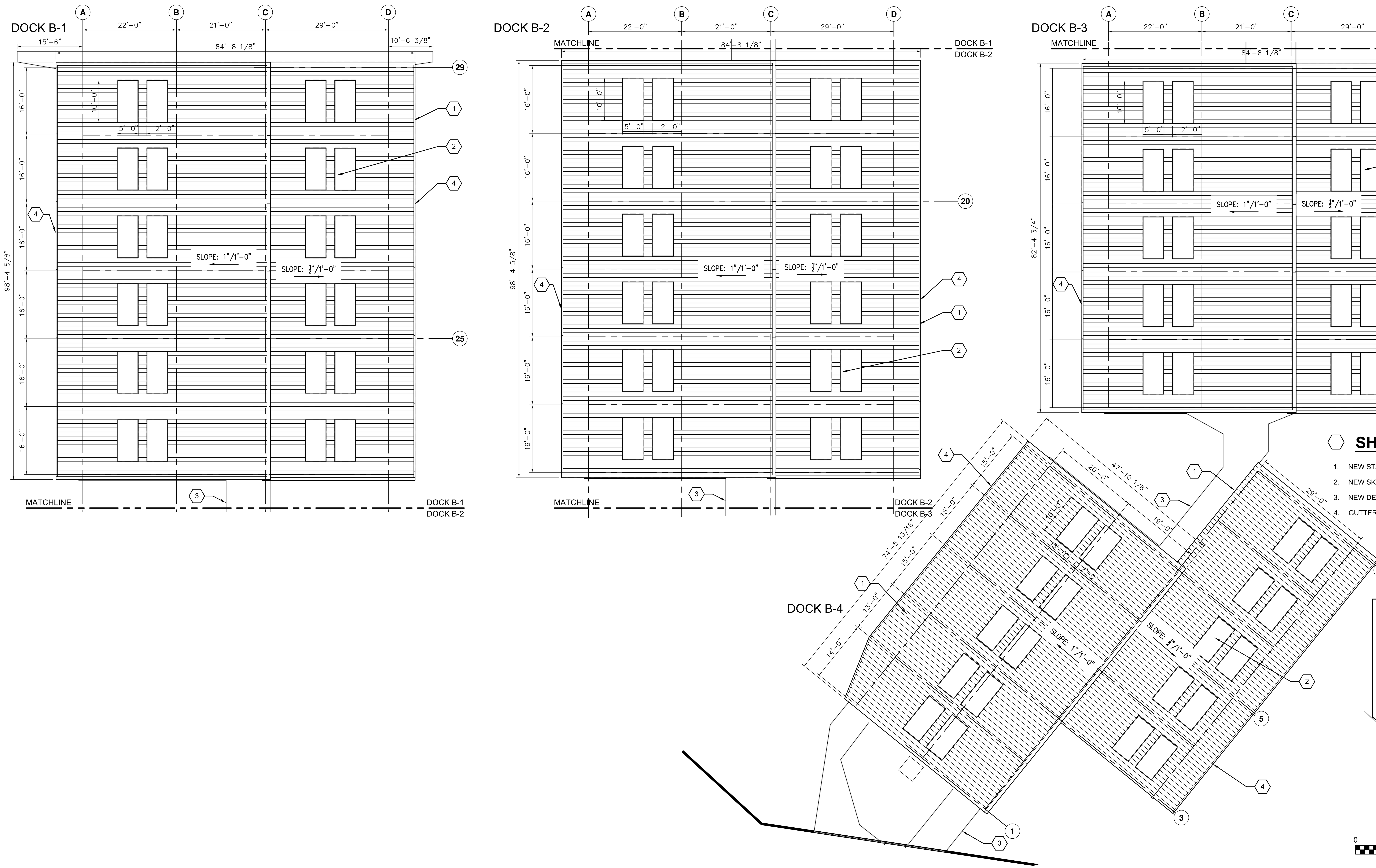
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

DOCK A TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

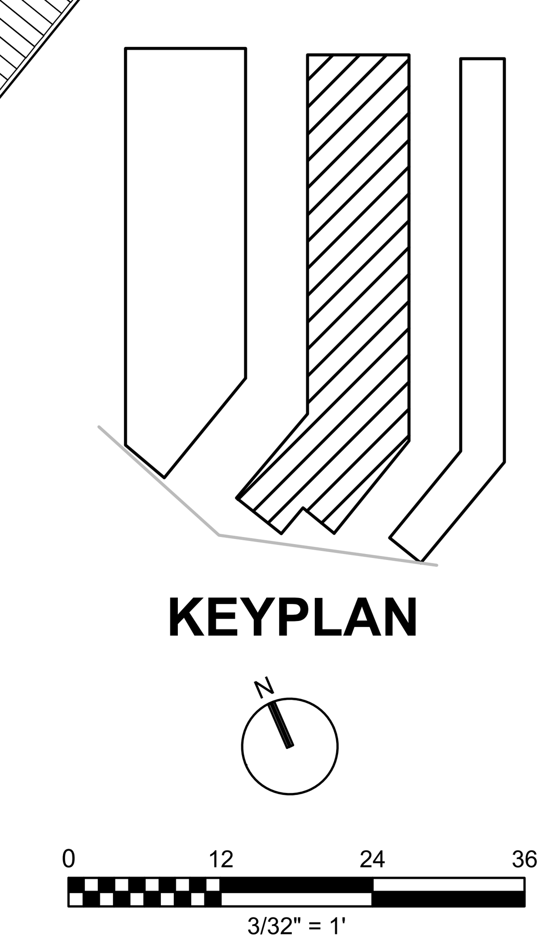
SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. A12.31

CONCEPT DESIGN SUBMITTAL



SHEET KEYNOTES

1. NEW STANDING SEAM METAL ROOF
2. NEW SKYLIGHT
3. NEW DECK
4. GUTTER



GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

ENLARGED DOCK B ROOF PLAN (OPTION 1 ROOF REPLACEMENT)

3/32" = 1'-0"

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

ENLARGED DOCK B PLAN
(OPTION 1 ROOF REPLACEMENT)

SCALE 1" = 12'
DATE OCTOBER 2024
REVISION

DRAWING NO.
A13.11

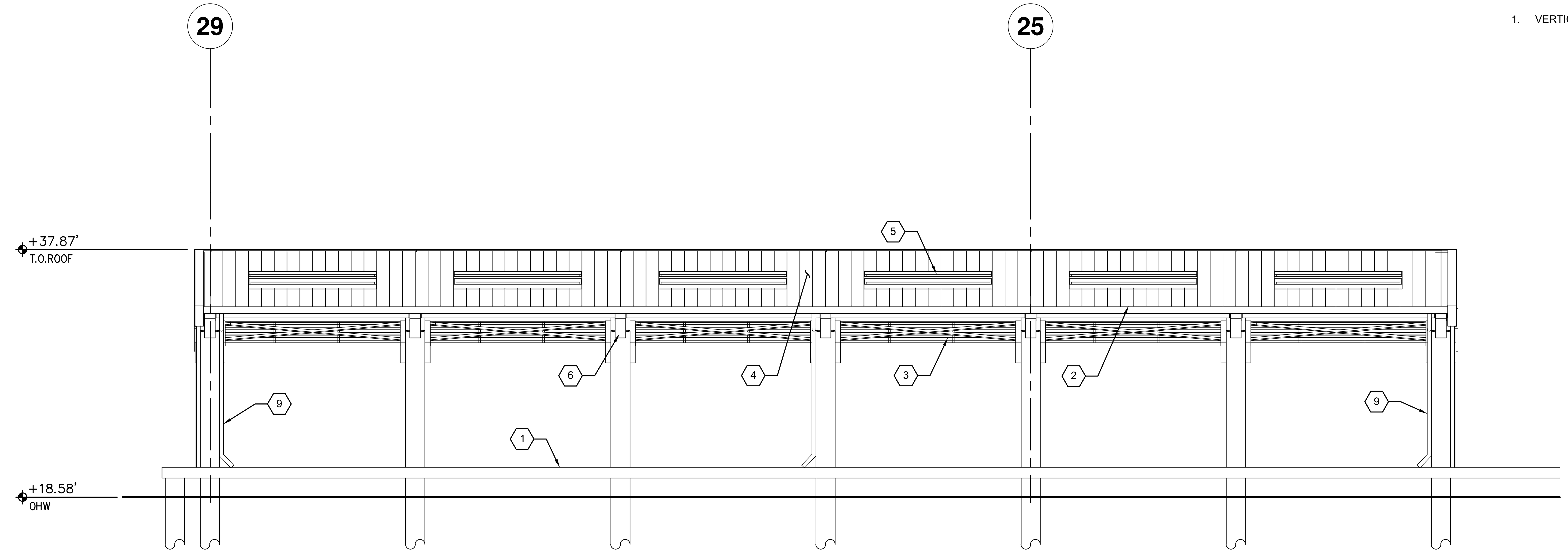
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

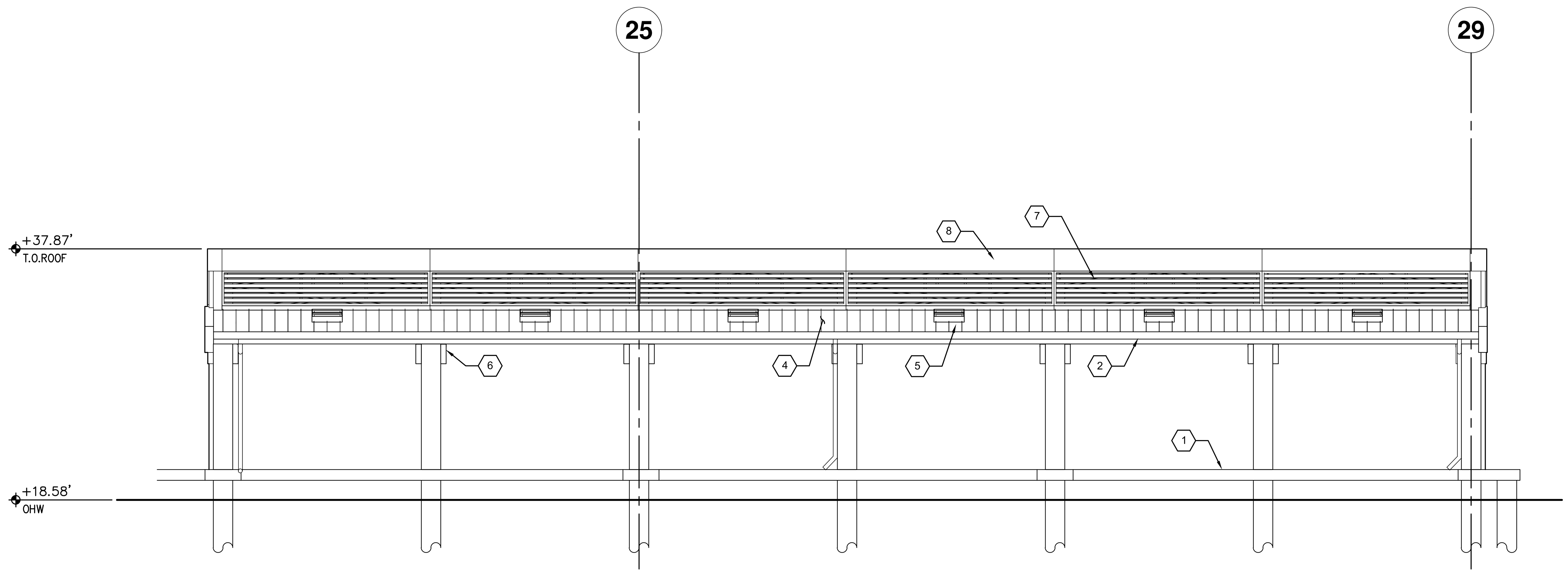
1. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. NEW DECK
2. GUTTER, TYPICAL
3. FLAT DIAGONAL TIMBER BRACING, SEE STRUCTURAL
4. NEW STANDING SEAM METAL ROOF
5. NEW SKYLIGHT
6. TIMBER GIRDER, SEE STRUCTURAL
7. ALUMINUM LOUVER
8. METAL SIDING
9. GUTTER DOWNSPOUT, TYPICAL



DOCK B-1 WEST ELEVATION (OPTION 1 ROOF REPLACEMENT)
3/16" = 1'–0"



DOCK B-1 EAST ELEVATION (OPTION 1 ROOF REPLACEMENT)
3/16" = 1'–0"

0 6 12 18
1"= 6'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY
DOCK B ELEVATIONS
(OPTION 1 ROOF REPLACEMENT)

SCALE 3/16"=1'–0"
DATE OCTOBER 2024
REVISION

DRAWING NO.
A13.21

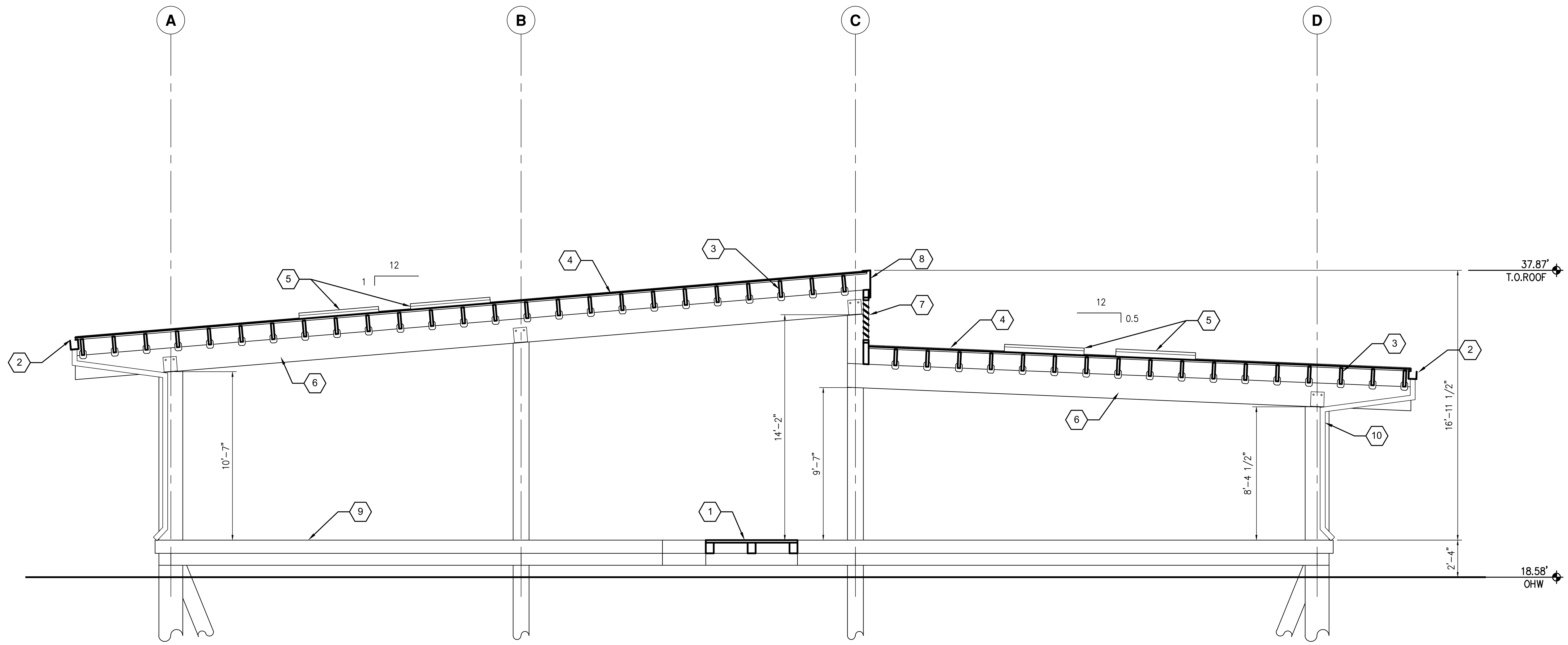
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

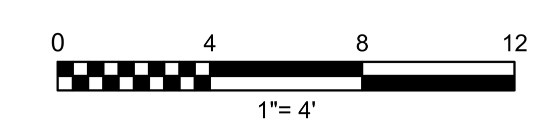
1. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. NEW DECK
2. GUTTER, TYPICAL
3. TIMBER PURLIN, SEE STRUCTURAL
4. NEW STANDING SEAM METAL ROOF
5. NEW SKYLIGHT
6. TIMBER GIRDER, SEE STRUCTURAL
7. ALUMINUM LOUVER
8. METAL SIDING
9. NEW DECK BEYOND
10. GUTTER DOWNSPOUT, TYPICAL



DOCK B TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)
1/4" = 1'-0"



GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1/4"=1'-0"	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	DOCK B TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)	A13.31	

CONCEPT DESIGN SUBMITTAL

SHEET KEYNOTES

1. NEW STANDING METAL SEAM ROOF
2. NEW SKYLIGHT
3. NEW DECK
4. GUTTER

ENLARGED DOCK C ROOF PLAN (OPTION 1 ROOF REPLACEMENT)

3/32" = 1'-0"

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1" = 12'	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	ENLARGED DOCK C PLAN (OPTION 1 ROOF REPLACEMENT)	A14.11	

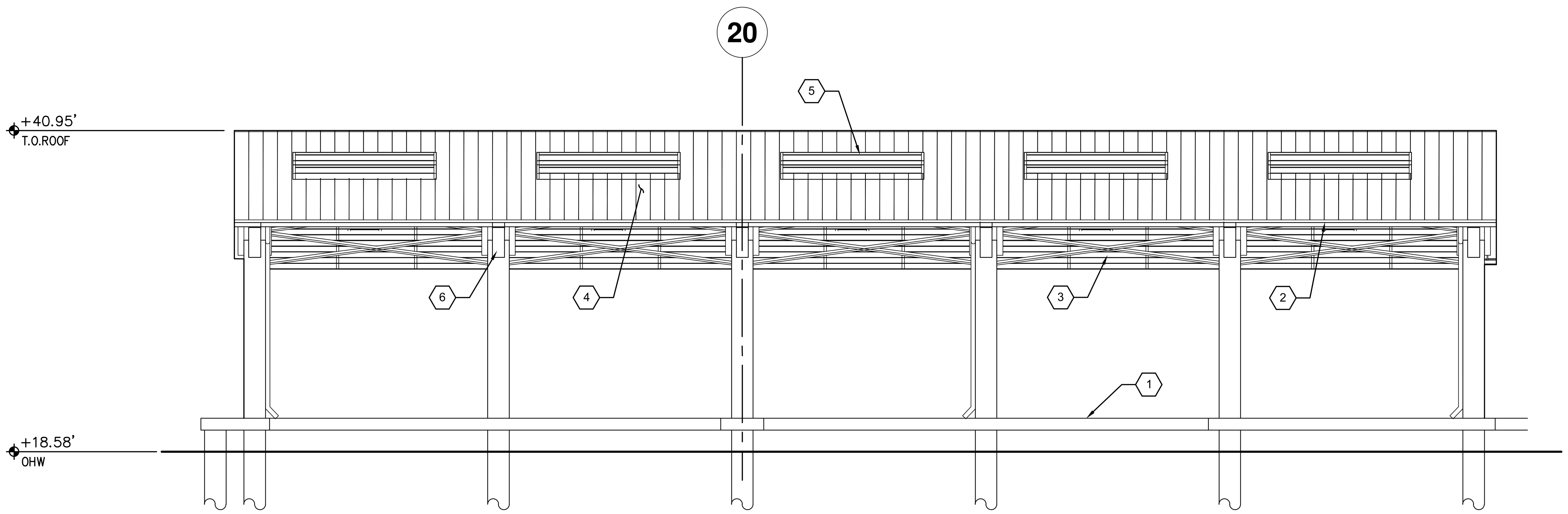
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

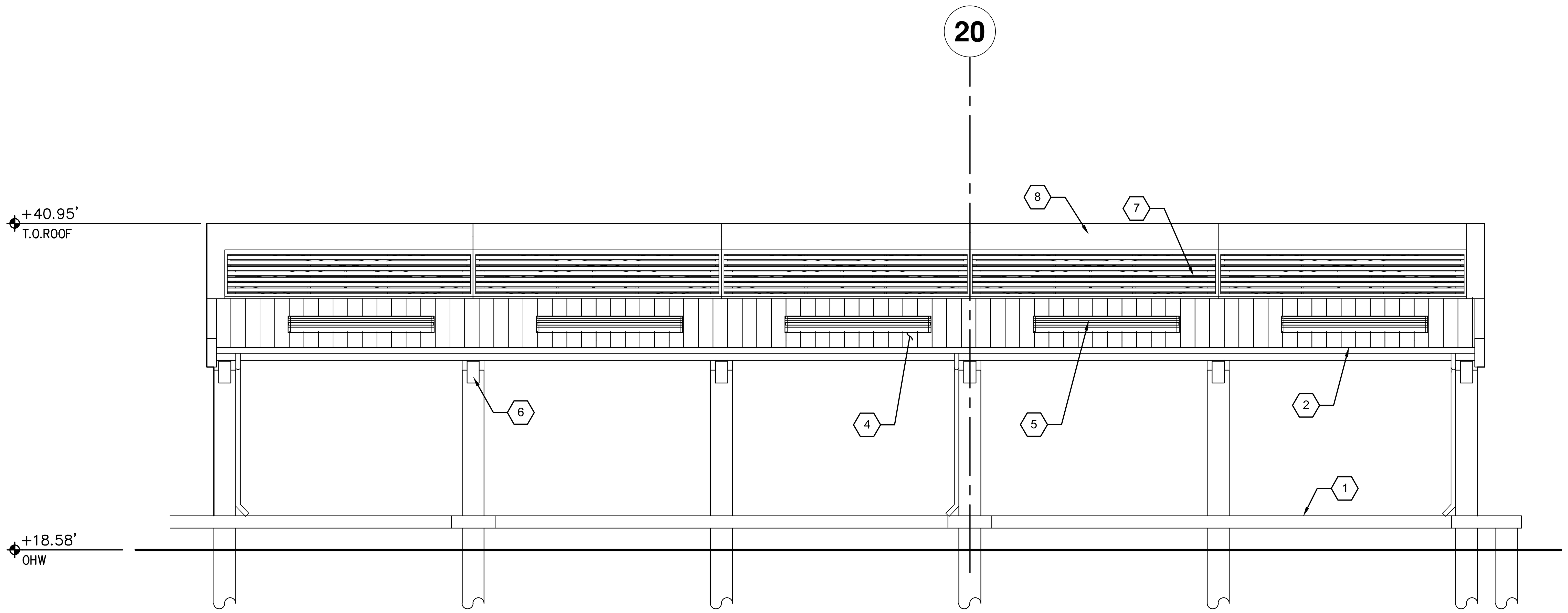
1. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. NEW DECK
2. GUTTER, TYPICAL
3. FLAT DIAGONAL TIMBER BRACING, SEE STRUCTURAL
4. NEW STANDING SEAM METAL ROOF
5. NEW SKYLIGHT
6. TIMBER GIRDER, SEE STRUCTURAL
7. ALUMINUM LOUVER
8. METAL SIDING



DOCK C-1 WEST ELEVATION (OPTION 1 ROOF REPLACEMENT)
3/16" = 1'-0"



DOCK C-1 EAST ELEVATION (OPTION 1 ROOF REPLACEMENT)
3/16" = 1'-0"

0 8 16 24
1"= 8'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK C ELEVATIONS
(OPTION 1 ROOF REPLACEMENT)

SCALE 3/16"=1'-0"
DATE OCTOBER 2024
REVISION

DRAWING NO.
A14.21

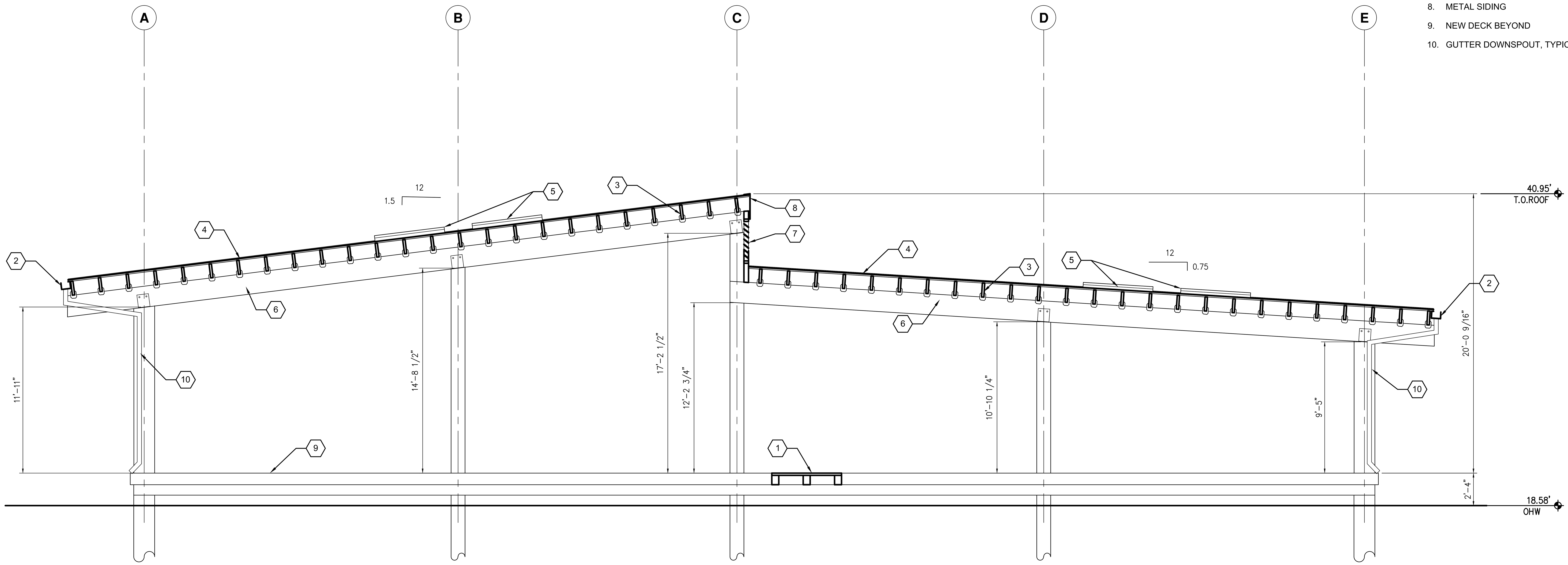
CONCEPT DESIGN SUBMITTAL

GENERAL NOTES:

1. VERTICAL DATUM IS BASED ON NAVD 88.

SHEET KEYNOTES

1. NEW DECK
2. GUTTER, TYPICAL
3. TIMBER PURLIN, SEE STRUCTURAL
4. NEW STANDING SEAM METAL ROOF
5. NEW SKYLIGHT
6. TIMBER GIRDER, SEE STRUCTURAL
7. ALUMINUM LOUVER
8. METAL SIDING
9. NEW DECK BEYOND
10. GUTTER DOWNSPOUT, TYPICAL



DOCK C TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)
1/4" = 1'-0"

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A-C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

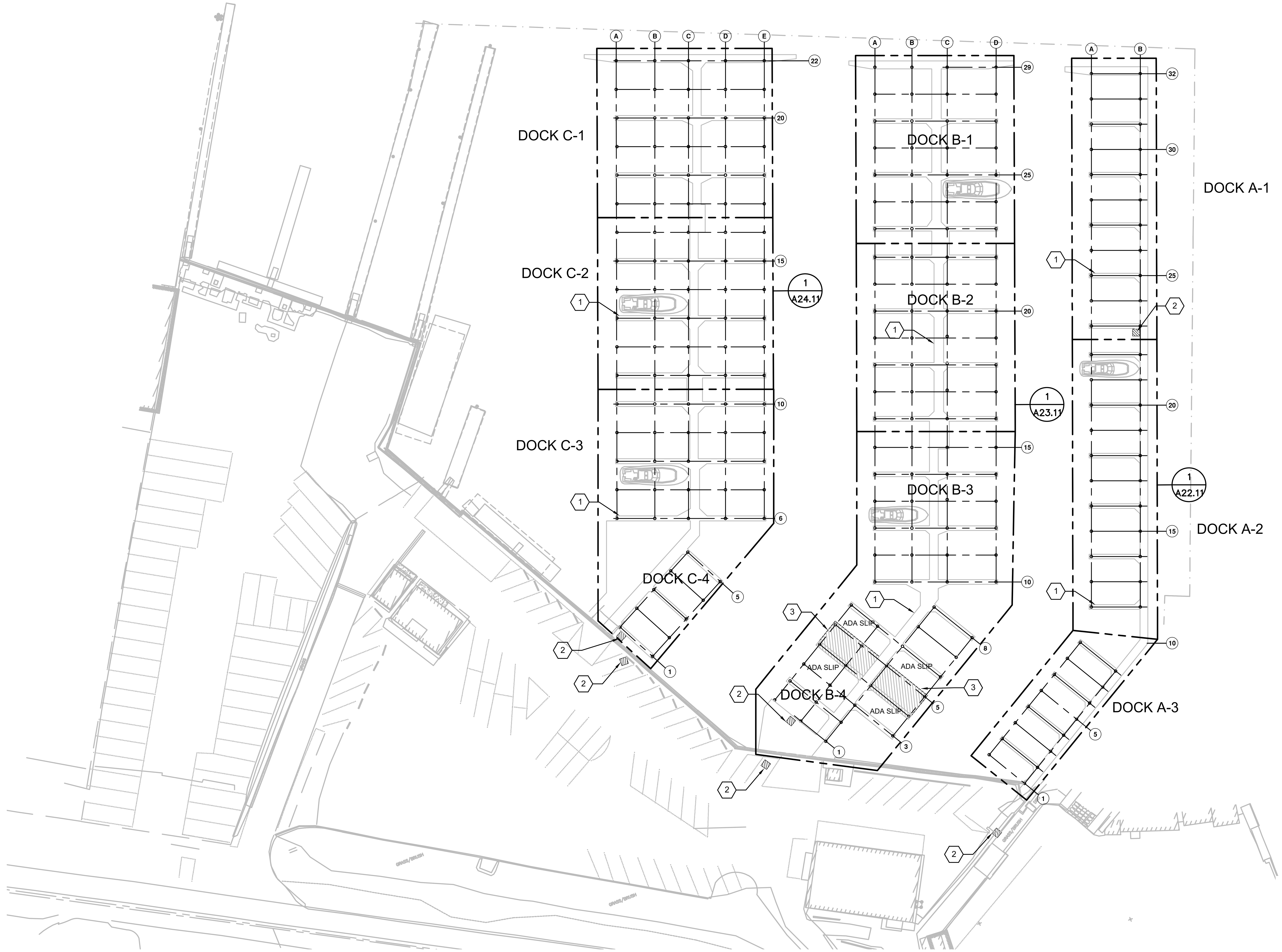
DOCK C TYPICAL SECTION
(OPTION 1 ROOF REPLACEMENT)

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. A14.31

CONCEPT DESIGN SUBMITTAL

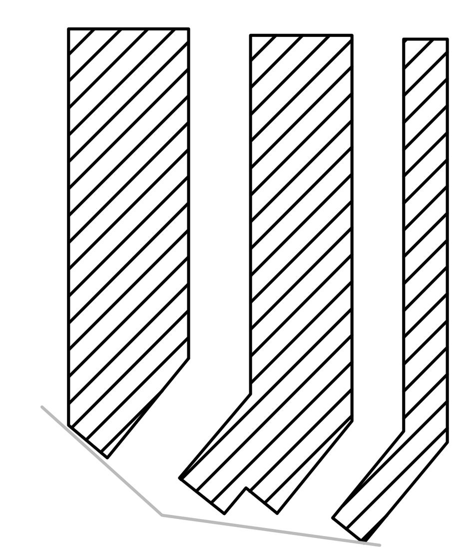
SHEET KEYNOTES

1. EXISTING DECK
2. PROPOSED ELECTRICAL TRANSFORMER LOCATION
3. NEW DECK



OVERALL DOCK PLAN (OPTION 2 ROOF REMOVAL)

1/32" = 1'-0"



KEYPLAN

0 32 64 96
1"= 32'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

OVERALL DOCK PLAN
(OPTION 2 ROOF REMOVAL)

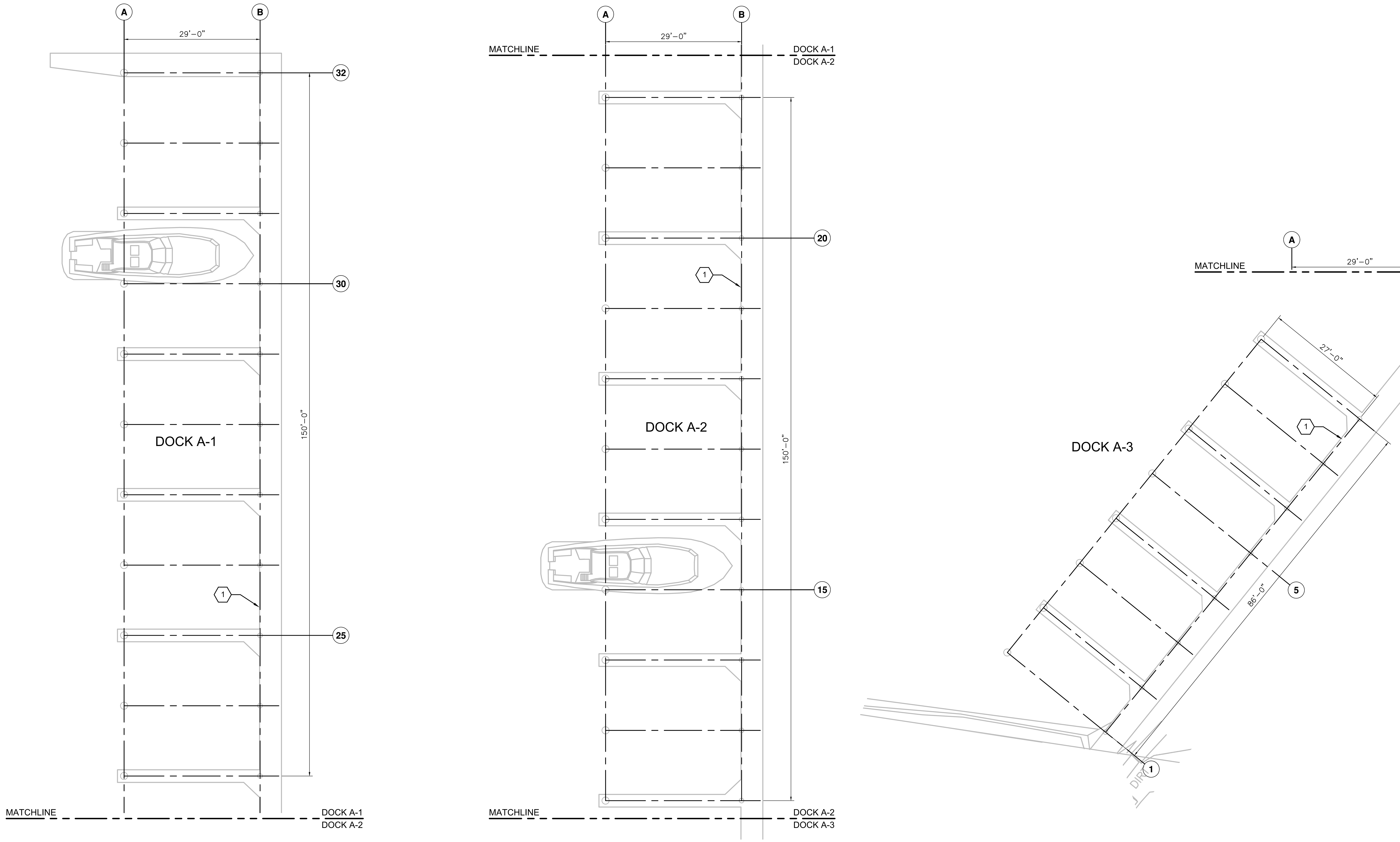
SCALE 1/32"=1'-0"
DATE OCTOBER 2024
REVISION

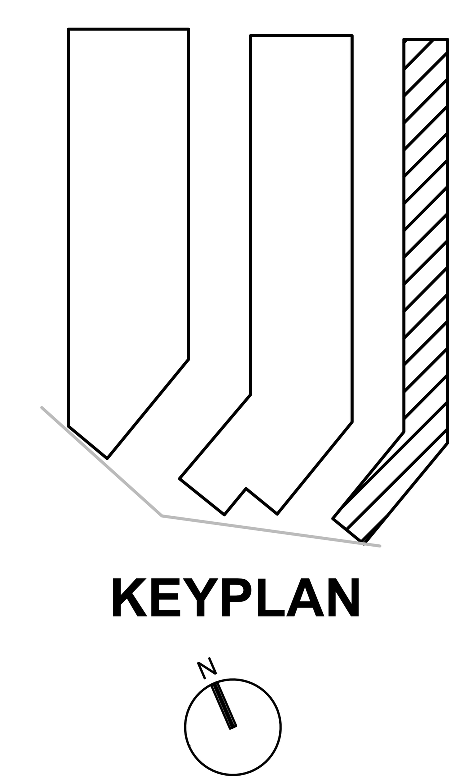
DRAWING NO.
A21.11

CONCEPT DESIGN SUBMITTAL

SHEET KEYNOTES

1. EXISTING DECK





KEYPLAN

0 12 24 36

3/32" = 1'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

ENLARGED DOCK A PLAN (OPTION 2 ROOF REMOVAL)

3/32" = 1'-0"

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI
DRAWN BY R. CATHERS
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

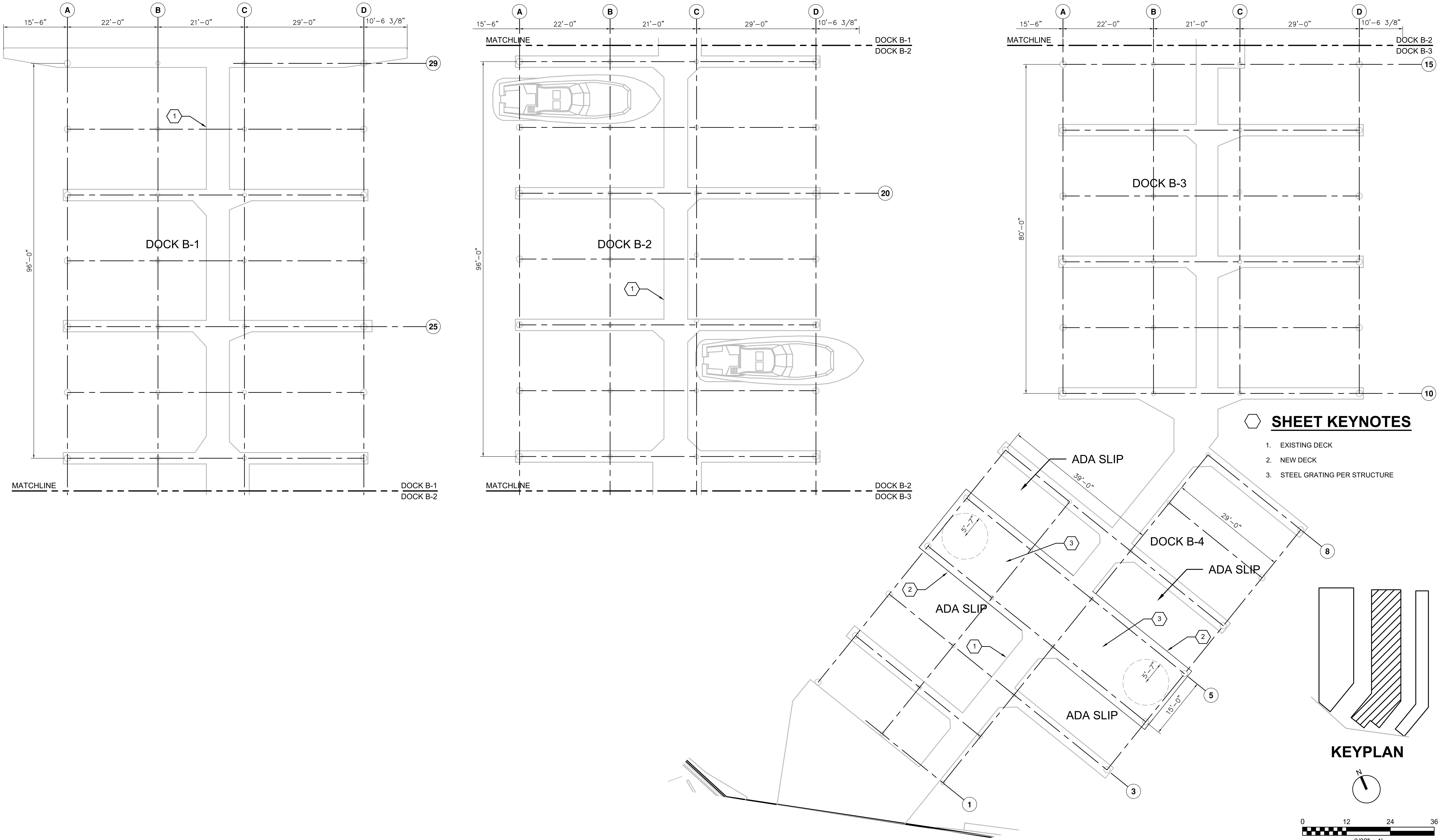
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

ENLARGED DOCK A PLAN
(OPTION 2 ROOF REMOVAL)

SCALE 1" = 12'
DATE OCTOBER 2024
REVISION
DRAWING NO. A22.11

CONCEPT DESIGN SUBMITTAL



SHEET KEYNOTES

1. EXISTING DECK
2. NEW DECK
3. STEEL GRATING PER STRUCTURE

KEYPLAN

N

0 12 24 36

3/32" = 1'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

ENLARGED DOCK B PLAN (OPTION 2 ROOF REMOVAL)

3/32" = 1'–0"

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY A. LOTFI	PORT OF SEATTLE MARINE FACILITIES	SCALE 1" = 12'	REVISION
DRAWN BY R. CATHERS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY J. DELUCA	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	ENLARGED DOCK B PLAN (OPTION 2 ROOF REMOVAL)	A23.11	

CONCEPT DESIGN SUBMITTAL

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

ENLARGED DOCK C PLAN (OPTION 2 ROOF REMOVAL)

3/32" = 1'-0"

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY	A. LOTFI
DRAWN BY	R. CATHERS
CHECKED BY	J. DELUCA
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

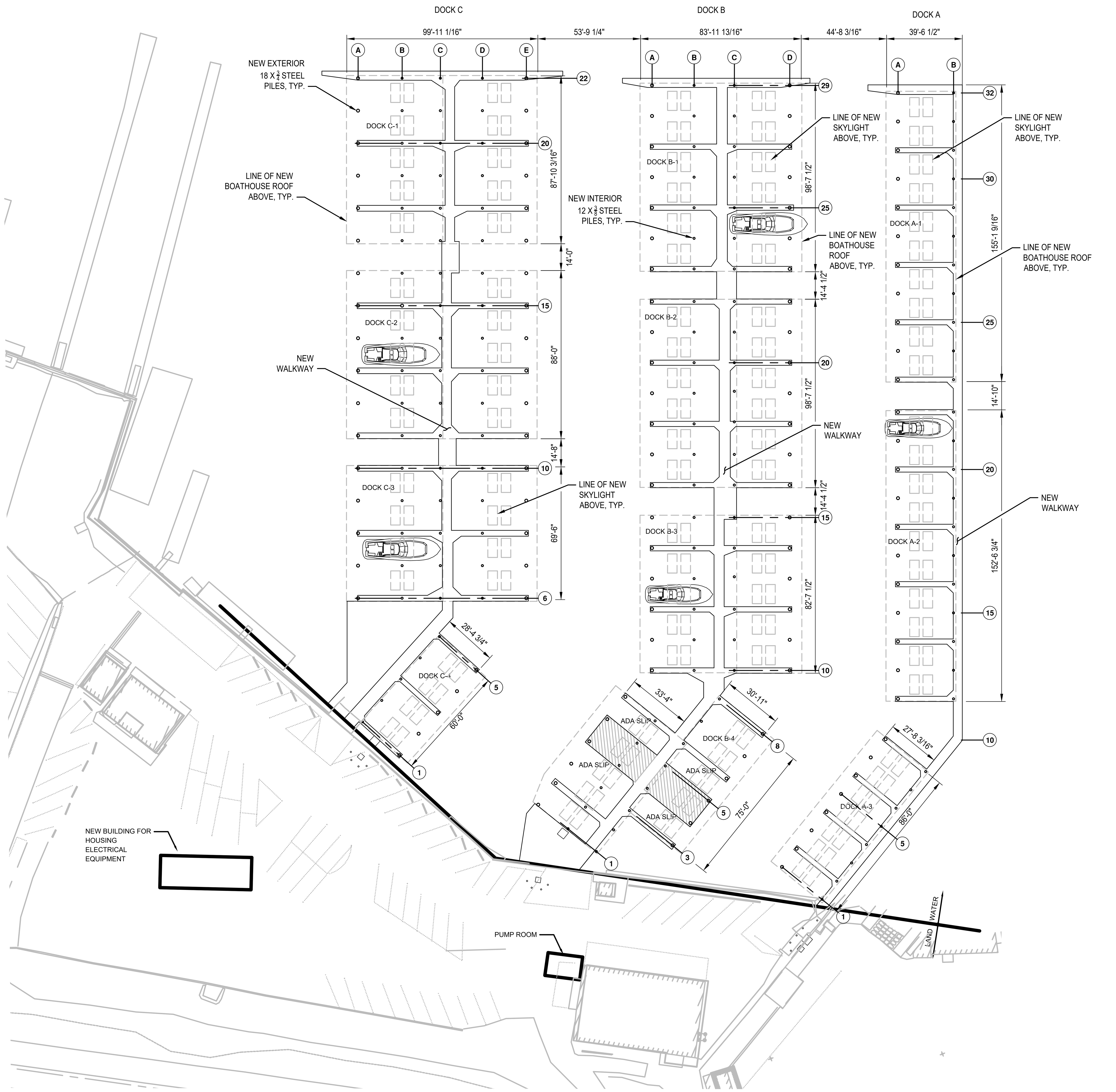
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

ENLARGED DOCK C PLAN
(OPTION 2 ROOF REMOVAL)

SCALE	1" = 12'
DATE	OCTOBER 2024
REVISION	
DRAWING NO.	A24.11

CONCEPT DESIGN SUBMITTAL



GROUND LEVEL PLAN(OPTION 1 ROOF REPLACEMENT)

1/32" = 1'-0"

NOTES:

1. ALL SAWN LUMBER TIMBER MEMBERS SHALL BE ALASKAN CEDAR, NO 2 OR BETTER UNLESS NOTED OTHERWISE.
2. ALL WALKWAYS AND CATWALKS SHALL BE COMPRISED OF STEEL GRATING PANELS.

0 32 64 96
1"= 32'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT, SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A-C ROOF SAFETY

DESIGNED BY	C. KUNEY-PITTS
DRAWN BY	M. ACOSTA
CHECKED BY	K. SOLBERG
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

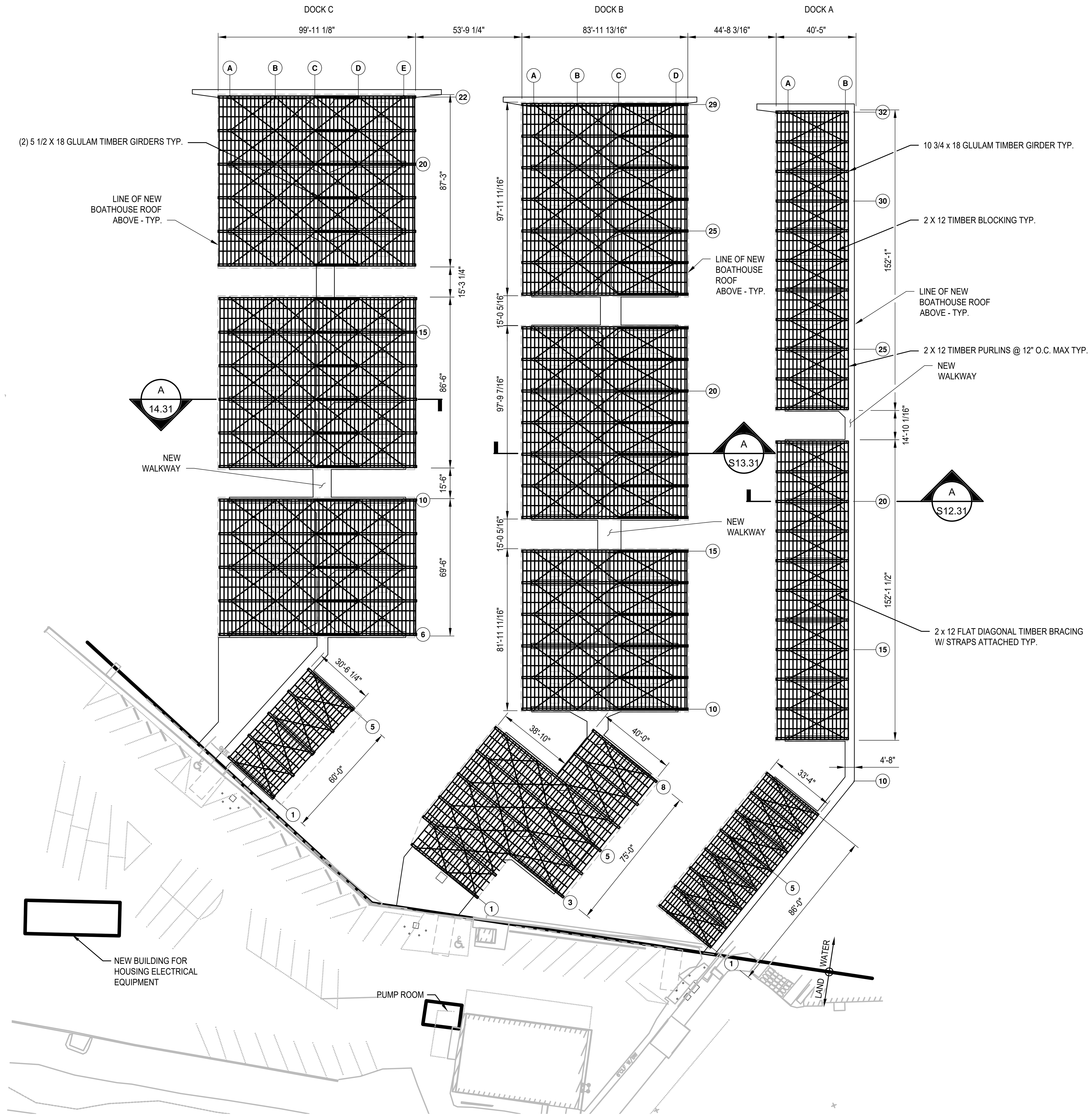
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

GROUND LEVEL PLAN
(OPTION 1 ROOF REPLACEMENT)

SCALE 1/32"=1'-0"
REVISION
DATE OCTOBER 2024
DRAWING NO.
S11.11

CONCEPT DESIGN SUBMITTAL



NOTES:

1. ALL SAWN LUMBER TIMBER MEMBERS SHALL BE ALASKAN CEDAR, NO 2 OR BETTER UNLESS NOTED OTHERWISE.
2. ALL GLULAM MEMBERS SHALL BE MARINE GRADE 20F-V13 AC/AC UNLESS NOTED OTHERWISE.

ROOF FRAMING PLAN(OPTION 1 ROOF REPLACEMENT)

1/32" = 1'-0"

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS							
NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY-PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

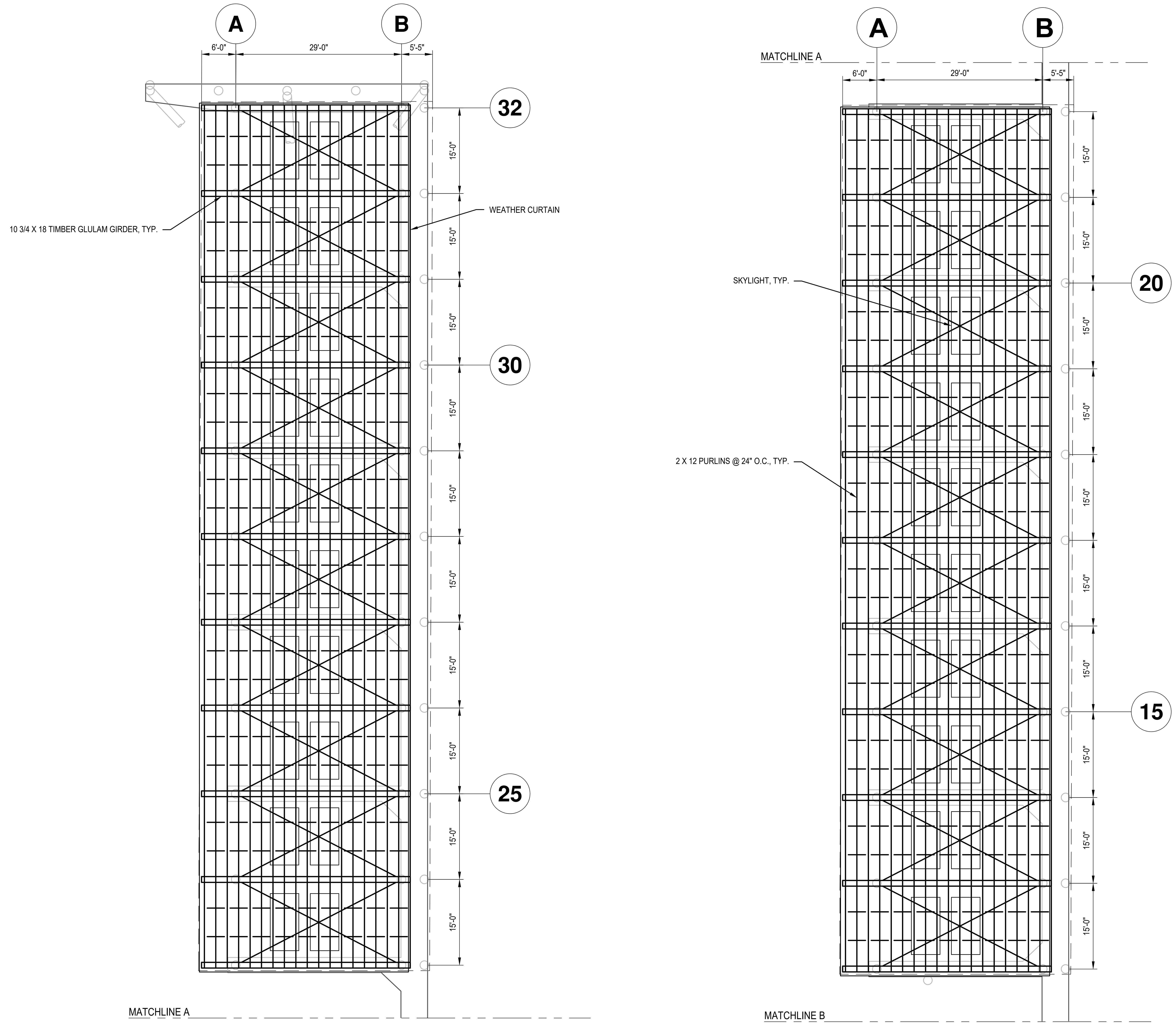
OVERALL STRUCTURAL ROOF FRAMING PLAN
(OPTION 1 ROOF REPLACEMENT)

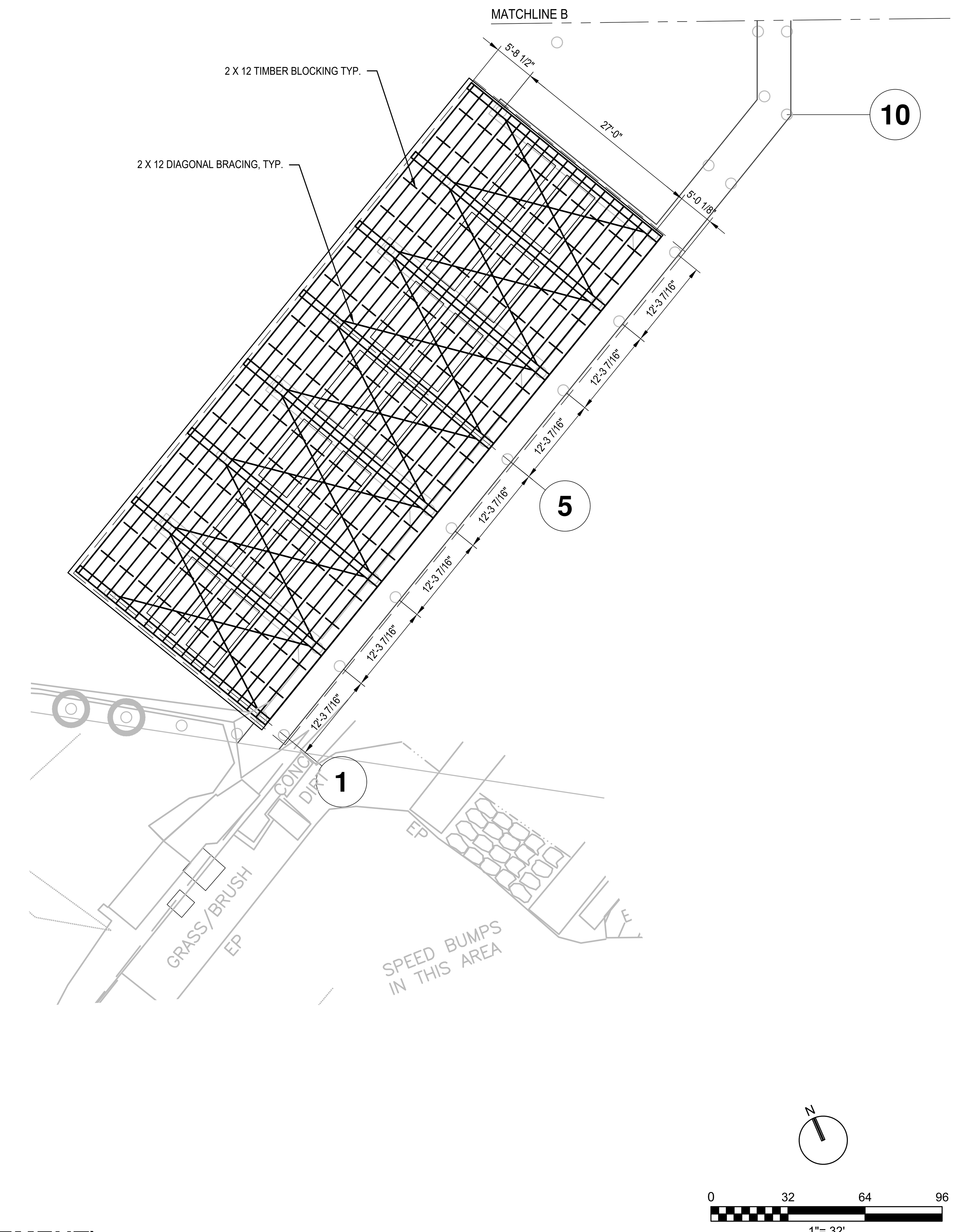
SCALE 1/32"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. S11.12

CONCEPT DESIGN SUBMITTAL

NOTES:

1. ALL SAWN LUMBER TIMBER MEMBERS SHALL BE ALASKAN CEDAR, NO 2 OR BETTER UNLESS NOTED OTHERWISE.
2. ALL GLULAM MEMBERS SHALL BE MARINE GRADE 20F-V13 AC/AC UNLESS NOTED OTHERWISE.





ROOF FRAMING PLAN(OPTION 1 ROOF REPLACEMENT)

1/32" = 1'-0"

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

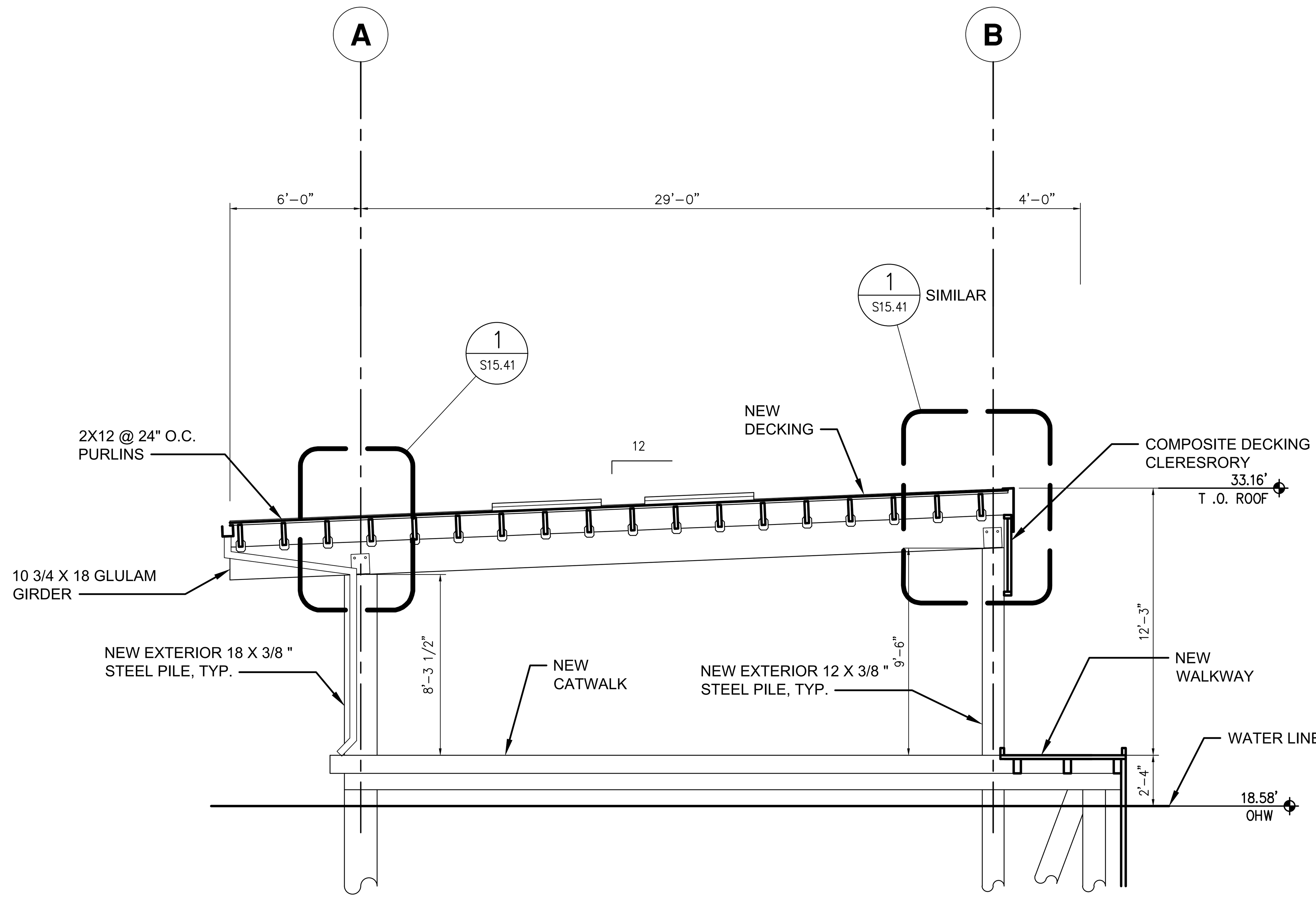
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK A STRUCTURAL ROOF FRAMING PLAN (OPTION 1 ROOF REPLACEMENT)

SCALE 1/32"=1'–0"
REVISION
DATE OCTOBER 2024
DRAWING NO. S12.11

CONCEPT DESIGN SUBMITTAL



DOCK A TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

1/4" = 1'-0"

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY	C. KUNEY–PITTS
DRAWN BY	M. ACOSTA
CHECKED BY	K. SOLBERG
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

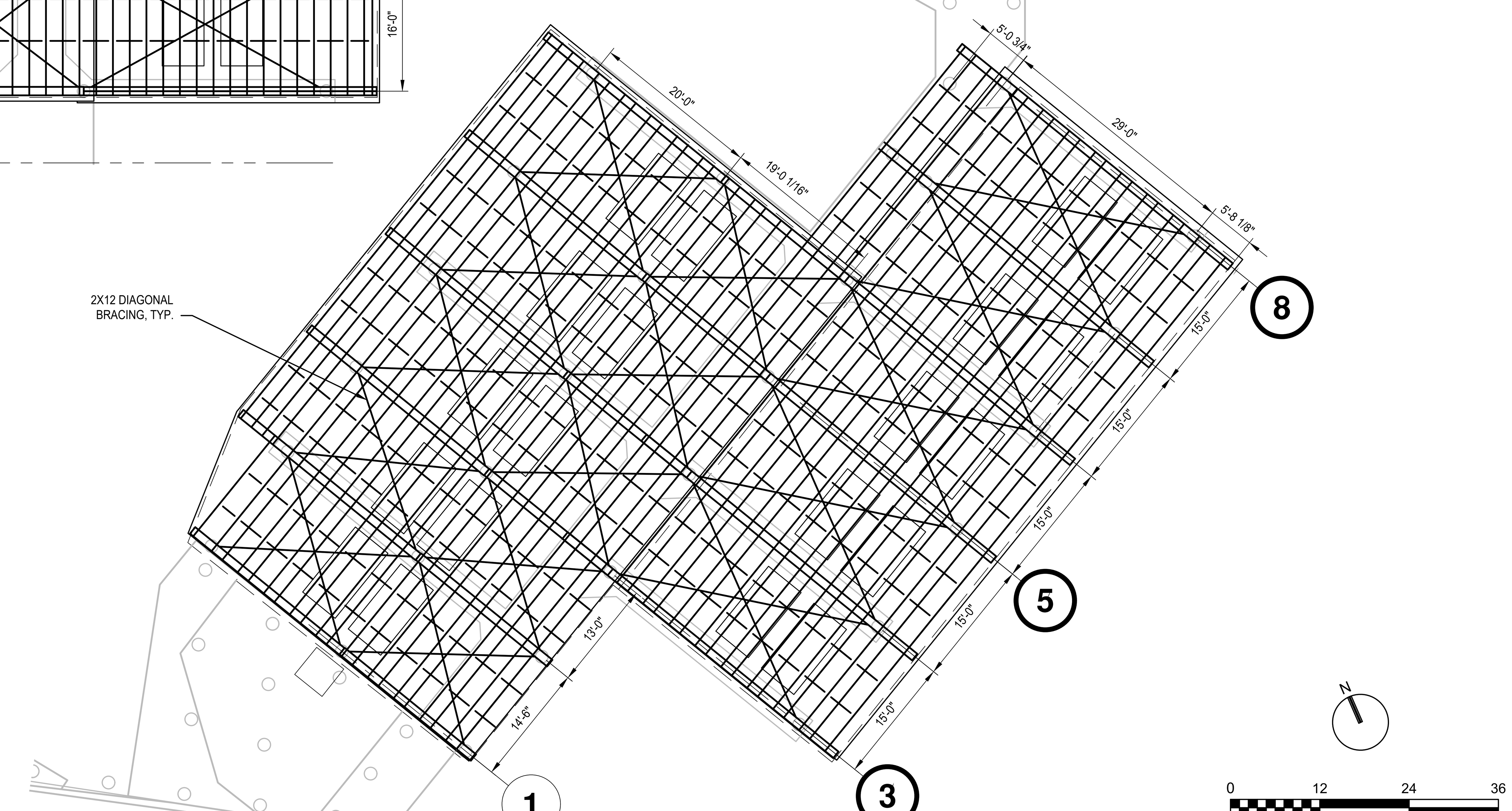
SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK A TYPICAL SECTION
(OPTION 1 ROOF REPLACEMENT)

SCALE 1/4"=1'-0"
DATE OCTOBER 2024
REVISION

DRAWING NO.
S12.31

CONCEPT DESIGN SUBMITTAL



NOTES:

1. ALL SAWN LUMBER TIMBER MEMBERS SHALL BE ALASKAN CEDAR, NO 2 OR BETTER UNLESS NOTED OTHERWISE.
2. ALL GLULAM MEMBERS SHALL BE MARINE GRADE 20F-V13 AC/AC UNLESS NOTED OTHERWISE.

ROOF FRAMING PLAN(OPTION 1 ROOF REPLACEMENT)

1/32" = 1'-0"

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

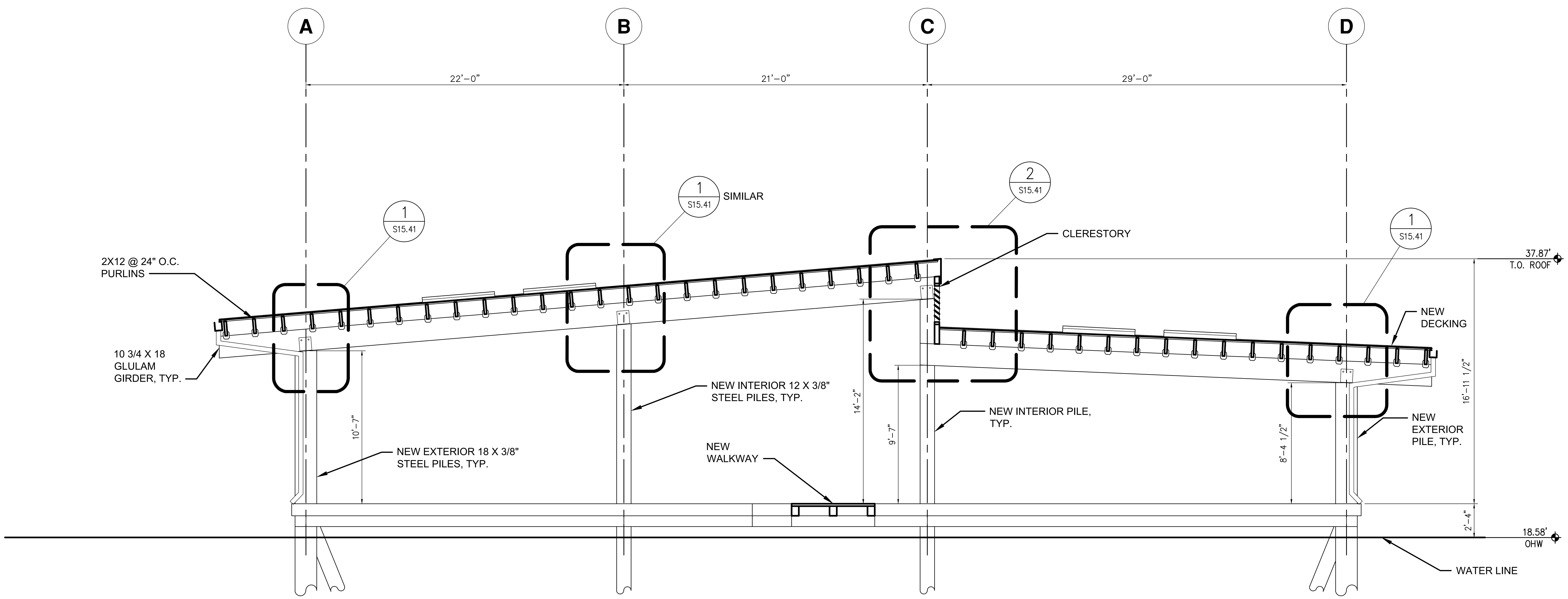
REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS	PORT OF SEATTLE MARINE FACILITIES	SCALE 3/32"=1'–0"	REVISION
DRAWN BY M. ACOSTA	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY K. SOLBERG	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	DOCK B STRUCTURAL ROOF FRAMING PLAN (OPTION 1 ROOF REPLACEMENT)	S13.11	

CONCEPT DESIGN SUBMITTAL



DOCK B TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

1/4" = 1'-0"

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A-C ROOF SAFETY

DESIGNED BY
C. KUNEY-PITTS
DRAWN BY
M. ACOSTA
CHECKED BY
K. SOLBERG
PROJECT ENGR
X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

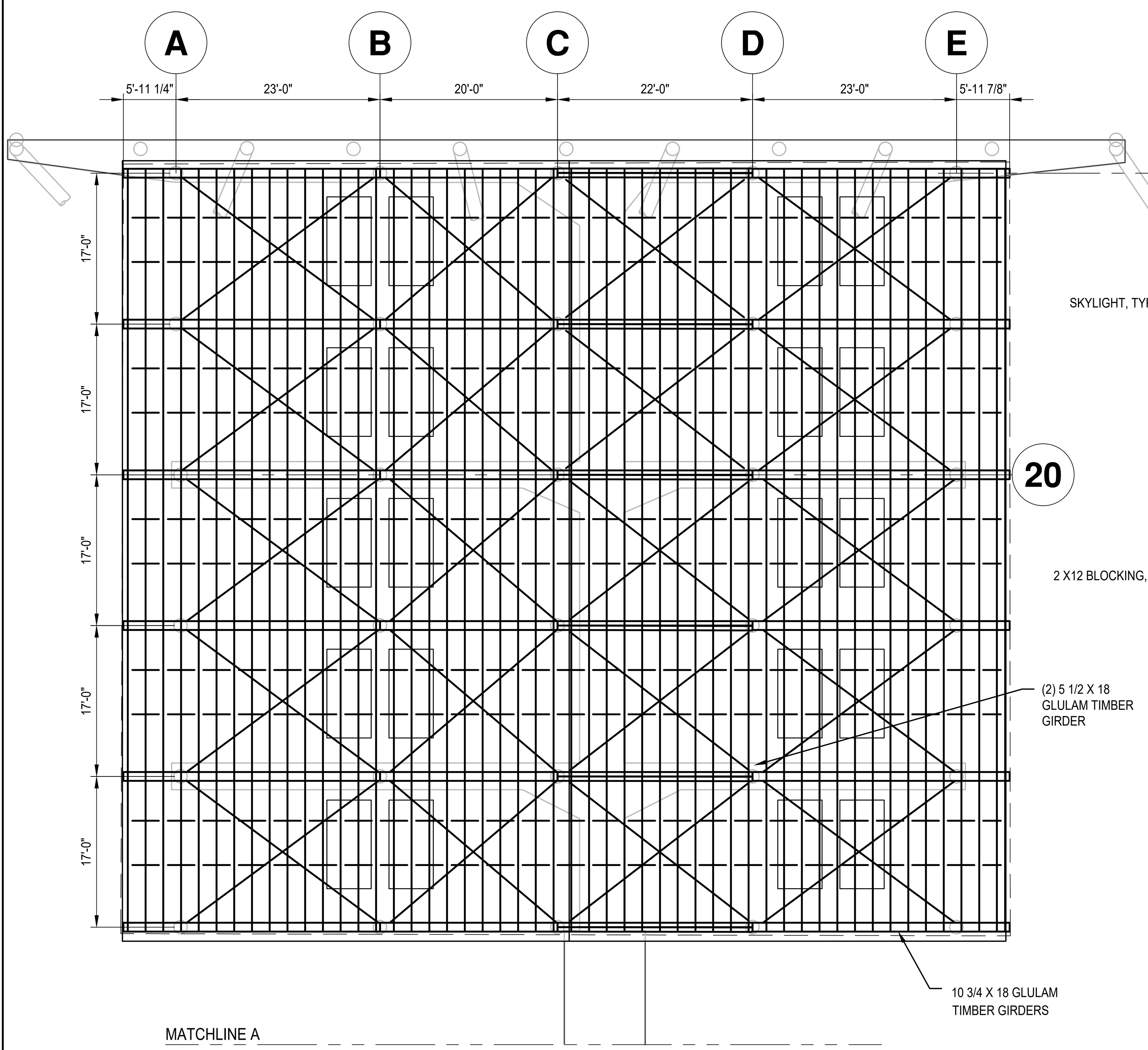
SALMON BAY MARINA DOCKS A-C ROOF SAFETY

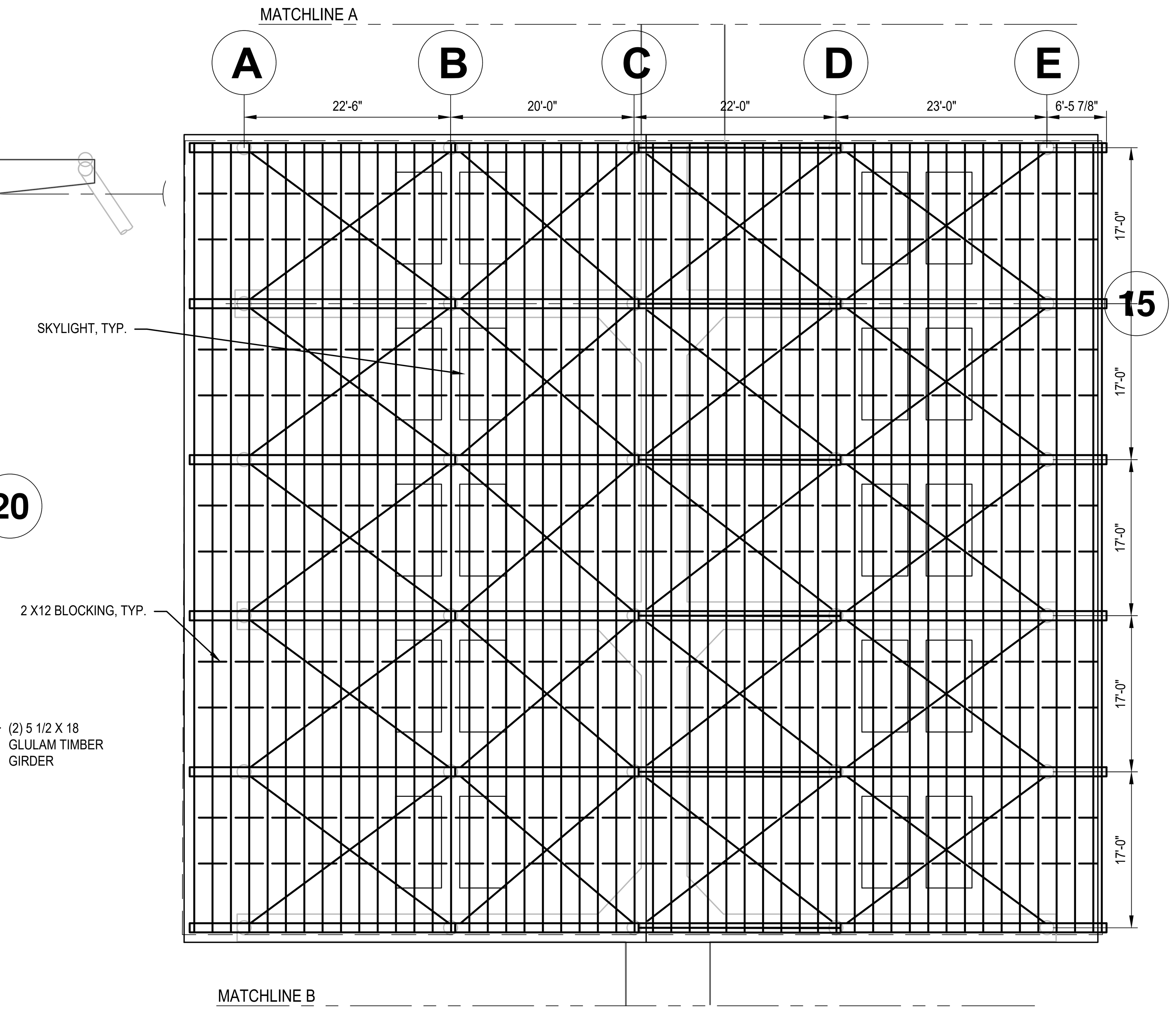
DOCK B TYPICAL SECTION
(OPTION 1 ROOF REPLACEMENT)

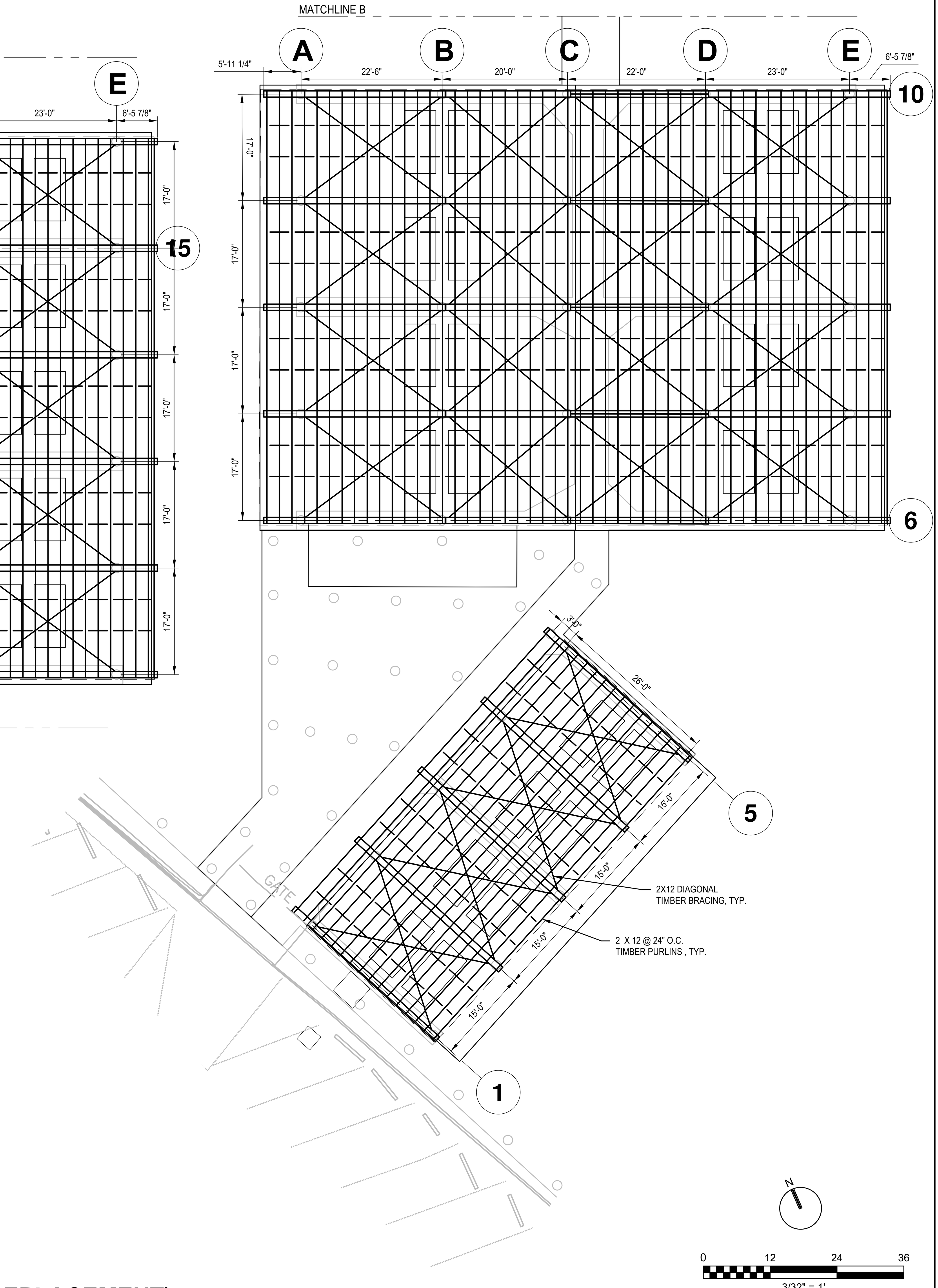
SCALE
1/4"=1'-0"
DATE
OCTOBER 2024
REVISION

DRAWING NO.
S13.31

CONCEPT DESIGN SUBMITTAL







GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

NOTES:

1. ALL SAWN LUMBER TIMBER MEMBERS SHALL BE ALASKAN CEDAR, NO 2 OR BETTER UNLESS NOTED OTHERWISE.

2. ALL GLULAM MEMBERS SHALL BE MARINE GRADE 20F-V13 AC/AC UNLESS NOTED OTHERWISE.

ROOF FRAMING PLAN(OPTION 1 ROOF REPLACEMENT)

1/32" = 1'-0"

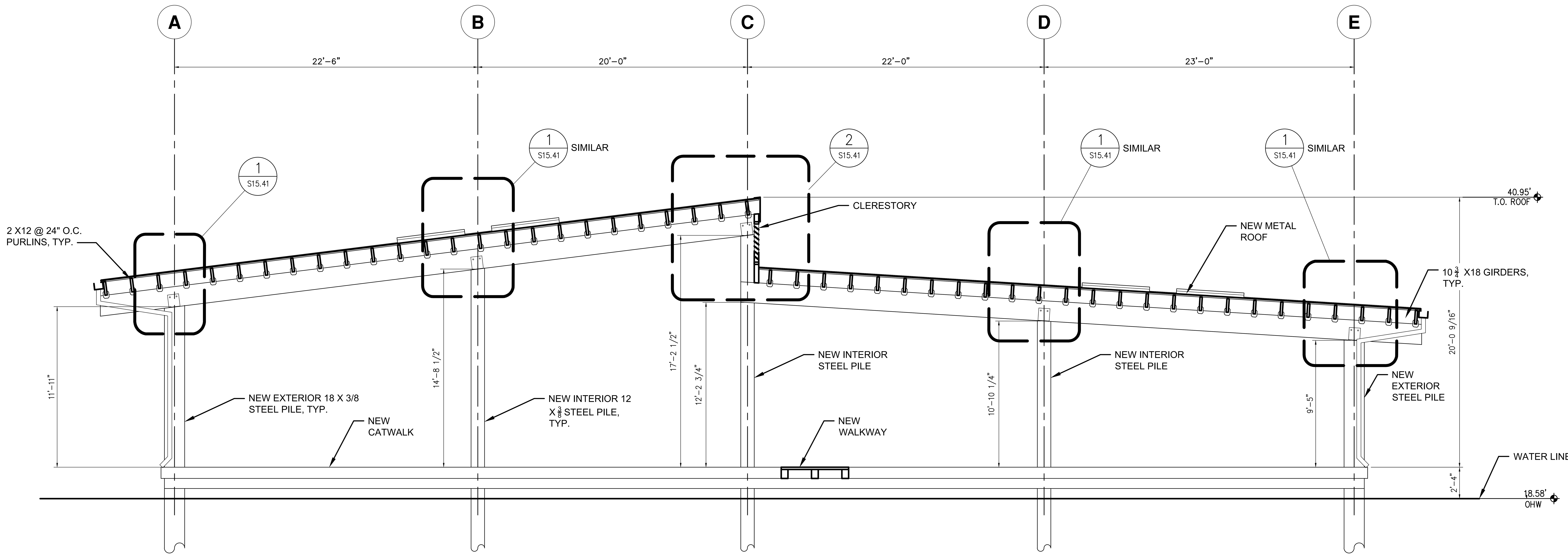
REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS	PORT OF SEATTLE MARINE FACILITIES	SCALE 3/32"=1'–0"	REVISION
DRAWN BY M. ACOSTA	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY K. SOLBERG	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	DOCK C STRUCTURAL ROOF FRAMING PLAN (OPTION 1 ROOF REPLACEMENT)	S14.11	

CONCEPT DESIGN SUBMITTAL



DOCK C TYPICAL SECTION (OPTION 1 ROOF REPLACEMENT)

1/4" = 1'-0"

0 4 8 12

1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY
C. KUNEY-PITTS
DRAWN BY
M. ACOSTA
CHECKED BY
K. SOLBERG
PROJECT ENGR
X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A-C ROOF SAFETY

DOCK C TYPICAL SECTION
(OPTION 1 ROOF REPLACEMENT)

SCALE
1/4"=1'-0"

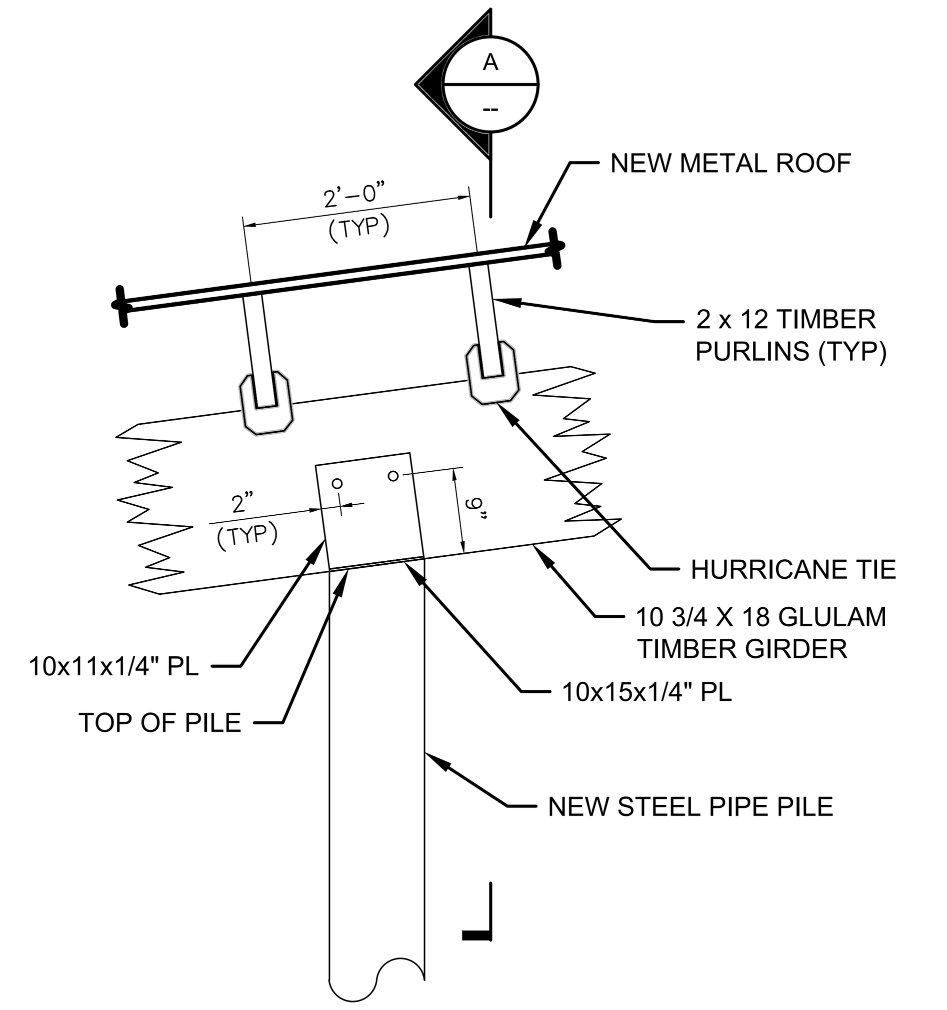
DATE
OCTOBER 2024

REVISION

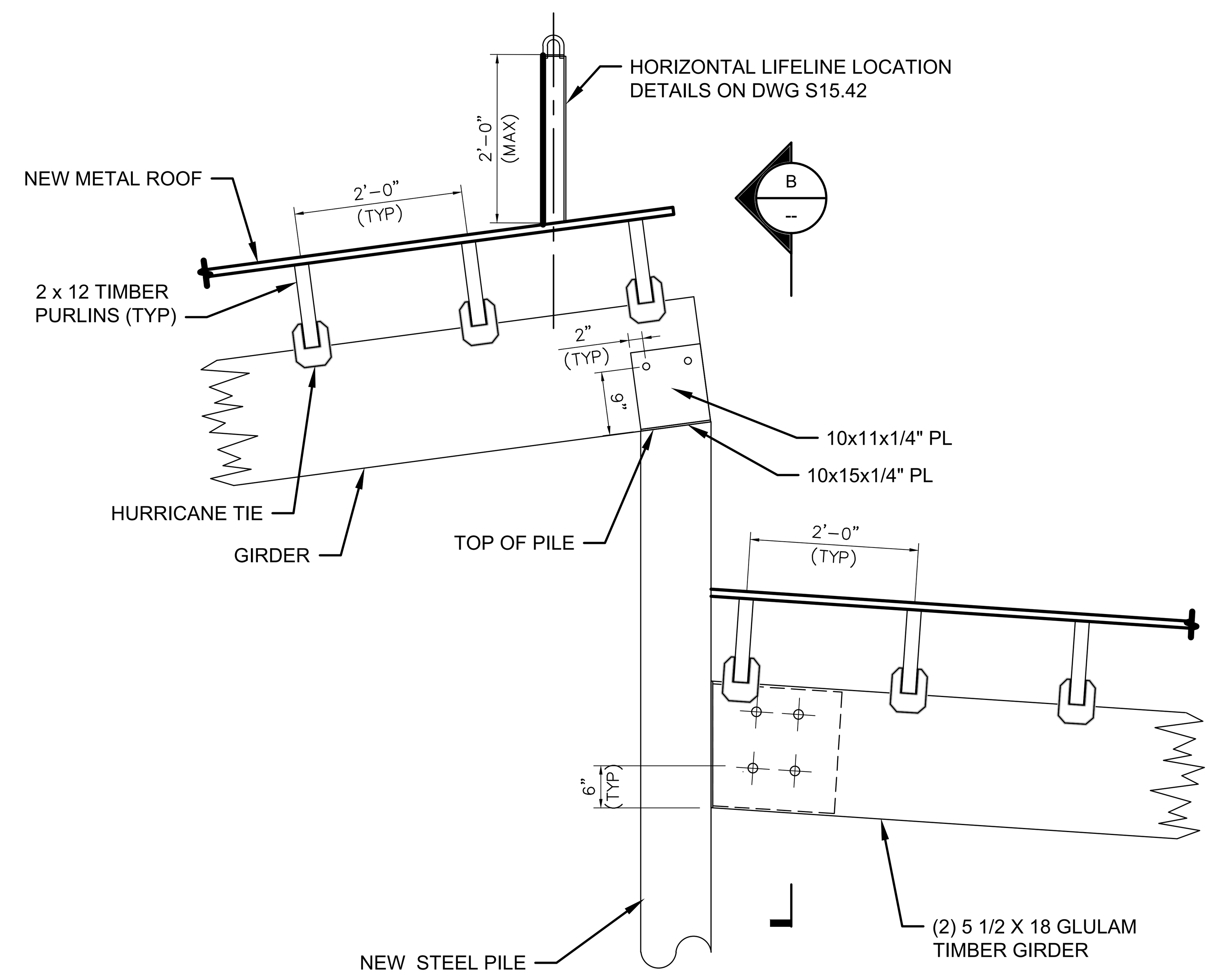
DRAWING NO.

S14.31

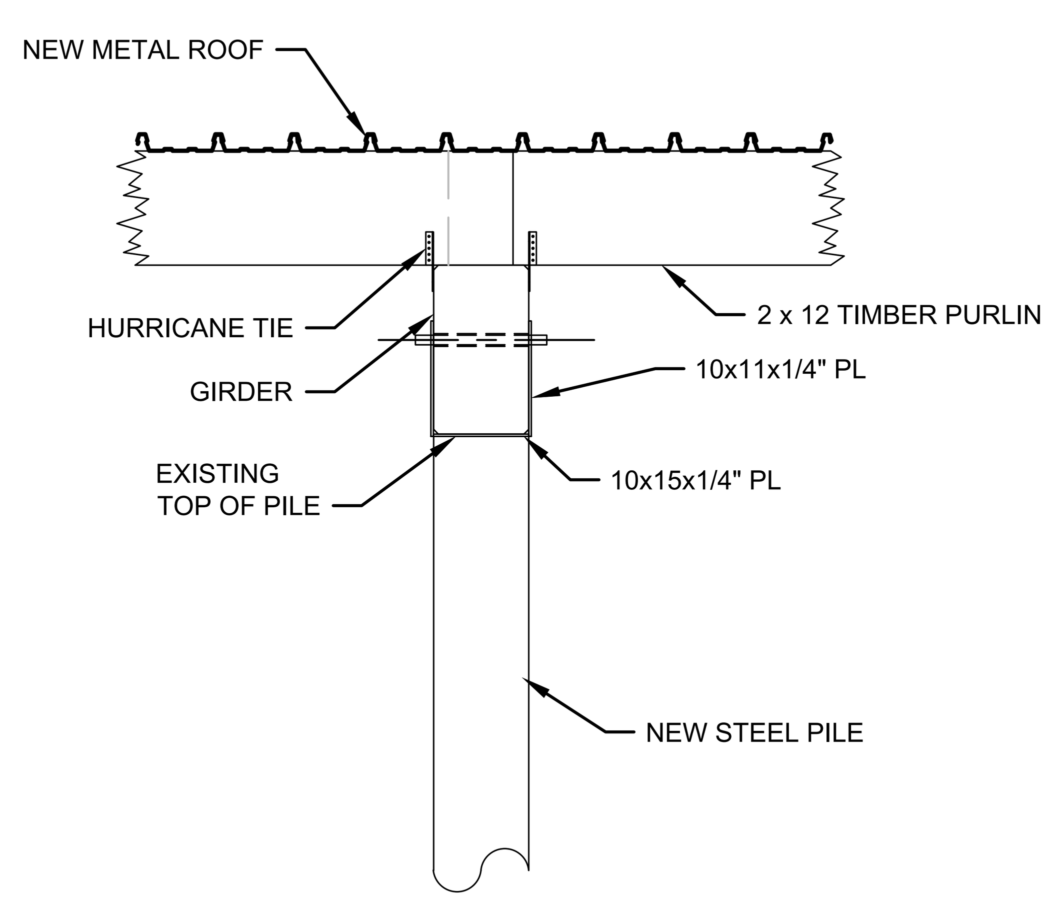
CONCEPT DESIGN SUBMITTAL



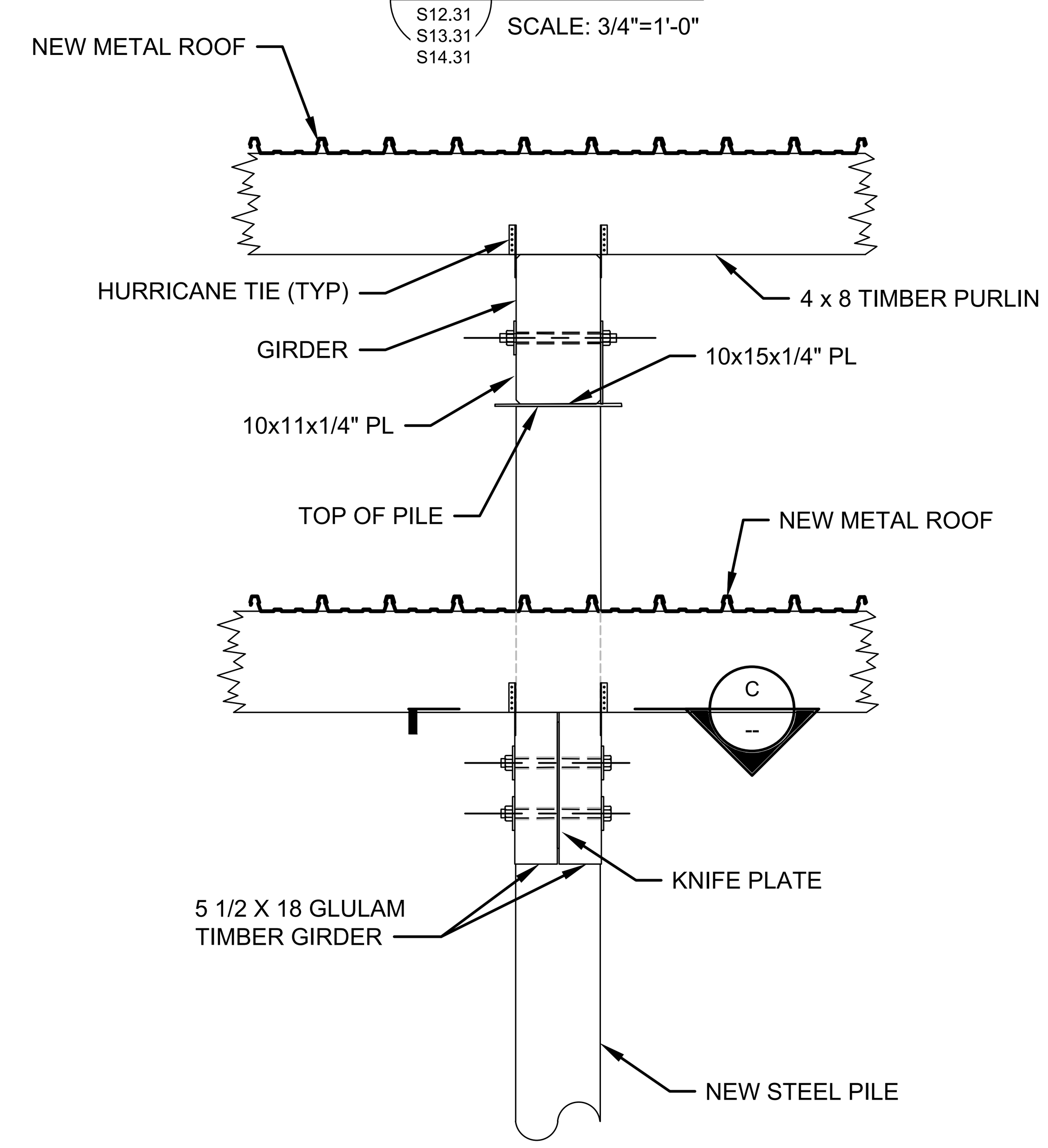
1 DETAIL
S12.31
S13.31
S14.31
SCALE: 3/4"=1'-0"



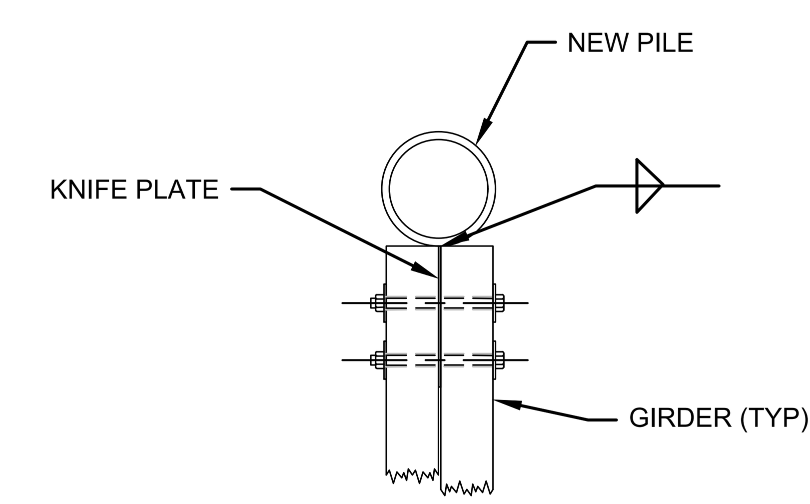
2 DETAIL
S12.31
S13.31
S14.31
SCALE: 3/4"=1'-0"



A SECTION
--
SCALE: 3/4"=1'-0"



B SECTION
--
SCALE: 3/4"=1'-0"



C SECTION
--
SCALE: 3/4"=1'-0"

0 1.25 2.50 3.75
3/4"= 1'-0"
GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY
C. KUNEY-PITTS
DRAWN BY
M. ACOSTA
CHECKED BY
K. SOLBERG
PROJECT ENGR
X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

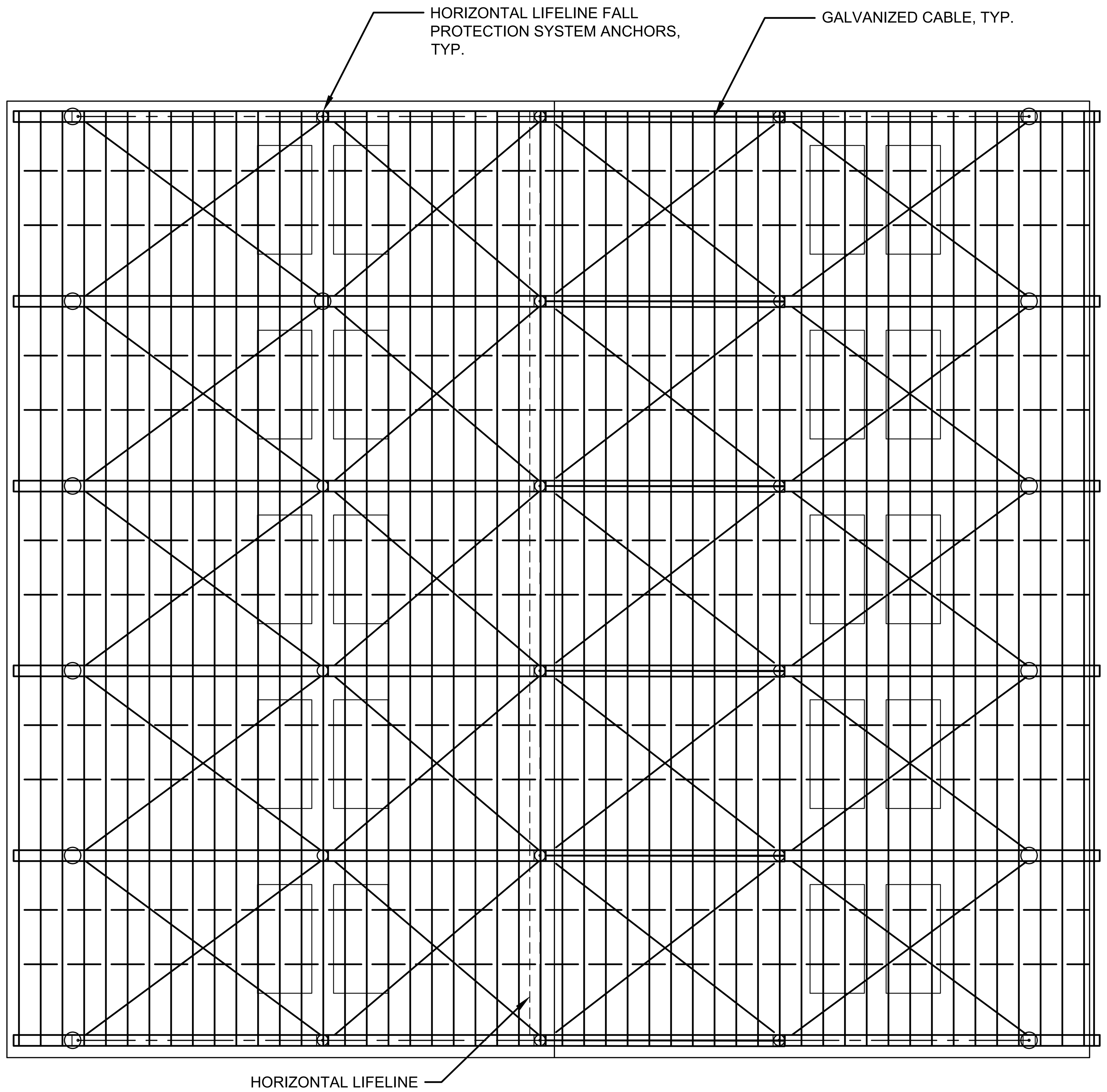
SALMON BAY MARINA DOCKS A-C ROOF SAFETY

SUPERSTRUCTURE DETAILS (1 OF 2)
(OPTION 1 ROOF REPLACEMENT)

SCALE
3/4"=1'-0"
DATE
OCTOBER 2024
REVISION

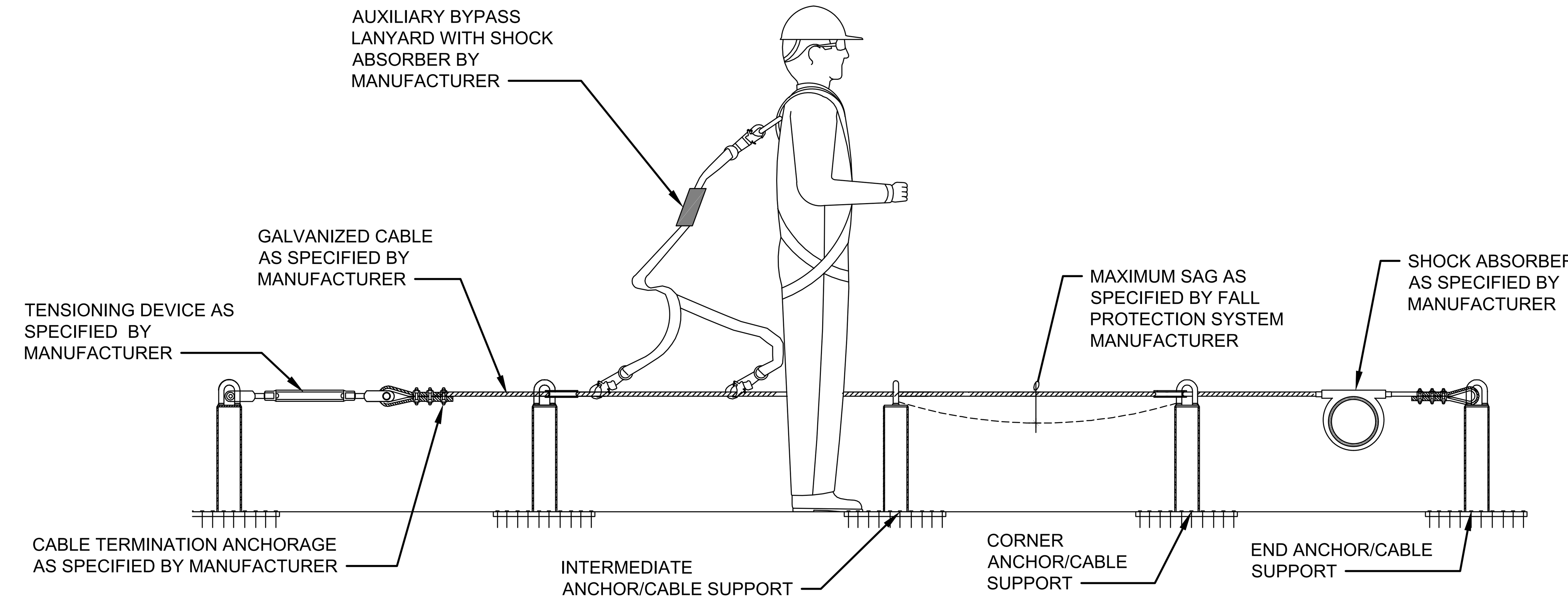
DRAWING NO.
S15.41

CONCEPT DESIGN SUBMITTAL



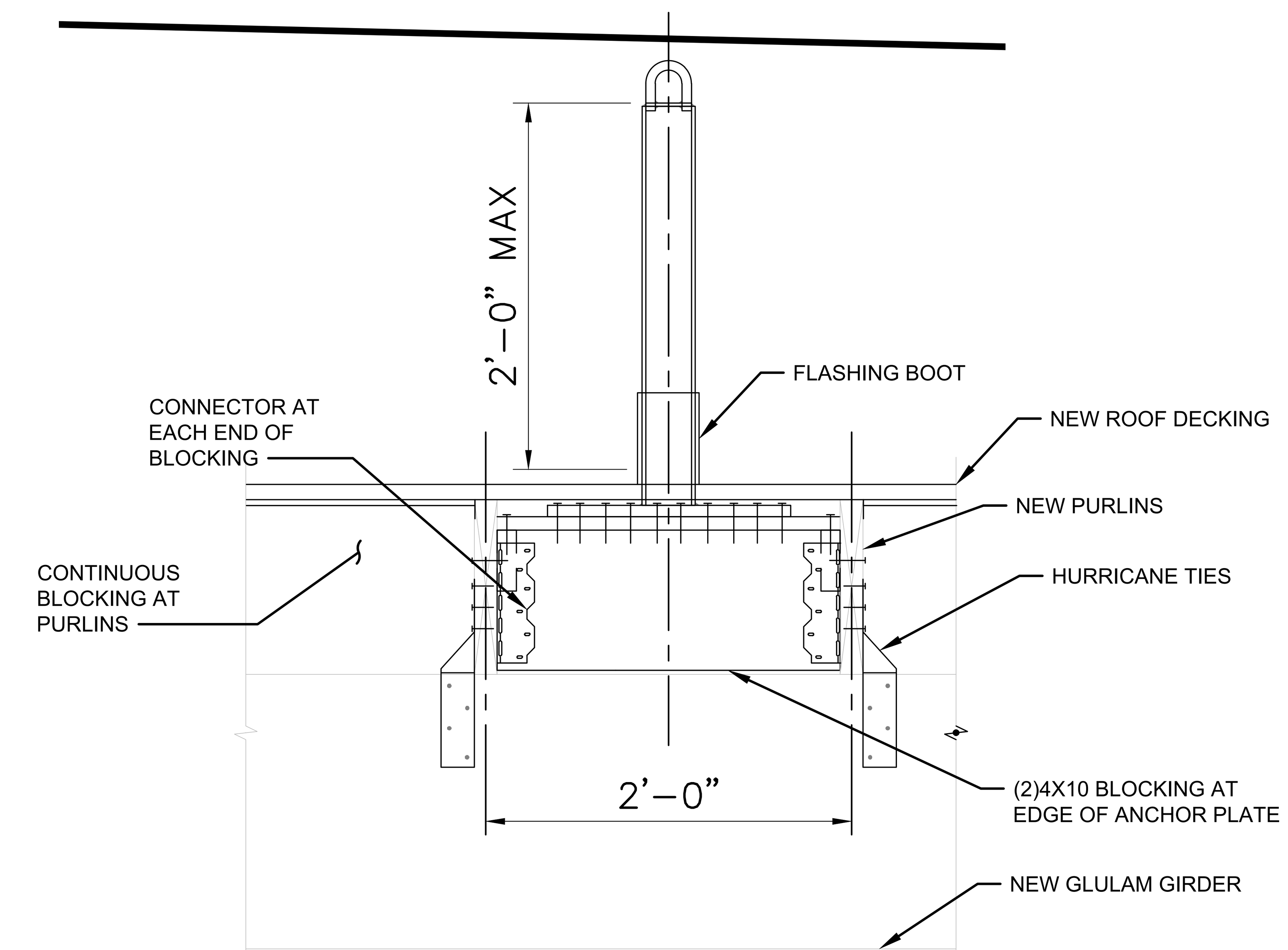
FALL PROTECTION EXAMPLE AT DOCK C-2

1/8" = 1'-0"



1 HORIZONTAL LIFELINE SYSTEM ASSEMBLY EXAMPLE

NTS



2 HORIZONTAL LIFELINE ANCHOR DETAIL

1 1/2" = 1'-0"

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY-PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

SUPERSTRUCTURE DETAILS (2 OF 2)
(OPTION 1 ROOF REPLACEMENT)

SCALE AS NOTED
REVISION
DATE OCTOBER 2024
DRAWING NO.
S15.42

CONCEPT DESIGN SUBMITTAL

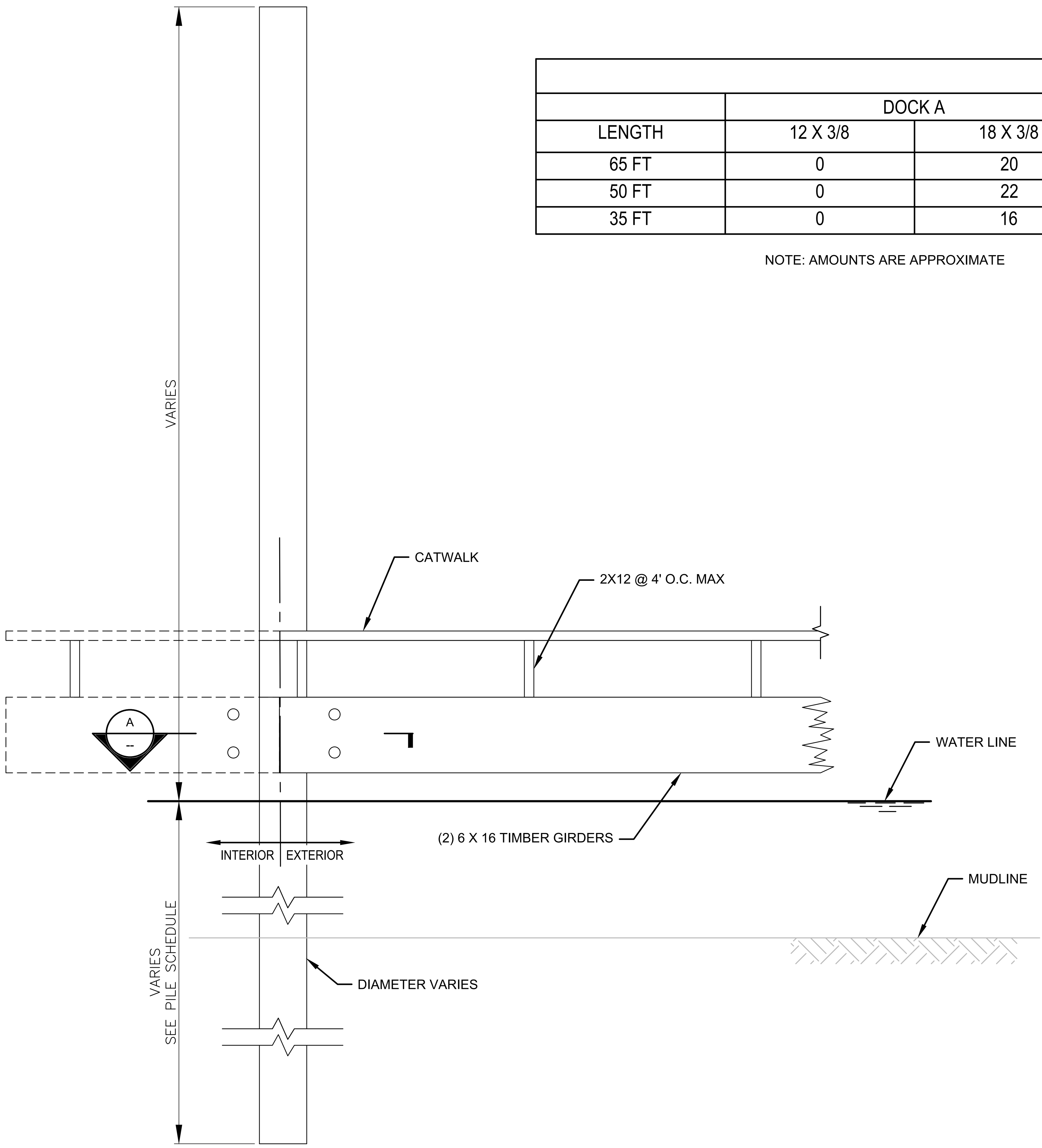
PILE SCHEDULE

	DOCK A		DOCK B		DOCK C	
LENGTH	12 X 3/8	18 X 3/8	12 X 3/8	18 X 3/8	12 X 3/8	18 X 3/8
65 FT	0	20	20	20	27	18
50 FT	0	22	20	20	21	14
35 FT	0	16	14	12	5	5

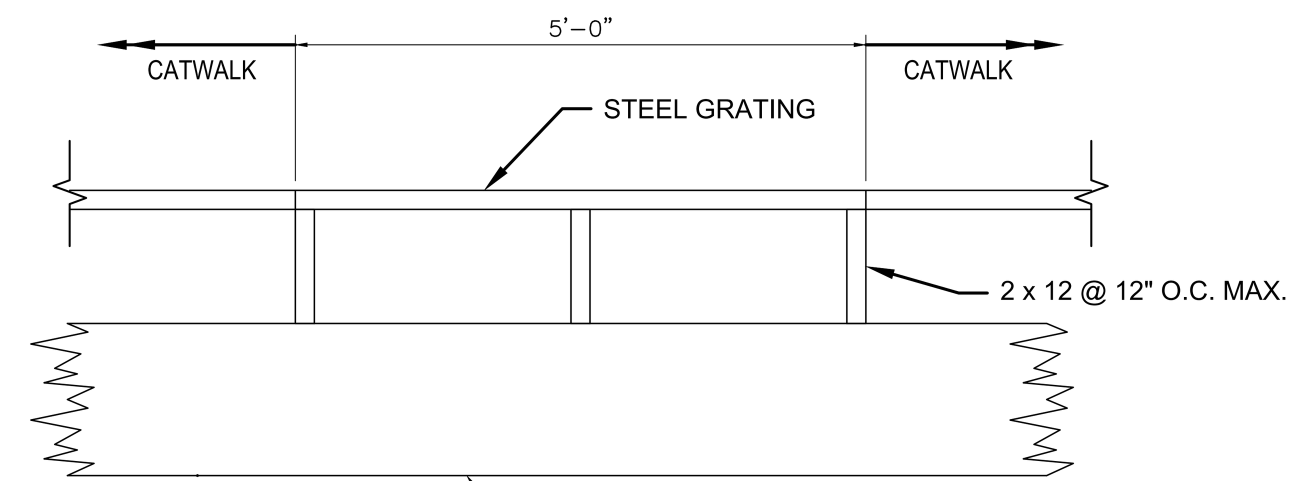
NOTE: AMOUNTS ARE APPROXIMATE

NOTES:

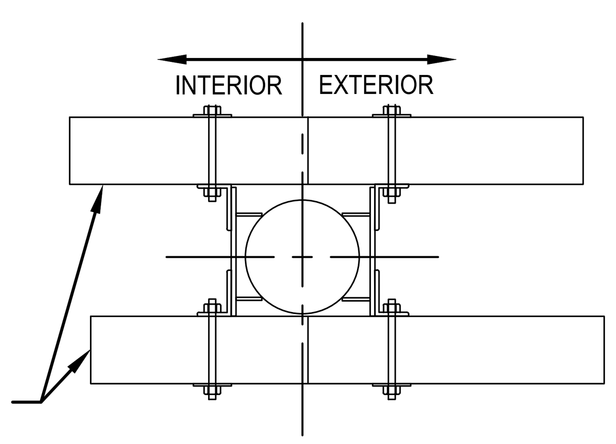
1. WALKWAY GIRDER SHALL BE ALASKAN CEDAR NO 1 OR BETTER. ALL OTHER TIMBER SHALL BE ALASKAN CEDAR NO 2 OR BETTER.
2. PILES SHALL BE A500 GRADE B GALVANIZED STEEL WITH EPOXY COATING AT SPLASH ZONES.
3. ALL WALKWAYS AND CATWALKS WILL BE COMPRISED OF TIMBER FRAMING WITH A STEEL GRATING FOR THE DECKING.



PILE DETAIL
3/4" = 1'-0"



WALKWAY DETAIL
3/4" = 1'-0"



A SECTION
SCALE: 3/4"=1'-0"

0 1.25 2.50 3.75
3/4"= 1'-0"
GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY-PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

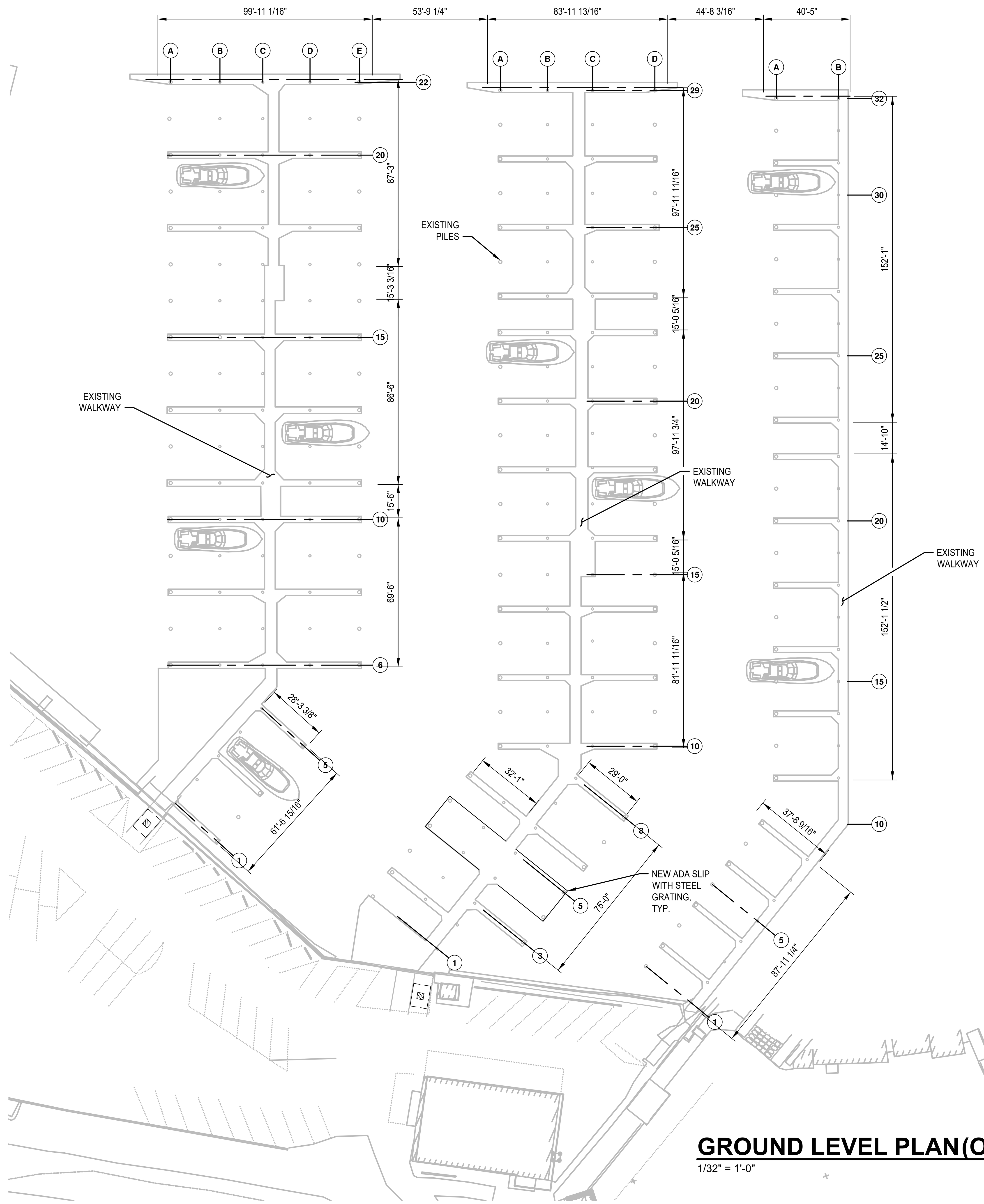
PORT OF SEATTLE
MARINE FACILITIES
SALMON BAY MARINA
SALMON BAY MARINA DOCKS A-C ROOF SAFETY
OPTION 1 DETAILS (2 OF 2)

SCALE 3/4" = 1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. S15.43

CONCEPT DESIGN SUBMITTAL

NOTES:

1. ADA SLIPS SHALL BE COMPRISED OF STEEL GRATING PANELS.



GROUND LEVEL PLAN(OPTION 2 ROOF REMOVAL)

1/32" = 1'-0"

N

0 32 64 96

1"= 32'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT,
SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY	C. KUNEY–PITTS
DRAWN BY	M. ACOSTA
CHECKED BY	K. SOLBERG
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

GROUND LEVEL PLAN
(OPTION 2 ROOF REMOVAL)

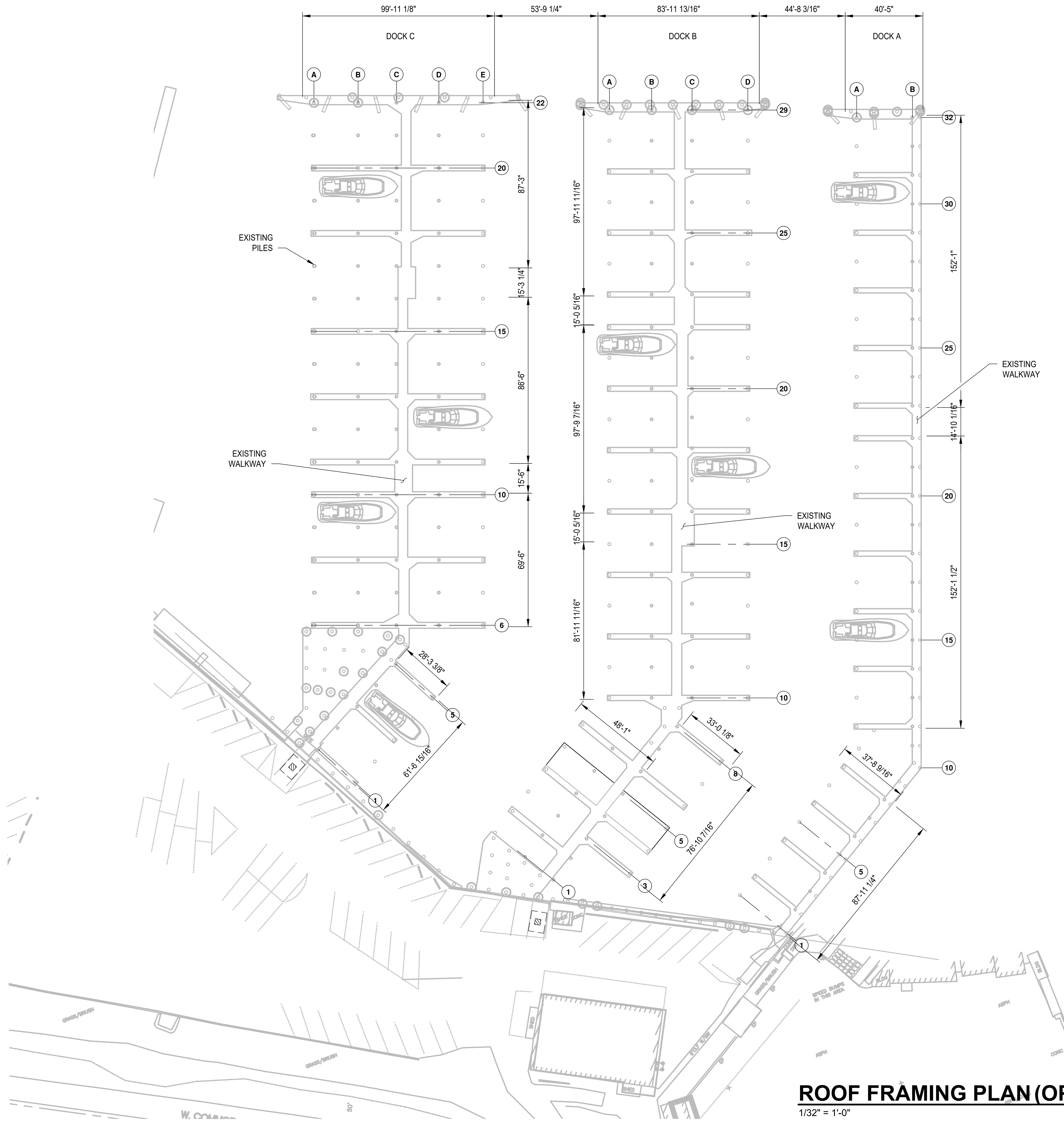
SCALE 1/32"=1'-0"

DATE OCTOBER 2024

REVISION

DRAWING NO.
S21.11

CONCEPT DESIGN SUBMITTAL



ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)

1/32" = 1'-0"

0 32 64 96

1"= 32'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY	C. KUNEY–PITTS
DRAWN BY	M. ACOSTA
CHECKED BY	K. SOLBERG
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

OVERALL STRUCTURAL ROOF FRAMING PLAN
(OPTION 2 ROOF REMOVAL)

SCALE 1/32"=1'-0"

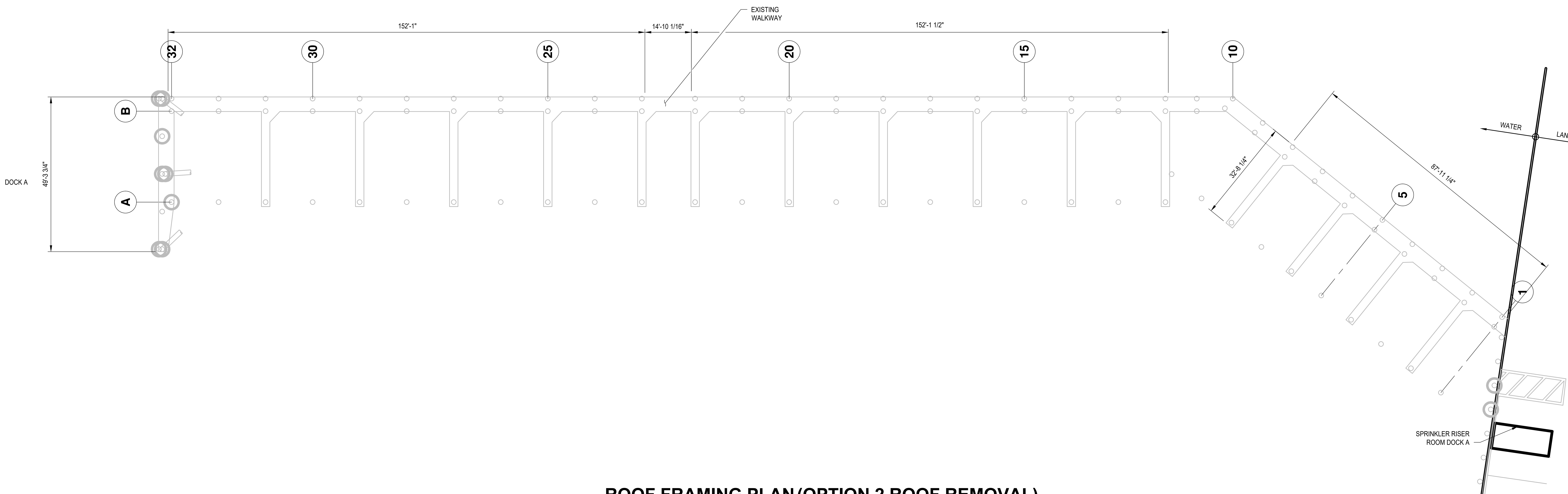
REVISION

DATE OCTOBER 2024

DRAWING NO.

S21.12

CONCEPT DESIGN SUBMITTAL



ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)

1/16" = 1'-0"

NOTES:

1. ASSUME ALL WOOD FRAMING IS TREATED SAWN LUMBER, DF-L NO. 1 OR BETTER

0 16 32 48

1"= 16'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

CONCEPT DESIGN SUBMITTAL

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

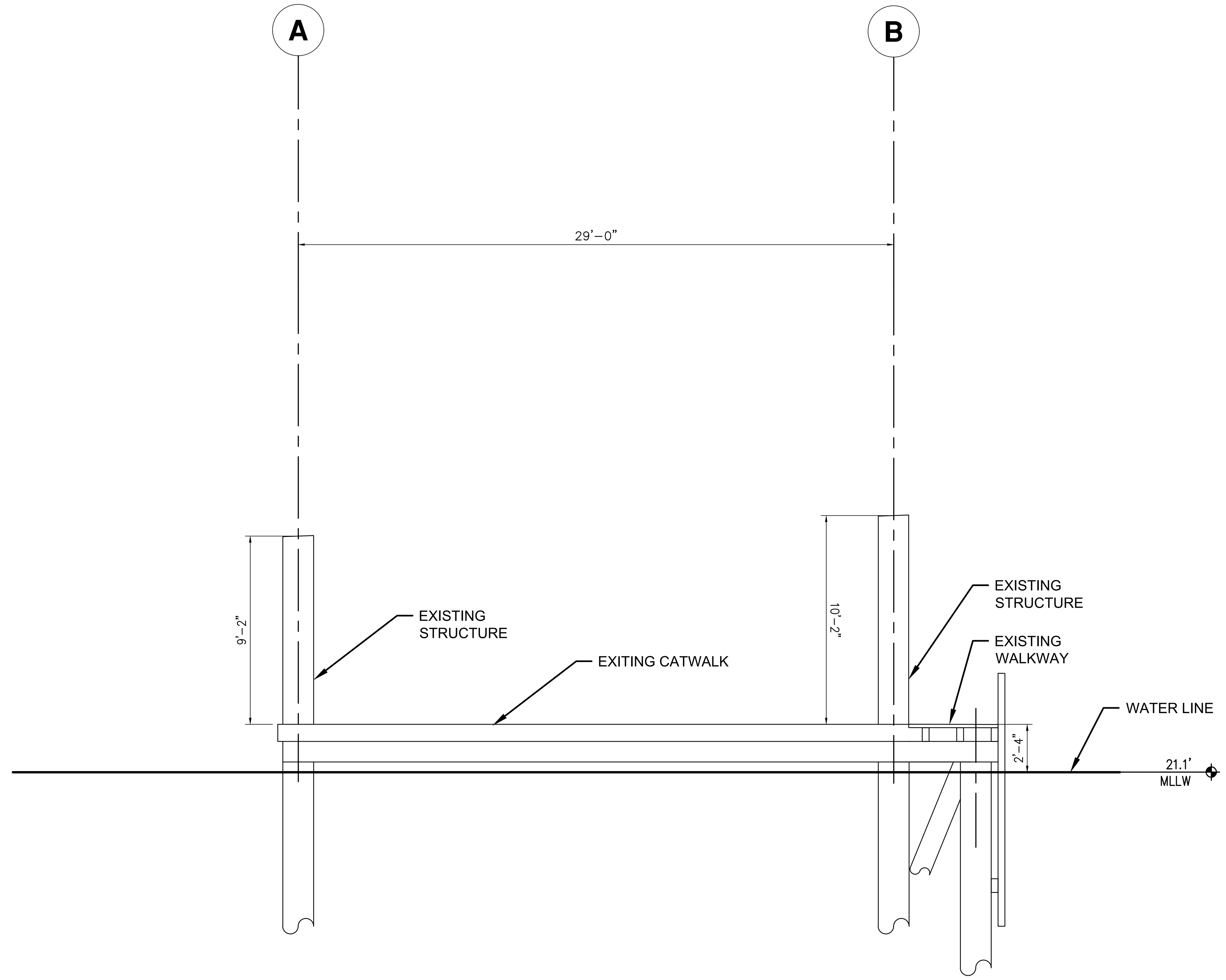
PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK A STRUCTURAL ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)

SCALE 1/16"=1'–0"
DATE OCTOBER 2024
REVISION
DRAWING NO. S22.11



DOCK A TYPICAL SECTION (OPTION 2 ROOF REMOVAL)

1/4" = 1'-0"

0 4 8 12

1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS	PORT OF SEATTLE MARINE FACILITIES	SCALE 1/4"=1'-0"	REVISION
DRAWN BY M. ACOSTA	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY K. SOLBERG	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	DOCK A TYPICAL SECTION (OPTION 2 ROOF REMOVAL)	S22.31	

CONCEPT DESIGN SUBMITTAL

ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)

1/16" = 1'-0"

NOTES:

1. ASSUME ALL WOOD FRAMING IS TREATED SAWN LUMBER, DF-L NO. 1 OR BETTER

0 16 32 48
1"= 16'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

REVISIONS

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SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

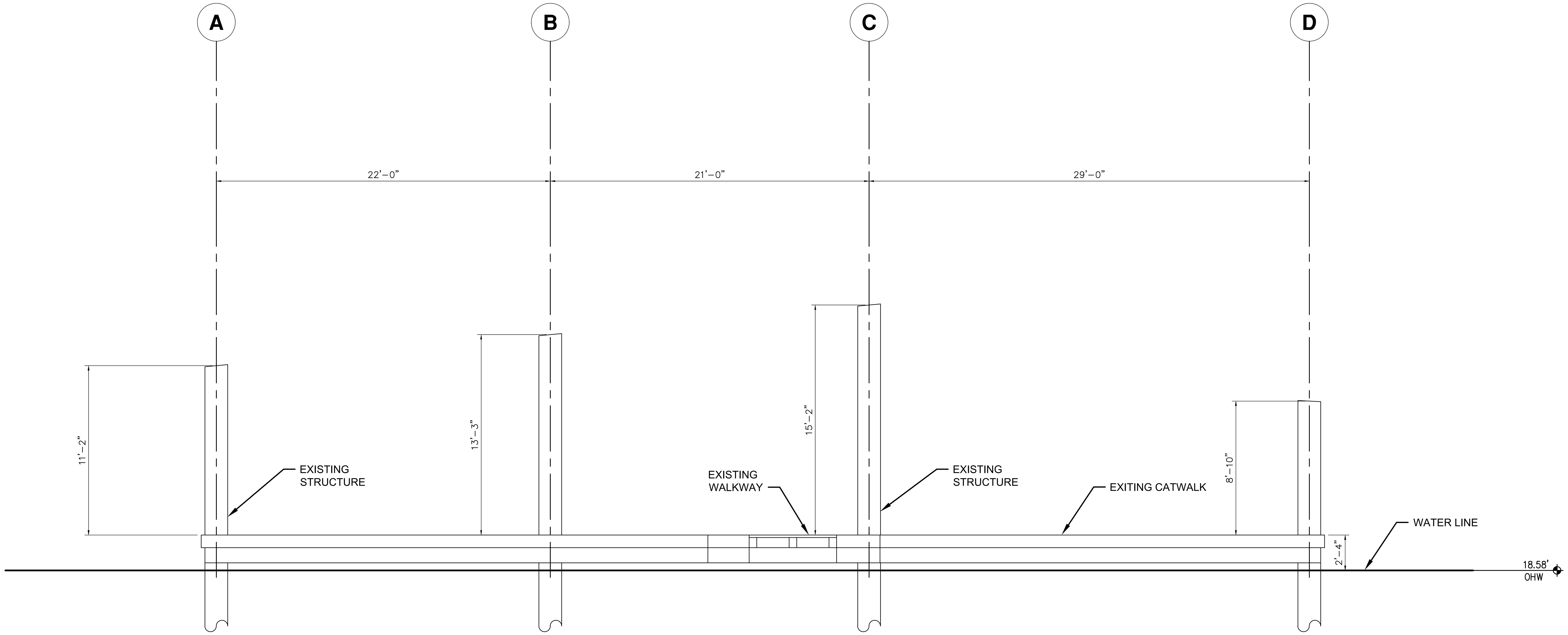
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK B STRUCTURAL ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)

SCALE 1/16"=1'-0"
DATE OCTOBER 2024
REVISION
DRAWING NO. S23.11

CONCEPT DESIGN SUBMITTAL



DOCK B TYPICAL SECTION (OPTION 2 ROOF REMOVAL)
1/4" = 1'–0"

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

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SCALE ACCORDINGLY

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REVISIONS

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DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS
DRAWN BY M. ACOSTA
CHECKED BY K. SOLBERG
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

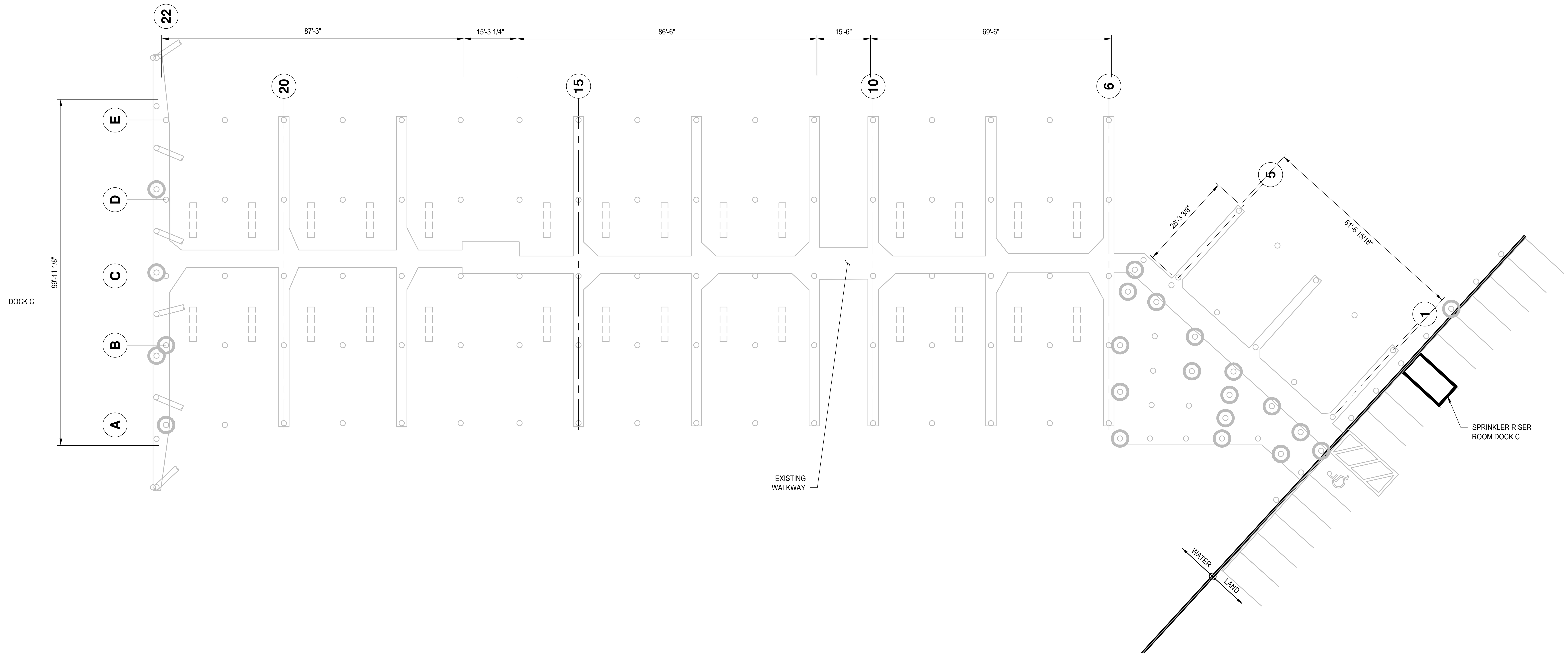
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK B TYPICAL SECTION
(OPTION 2 ROOF REMOVAL)

SCALE 1/4"=1'–0"
REVISION
DATE OCTOBER 2024
DRAWING NO.
S23.31

CONCEPT DESIGN SUBMITTAL



ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)

1/16" = 1'-0"

NOTES:

1. ASSUME ALL WOOD FRAMING IS TREATED SAWN LUMBER, DF-L NO. 2 OR BETTER

0 16 32 48

1"= 16'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
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SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

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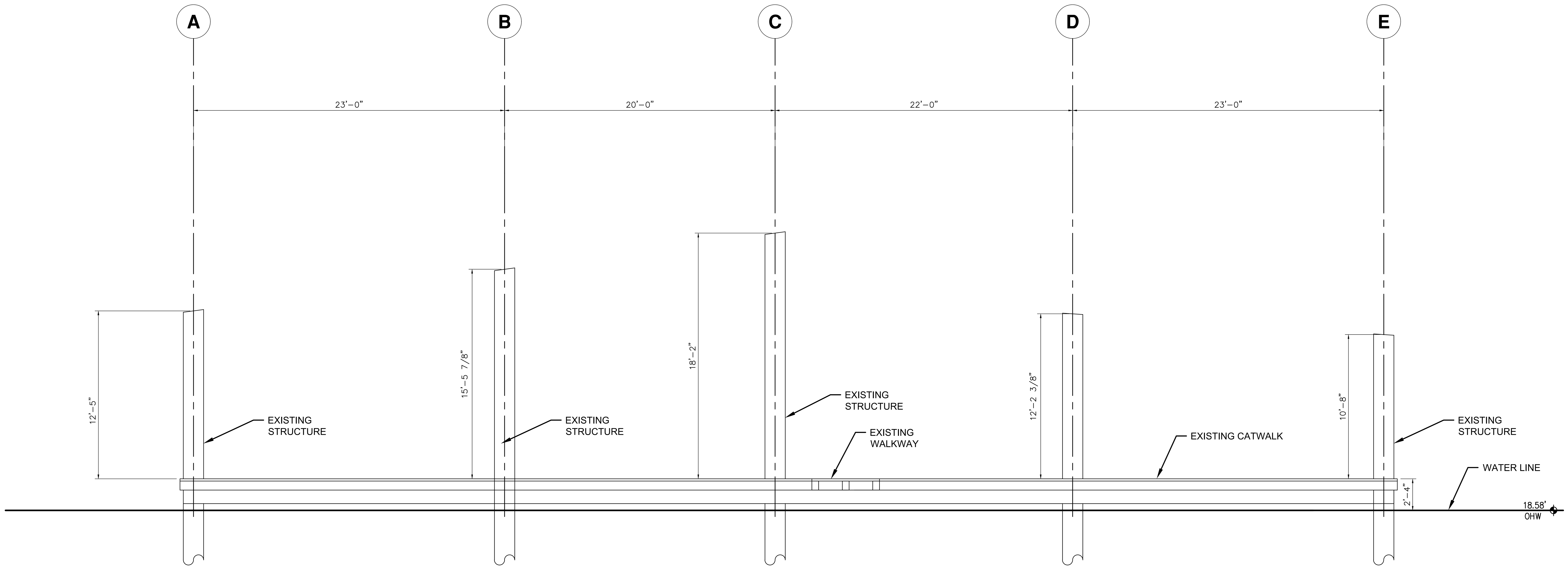
SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY C. KUNEY–PITTS	PORT OF SEATTLE MARINE FACILITIES	SCALE 1/16"=1'-0"	REVISION
DRAWN BY M. ACOSTA	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY K. SOLBERG	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR X	DOCK C STRUCTURAL ROOF FRAMING PLAN (OPTION 2 ROOF REMOVAL)	S24.11	

CONCEPT DESIGN SUBMITTAL



DOCK C TYPICAL SECTION (OPTION 2 ROOF REMOVAL)

1/4" = 1'–0"

0 4 8 12
1"= 4'

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY	C. KUNEY–PITTS
DRAWN BY	M. ACOSTA
CHECKED BY	K. SOLBERG
PROJECT ENGR	X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DOCK C TYPICAL SECTION
(OPTION 2 ROOF REMOVAL)

SCALE	REVISION
1/4"=1'–0"	
DATE OCTOBER 2024	

DRAWING NO.
S24.31

CONCEPT DESIGN SUBMITTAL

POWER

FOR RECEPTACLES IN THIS SECTION, WP DENOTES WEATHERPROOF WHILE-IN-USE BOX AND GFI RECEPTACLE. FOR ALL OTHER DEVICES, WP DENOTES NEMA 3R ENCLOSURE UNO.

- CONVENIENCE RECEPTACLE - DUPLEX UNO, MOUNTING HEIGHT TO BE 18" AFF UNO; 3 = CIRCUIT NUMBER
- CONVENIENCE RECEPTACLE - FOURPLEX
- SIMPLEX RECEPTACLE WITH BRASS FLOORPLATE AND SCREW CAP
- DUPLEX RECEPTACLE - FLUSH MOUNTED IN FLOOR
- FOURPLEX RECEPTACLE - FLUSH MOUNTED IN FLOOR
- JUNCTION BOX
- "A" SPECIAL PURPOSE RECEPTACLE, DESIGNATION AND AMPERAGE AS INDICATED, OR SHOWN IN SCHEDULE, SEE SPECIFICATIONS
- CONNECTION POINT TO EQUIPMENT SPECIFIED FURNISHED AND INSTALLED BY OTHER TRADES. RACEWAY, CONDUCTOR AND CONNECTION BY ELECTRICAL CONTRACTOR.
- NONFUSED DISCONNECT SWITCH. SIZE 30A UNLESS INDICATED OTHERWISE, 3 POLE UNO
- 60/40 FUSED DISCONNECT SWITCH. SIZE INDICATED, (60 = SWITCH RATING, 40 = FUSE RATING) 3 POLE UNO
- COMBINATION MOTOR STARTER AND DISCONNECT, SIZE PER MANUFACTURER REQUIREMENTS, NUMBER OF POLES AS REQUIRED
- PANEL
- T TRANSFORMER
- H HANDHOLE, SIZE AS NOTED
- T THERMOSTAT
- GROUND ROD
- G GENERATOR

ONE-LINE DIAGRAM

ALL DEVICES THIS SECTION TO BE 3 POLE UNO, RATINGS AS INDICATED.

- TRANSFORMER, SECONDARY VOLTAGE. PHASE AND RATING INDICATED AS APPLICABLE.
- GROUND
- 400 FUSE
- 400 CIRCUIT BREAKER
- 400 SWITCH
- M REVENUE GRADE METER AND ENCLOSURE
- CURRENT TRANSFORMER
- TRANSFER SWITCH
- M MOTOR CONNECTION
- XX FEEDER TAG - SEE FEEDER SCHEDULE FOR FURTHER INFORMATION

LIGHTING

SEE LUMINAIRE SCHEDULE FOR FURTHER INFORMATION. SMALL LETTER SUBSCRIPT ON SWITCH AND LUMINAIRE INDICATES SWITCHING. MULTIPLE SUBSCRIPTS INDICATE MULTIPLE SWITCHLEGS CONTROLLED BY ONE SWITCH.

- LIGHTING CONTROL RISER DIAGRAM: MORE FIXTURES CONNECTED IN A SIMILAR CONFIGURATION
- LIGHTING PLANS: ENERGY CODE PRIMARY DAYLIGHT ZONE AREA
- LIGHTING PLANS: ENERGY CODE SECONDARY DAYLIGHT ZONE AREA
- +10' F1 TYP — FIXTURE IDENTIFICATION TAG: HEX - FIXTURE TYPE; TOP - MOUNTING HEIGHT AFF OR AFG; BOTTOM - COMMENTS
- 3a LUMINAIRES: 3 = CIRCUIT NUMBER; a = SWITCH LEG
- LUMINAIRES ON EMERGENCY CIRCUIT
- EMERGENCY EGRESS LUMINAIRE
- EXIT LIGHT ON UNSWITCHED LEG OF EMERGENCY CIRCUIT WITH FACE(S) SHOWN, SEE SCHEDULE
- POLE MOUNTED LUMINAIRE
- $a WALL SWITCH, SYMBOL INDICATED WALL SWITCH LOCATION. SEE LIGHTING CONTROL SCHEDULE FOR WALL SWITCH TYPE AND FEATURES.
- D REMOTE LED DRIVER
- C REMOTE 0-10V LIGHTING CONTROLLER
- PC PHOTOCELL CONTACTOR RELAY

CONDUIT AND RACEWAY

ALL CONDUCTORS INCLUDING NEUTRAL AND GROUND SHALL BE SIZED TO MATCH OR EXCEED OVERCURRENT PROTECTION DEVICE PER NEC, 2#12, 1#12G MINIMUM UNO. ALL CONDUITS SHALL BE SIZED TO MATCH OR EXCEED QUANTITIES AND SIZES OF CONDUCTORS PER NEC, 3/4" MINIMUM UNO.

- P1-1,3 HOME RUN, DESTINATION SHOWN, CIRCUIT NUMBERS PRECEDED BY PANEL NAME, SEE PANEL SCHEDULE, ARROW DOES NOT ALWAYS POINT TO PANEL.
- ABOVE GROUND CONDUIT AND CONDUCTORS, CONCEALED UNO. EXPOSED CONDUITS SHALL BE GRS PAINTED TO MATCH THE STRUCTURE, EMBEDDED CONDUITS SHALL BE SCHEDULE 40 PVC UNO.
- UNDERGROUND CONCEALED CONDUIT AND CONDUCTORS, SCHEDULE 40 PVC UNO.
- CONDUIT DOWN
- CONDUIT UP
- CONDUIT STUBBED AND CAPPED AS SHOWN
- CONDUIT CONTINUED
- EXPOSED FLEX CONDUIT

SYSTEMS & COMMUNICATIONS

- TELEPHONE OUTLET
- CAT-6 DATA OUTLET
- TV TELEVISION OUTLET
- TTB TELEPHONE TERMINAL BOARD
- MDF MAIN DISTRIBUTION FRAME
- IDF INTERMEDIATE DISTRIBUTION FRAME

ABBREVIATIONS

A	AMMETER, AMPERE	KVA	KILOVOLT AMPERE(S)
AC	ABOVE COUNTER	KW	KILOWATT(S)
AF	AMPERE FRAME	LC	LIGHTING CONTACTOR
AFF	ABOVE FINISHED FLOOR	LED	LIGHT EMITTING DIODE
AFG	ABOVE FINISHED GRADE	M	MAGNETIC COIL
AHJ	AUTHORITY HAVING JURISDICTION	MCB	MAIN CIRCUIT BREAKER
AIC	AMPERE INTERRUPTING CAPACITY	MCC	MOTOR CONTROL CENTER
AL	ALUMINUM	MH	MANHOLE, METAL HALIDE
ANN	ANNUNCIATOR	MIN	MINIMUM
ASYM	ASYMMETRICAL	MISC	MISCELLANEOUS
AT	AMPERE TRIP	MLO	MAIN LUGS ONLY
ATS	AUTOMATIC TRANSFER SWITCH	MOV	METAL OXIDE VARISTOR
AUX	AUXILIARY	MTD	MOUNTED
BLDG	BUILDING	MTG	MOUNTING
BRKR	BREAKER	MTS	MANUAL TRANSFER SWITCH
C	CONDUIT	N	NEUTRAL, NEW
CATV	CABLE TELEVISION	NC	NORMALLY CLOSED
CB	CIRCUIT BREAKER	NEUT	NEUTRAL
CCTV	CLOSED CIRCUIT TELEVISION	NO	NORMALLY OPEN, NUMBER
CKT	CIRCUIT	NIC	NOT IN CONTRACT
℄	CENTER LINE	NP	NAMEPLATE
CL	CURRENT LIMITING	Ø	PHASE, DIAMETER
CLF	CURRENT LIMITING FUSE	P	PANEL, POLE
CLR	CLEAR	PB	PUSH-BUTTON
CM	CIRCULAR MILS	PF	POWER FACTOR
COMM	COMMUNICATIONS	PH	PHASE
CONC	CONCRETE	PIR	PASSIVE INFRARED
CONST	CONSTRUCTION	PIV	POST INDICATOR VALVE
CONT	CONTINUED	PNL	PANEL
CPT	CONTROL POWER TRANSFORMER	POMB	POSITION ORIENTED MOGUL BASE (SOCKET)
CR	CONTROL RELAY	PS	PRESSURE SWITCH
CT	CURRENT TRANSFORMER	PSE	PUGET SOUND ENERGY
CTRL	CONTROL	R	RELAY
CU	COPPER	REC	RECEPTACLE(S), RECESSED
DDC	DEDICATED DIALER CIRCUIT	RM	ROOM
DEM	DEMAND	SCH	SCHEDULE
DEMO	DEMOLITION	SCL	SEATTLE CITY LIGHT
DIM	DIMENSION	SEC	SEATTLE ENERGY CODE
DISC	DISCONNECT	SD	SMOKE DETECTOR
DN	DOWN	SF	SQUARE FEET
DS	DISCONNECT SWITCH	SHT	SHEET
DWG	DRAWING	SPD	SURGE PROTECTIVE DEVICE
DZ	DAYLIGHT ZONE	SUPV	SUPERVISOR
E	EMPTY, EXISTING	SW	SWITCH
EF	EXHAUST FAN	SWBD	SWITCHBOARD
ELEC	ELECTRICAL	SWGR	SWITCHGEAR
ELEV	ELEVATION, ELEVATOR	SYM	SYMMETRICAL
EMT	ELECTRICAL METALLIC TUBING	T	THERMOSTAT
EXIST	EXISTING	TB	TERMINAL BLOCK, TRANSFORMER BANK
F,FU	FUSE	TEL	TELEPHONE
FACP	FIRE ALARM CONTROL PANEL	TPU	TACOMA PUBLIC UTILITIES
FBOIC	FURNISHED BY OTHERS INSTALLED BY CONTRACTOR	TTB	TELEPHONE TERMINAL BOARD
		TYP	TYPICAL
FLUOR	FLUORESCENT	UG	UNDERGROUND
FSA	FIRE SYSTEM ANNUNCIATOR	UH	UNIT HEATER
FT	FOOT	UL	UNDERWRITERS LABORATORIES
FVNR	FULL VOLTAGE NON-REVERSING	UNO	UNLESS NOTED OTHERWISE
G,GND	GROUND	UPS	UNINTERRUPTIBLE POWER SUPPLY
GA	GAUGE	V	VOLTMETER, VOLT
GALV	GALVANIZED	VA	VOLT AMPERE(S)
GFI	GROUND FAULT INTERRUPTER	VP	VAPORPROOF
GRC,GRS	GALVANIZED RIGID STEEL	W	WIRE, WATT
HH	HANDHOLE	W/	WITH
HP	HORSEPOWER	WAC	WASHINGTON ADMINISTRATIVE CODE
HPS	HIGH PRESSURE SODIUM	WHD	WATTHOUR DEMAND METER
HVAC	HEATING, VENTILATION, AIR CONDITIONING	W/O	WITHOUT
HWH	HOT WATER HEATER	WP	WEATHERPROOF
IC	INTERRUPTING CAPACITY	WSEC	WASHINGTON STATE ENERGY CODE
JB,J-BOX	JUNCTION BOX	XFMR	TRANSFORMER
K	KELVIN	3P	3-POLE
KCM	THOUSAND CIRCULAR MILS		
KV	KILOVOLT		

DRAWING CONVENTIONS

- A / E1 TITLE SCALE: 1/4"=1'-0" — DETAIL/SECTION TITLE UNDERLINE, E1 = SHEET WHERE REFERENCED
- A / E2 — A = DETAIL/SECTION NUMBER, E2 = SHEET WHERE SHOWN
- N — NORTH ARROW
- 3 — NOTE
- 1 — REVISION REFERENCE
- XXX; FTP-1 = FTP 1 — EQUIPMENT ID TAG - SEE EQUIPMENT SCHEDULE FOR FURTHER INFORMATION, COORDINATE EQUIPMENT LOCATION WITH ASSOCIATED MECHANICAL, CIVIL, ETC. PLANS

GENERAL NOTES

1. MEET ALL REQUIREMENTS OF THE NEC AND AHJ FOR INSTALLATION AND CONSTRUCTION.
2. VERIFY LOCATION OF ALL MECHANICAL AND HEATING EQUIPMENT WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN. COORDINATE EXACT CIRCUIT BREAKER, FUSE AND WIRE SIZE WITH MECHANICAL PRIOR TO ROUGH-IN.
3. VERIFY LOCATION OF ALL LUMINAIRES AND DEVICES WITH ARCHITECTURAL AND/OR LANDSCAPE PLANS AND ELEVATIONS PRIOR TO ROUGH-IN.
4. ALL EXTERIOR DEVICES TO BE CIRCUITED WITH #10 WIRE MINIMUM UNLESS NOTED OTHERWISE.
5. ALL WIRING SHALL BE COPPER UNLESS NOTED OTHERWISE.
6. VERIFY LOCATIONS OF OTHER UTILITIES PRIOR TO COMMENCING WORK, PROVIDE REQUIRED CLEARANCES FROM OTHER UTILITIES, BUILDINGS, AND FREESTANDING STRUCTURES, DURING INSTALLATION OF CONDUITS, CABLES, ETC.
7. USE ELECTRICAL PLANS FOR DETERMINING LUMINAIRE AND DEVICE COUNTS. QUANTITIES SHOWN WITHIN CALCULATION AND CONTROL SCHEDULES SHALL NOT BE USED FOR BID COUNTS.
8. NOT ALL COMPONENTS OF THE ELECTRICAL SYSTEMS ARE SHOWN (FOR CLARITY). PROVIDE MATERIALS AND LABOR NECESSARY FOR A COMPLETE AND OPERATIONAL SYSTEM.
9. THE AIC OF THE PANELS SHOWN ARE TENTATIVE AND GIVEN FOR BIDDING PURPOSES ONLY. CONTRACTOR SHALL CALCULATE THE PANEL AIC BASED UPON FINAL CONDUIT ROUTING AND TRANSFORMERS AND FUSES SUBMITTED.
10. THE OPERATION OF THE FACILITY WILL TAKE PRECEDENCE OVER THE WORK OF THE CONTRACTOR. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE CONSTRUCTION WITH OWNER'S PERSONNEL TO MINIMIZE DISRUPTION TO THE FACILITY.
11. OUTAGES ARE TO BE MINIMIZED. PROVIDE NOTIFICATION TO OWNER'S PERSONNEL OF ANY IMMINENT POWER OUTAGES A MINIMUM OF 48 HOURS PRIOR TO OUTAGE. PROCEED WITH EACH OUTAGE ONLY AFTER APPROVAL FROM OWNER'S PERSONNEL IS GIVEN.
12. CONTRACTOR IS RESPONSIBLE TO FIELD VERIFY ALL DIMENSIONS AND CONDITIONS, WHICH MAY AFFECT THE WORK REQUIRED FOR THIS PROJECT PRIOR TO THE BEGINNING WORK.

GRAPHIC SCALES
CHECK BEFORE USE

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REVISIONS

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DIMITRIOS K. SIATERLIS — STATE OF WASHINGTON — 23791 — REGISTERED PROFESSIONAL ENGINEER — PRELIMINARY

DESIGNED BY CMS
DRAWN BY CMS
CHECKED BY DKS
PROJECT ENGR DKS

PORT OF SEATTLE
MARINE FACILITIES

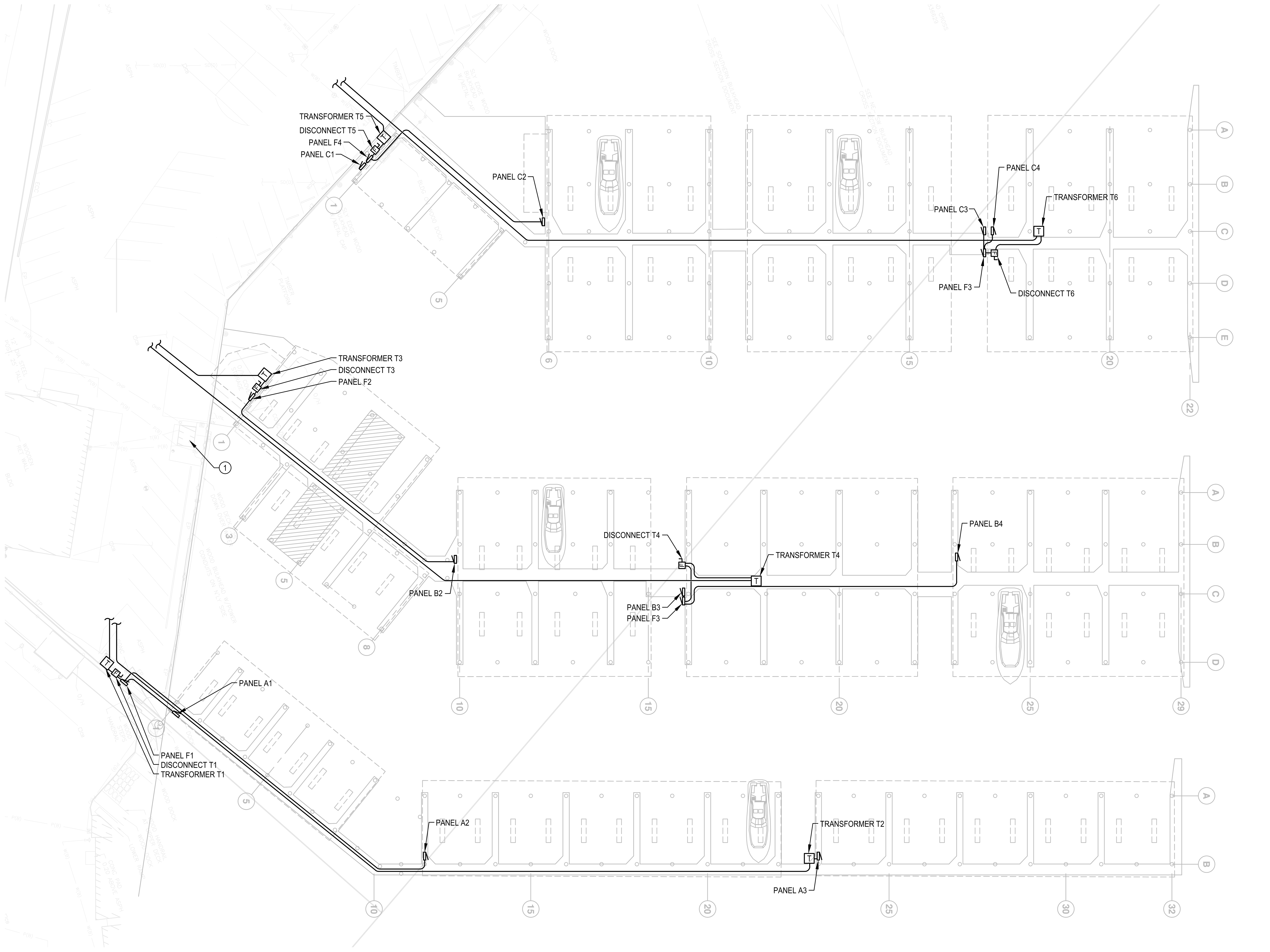
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

ELECTRICAL SYMBOLS AND ABBREVIATIONS

SCALE NONE
REVISION
DATE OCTOBER 2024
DRAWING NO. E00.01

CONCEPT DESIGN SUBMITTAL



GENERAL NOTES

1. DEMOLISH ALL EQUIPMENT SHOWN UNLESS NOTED OTHERWISE.
2. DEMOLISH ALL LUMINAIRES, LIGHTING WIRING AND CONDUITS ON DOCKS A, B AND C UNLESS NOTED OTHERWISE.
3. DEMOLISH ALL COMMUNICATIONS WIRING ON DOCKS A, B AND C UNLESS NOTED OTHERWISE.

KEYED NOTES

(1) PRESUMPTIVE LIGHTING PANEL AND TELEPHONE DEMARCATION LOCATION, TO BE FIELD VERIFIED.

NOTE TO REVIEWER

1. EXISTING ELECTRICAL INFORMATION IS BASED ON PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT, NO OTHER AS-BUILT INFORMATION HAS BEEN PROVIDED TO DATE. ALL INTERCONNECTIONS SHOWN ARE ASSUMED AND HAVE NOT BEEN FIELD VERIFIED.

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PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

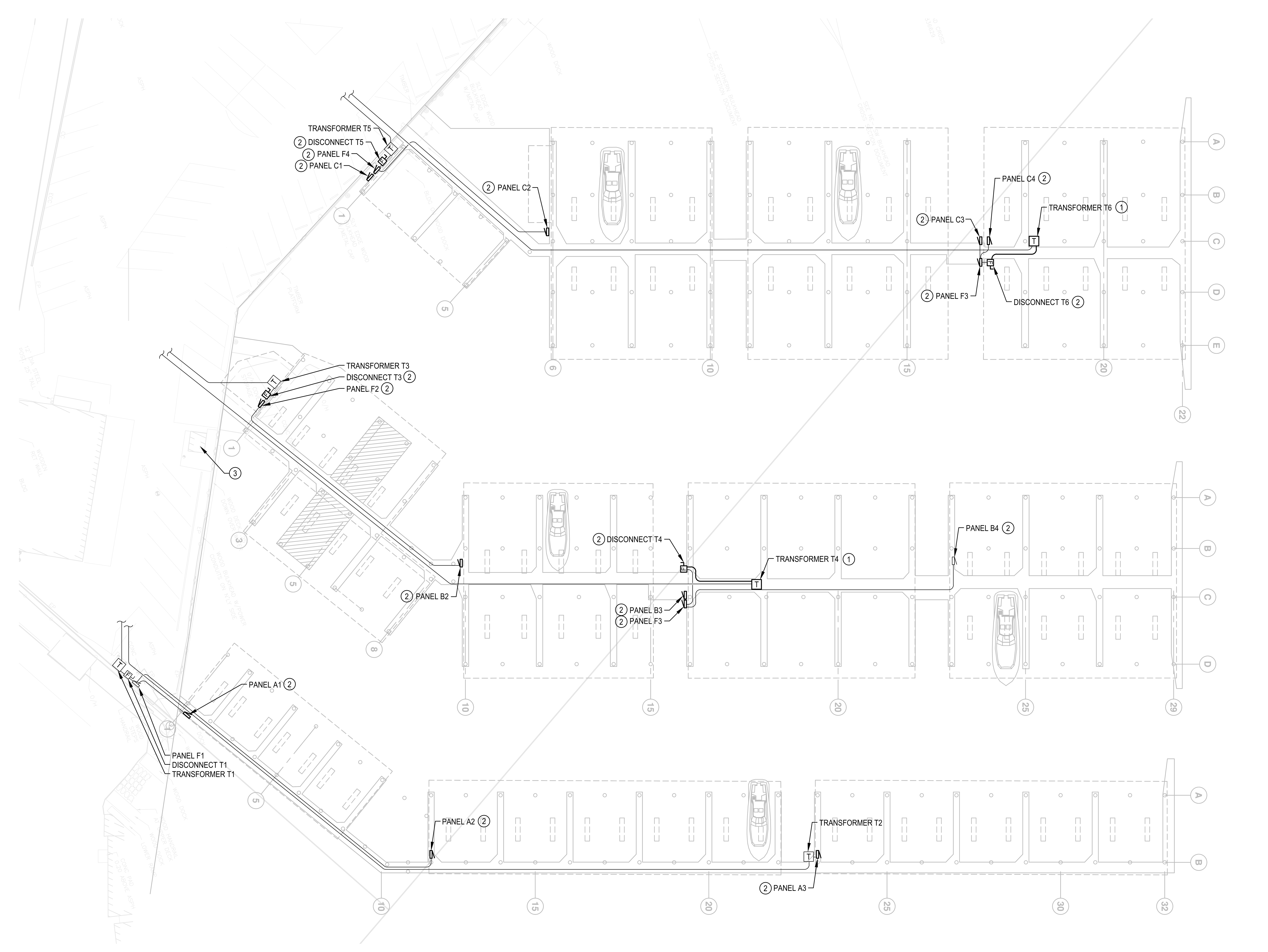
SALMON BAY MARINA DOCKS A–C ROOF SAFETY

ELECTRICAL DEMOLITION PLAN – OPTION 1
ROOF REPLACEMENT

SCALE AS NOTED
DATE OCTOBER 2024
REVISION

DRAWING NO.
DE11.11

CONCEPT DESIGN SUBMITTAL



GENERAL NOTES

1. ALL EQUIPMENT SHOWN IS EXISTING TO REMAIN UNLESS NOTED OTHERWISE.
2. DEMOLISH ALL LUMINAIRES, LIGHTING WIRING AND CONDUITS ON DOCKS A, B AND C UNLESS NOTED OTHERWISE.
3. DEMOLISH ALL COMMUNICATIONS WIRING ON DOCKS A, B AND C UNLESS NOTED OTHERWISE.

KEYED NOTES

1. RELOCATE TRANSFORMER PER SHEET E21.11.
2. REMOVE PANELBOARD / DISCONNECT TO ALLOW FOR DEMOLITION OF WALL. SEE SHEET E21.11 FOR REMOUNTING.
3. PRESUMPTIVE LIGHTING PANEL AND TELEPHONE DEMARCATION LOCATION, TO BE FIELD VERIFIED.

NOTE TO REVIEWER

1. EXISTING ELECTRICAL INFORMATION IS BASED ON PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT, NO OTHER AS-BUILT INFORMATION HAS BEEN PROVIDED TO DATE. ALL INTERCONNECTIONS SHOWN ARE ASSUMED AND HAVE NOT BEEN FIELD VERIFIED.

0 20 40
scale feet

GRAPHIC SCALES
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CONCEPT DESIGN SUBMITTAL

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PROJECT ENGR	DKS

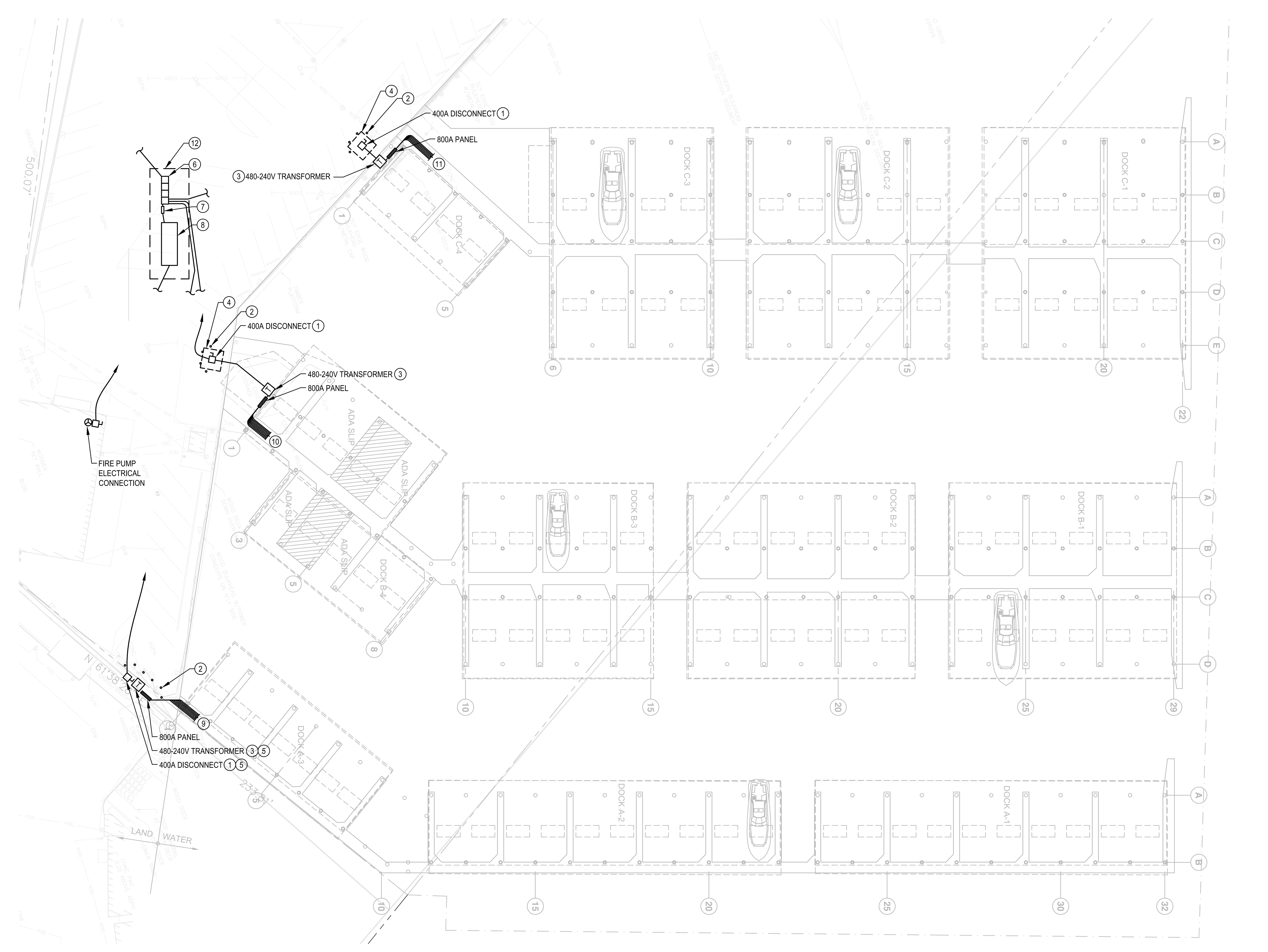
PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

ELECTRICAL DEMOLITION PLAN – OPTION 2
ROOF REMOVAL

SCALE: AS NOTED
DATE: OCTOBER 2024
REVISION
DRAWING NO.
DE21.11



GENERAL NOTES

1. PROVIDE FULL CUTOFF BOLLARD LUMINAIRES EVERY 15' ALONG DOCK PATHWAY.

KEYED NOTES

1. LOCATE SHOREPOWER DISCONNECT NO LESS THAN 5' FROM SHORE PER NEC 555.4.
2. PROVIDE STRUCTURAL BOLLARD, LOCATE BOLLARDS 5' ON CENTER FROM OTHER BOLLARDS.
3. PROVIDE 12" HIGH STAND FOR TRANSFORMER PER NEC 555.7.
4. PROVIDE EQUIPOTENTIAL BONDING CONDUCTORS PER NEC 555.14.
5. LOCATE EQUIPMENT AT LEAST 10' FROM SHORE PER 555.14.
6. 2000A SWITCHBOARD, LOCATION TO BE DETERMINED.
7. 1200A AUTOMATIC TRANSFER SWITCH, LOCATION TO BE DETERMINED.
8. 300KW GENERATOR, LOCATION TO BE DETERMINED.
9. PROVIDE SHOREPOWER PEDESTALS, LOCATIONS AND QUANTITIES TO BE DETERMINED. EXISTING TOTALS FOR THIS DOCK ARE 37 30A 120/240V AND 7 50A 120/240V RECEPTACLES PER THE PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT.
10. PROVIDE SHOREPOWER PEDESTALS, LOCATIONS AND QUANTITIES TO BE DETERMINED. EXISTING TOTALS FOR THIS DOCK ARE 54 30A 120/240V AND 2 50A 120/240V RECEPTACLES PER THE PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT.
11. PROVIDE SHOREPOWER PEDESTALS, LOCATIONS AND QUANTITIES TO BE DETERMINED. EXISTING TOTALS FOR THIS DOCK ARE 21 30A 120/240V AND 10 50A 120/240V RECEPTACLES PER THE PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT.
12. PROVIDE ~800 SQUARE FOOT BUILDING FOR HOUSING ELECTRICAL EQUIPMENT.

NOTE TO REVIEWER

1. EXISTING ELECTRICAL INFORMATION IS BASED ON PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT, NO OTHER AS-BUILT INFORMATION HAS BEEN PROVIDED TO DATE. ALL INTERCONNECTIONS SHOWN ARE ASSUMED AND HAVE NOT BEEN FIELD VERIFIED.

0 20 40
scale feet

GRAPHIC SCALES
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PROJECT ENGR	DKS

PORT OF SEATTLE
MARINE FACILITIES

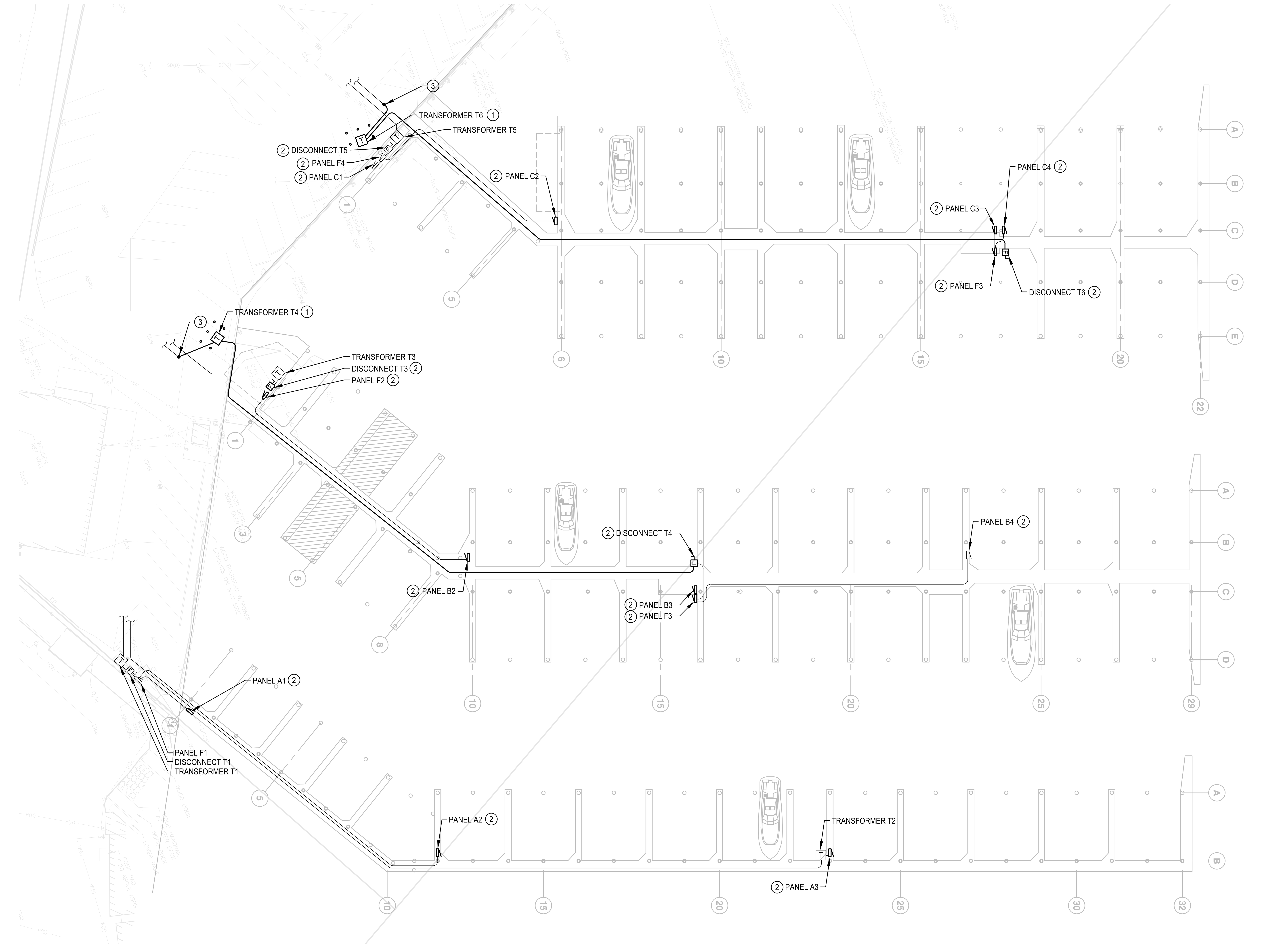
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

ELECTRICAL CONSTRUCTION PLAN – OPTION 1
ROOF REPLACEMENT

SCALE: AS NOTED
DATE: OCTOBER 2024
REVISION:
DRAWING NO. E11.11

CONCEPT DESIGN SUBMITTAL



GENERAL NOTES

1. PROVIDE FULL CUTOFF BOLLARD LUMINAIRES EVERY 15' ALONG DOCK PATHWAY.

KEYED NOTES

1. REMOUNT EXISTING TRANSFORMER TO NEW LOCATION PER NEC 555 AND SEATTLE ELECTRICAL CODE, SPLICE/EXTEND EXISTING CONDUITS AS NECESSARY AND RESTORE ALL EXISTING CONNECTIONS.
2. REMOUNT EXISTING PANELBOARD / DISCONNECT TO NEW FRAME STRUCTURE AND RESTORE ALL EXISTING CONNECTIONS.
3. INTERCEPT EXISTING FEEDER AND EXTEND TO NEW TRANSFORMER LOCATION, SEE KEYED NOTE 1.

NOTE TO REVIEWER

1. EXISTING ELECTRICAL INFORMATION IS BASED ON PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT, NO OTHER AS-BUILT INFORMATION HAS BEEN PROVIDED TO DATE. ALL INTERCONNECTIONS SHOWN ARE ASSUMED AND HAVE NOT BEEN FIELD VERIFIED.

0 20 40
scale feet

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PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

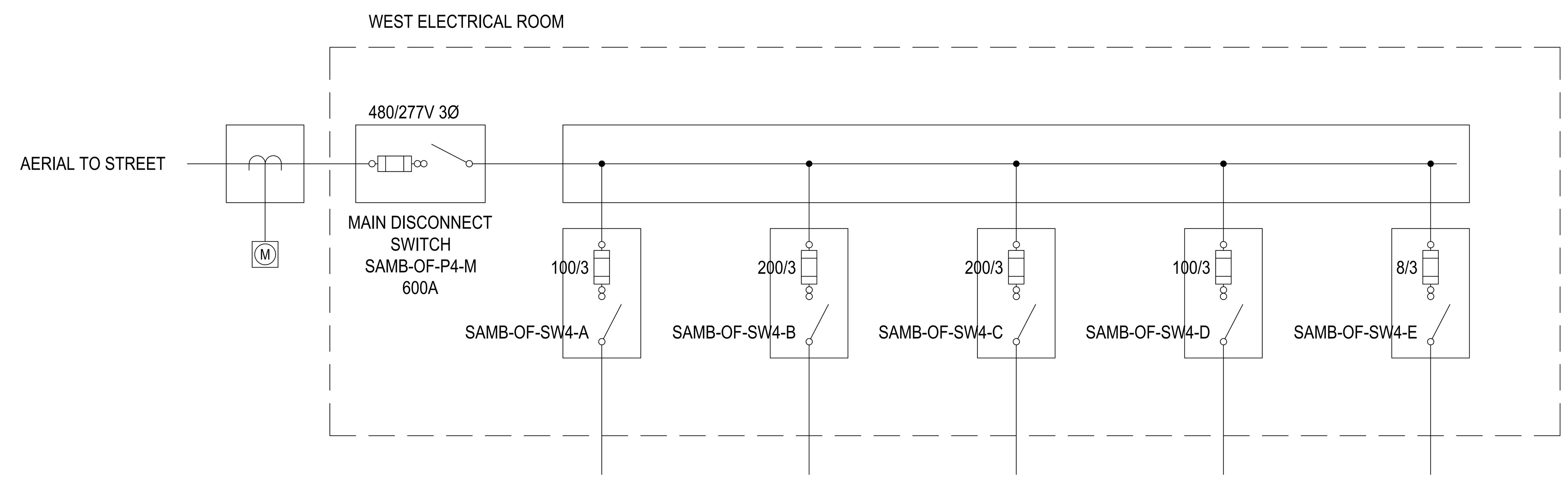
SALMON BAY MARINA DOCKS A–C ROOF SAFETY
ELECTRICAL CONSTRUCTION PLAN – OPTION 2
ROOF REMOVAL

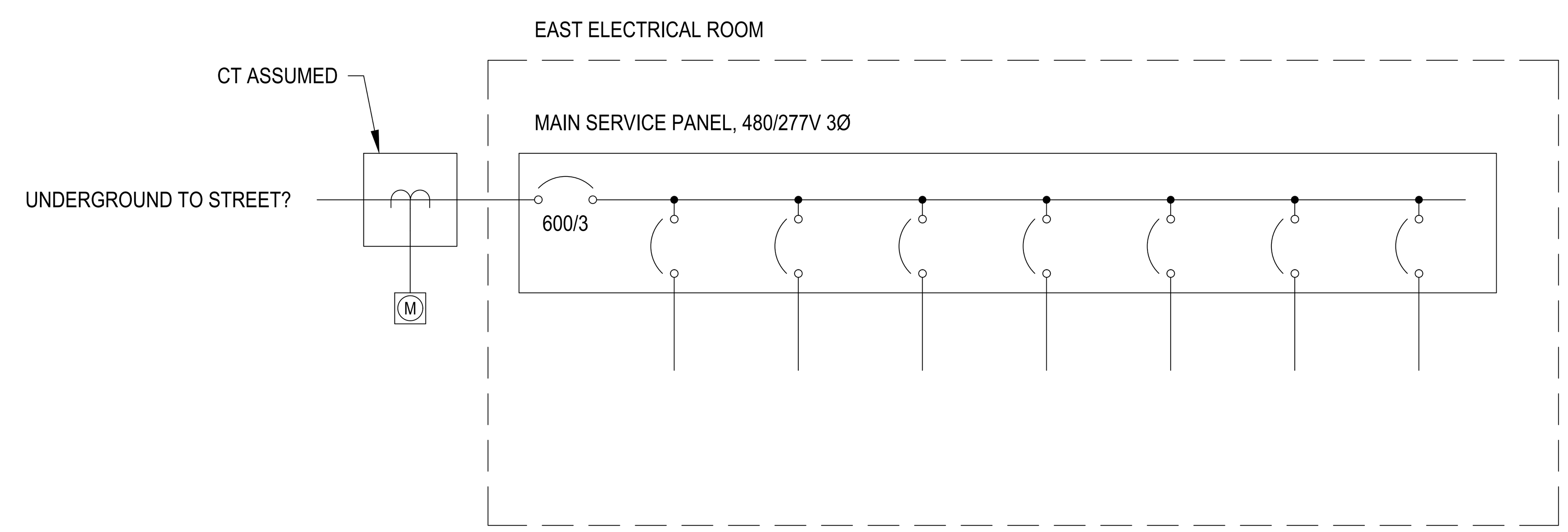
SCALE AS NOTED
DATE OCTOBER 2024
REVISION
DRAWING NO.
E21.11

CONCEPT DESIGN SUBMITTAL

GENERAL NOTES

1. ALL EQUIPMENT SHOWN IS EXISTING TO REMAIN UNLESS NOTED OTHERWISE.





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PORT OF SEATTLE
MARINE FACILITIES

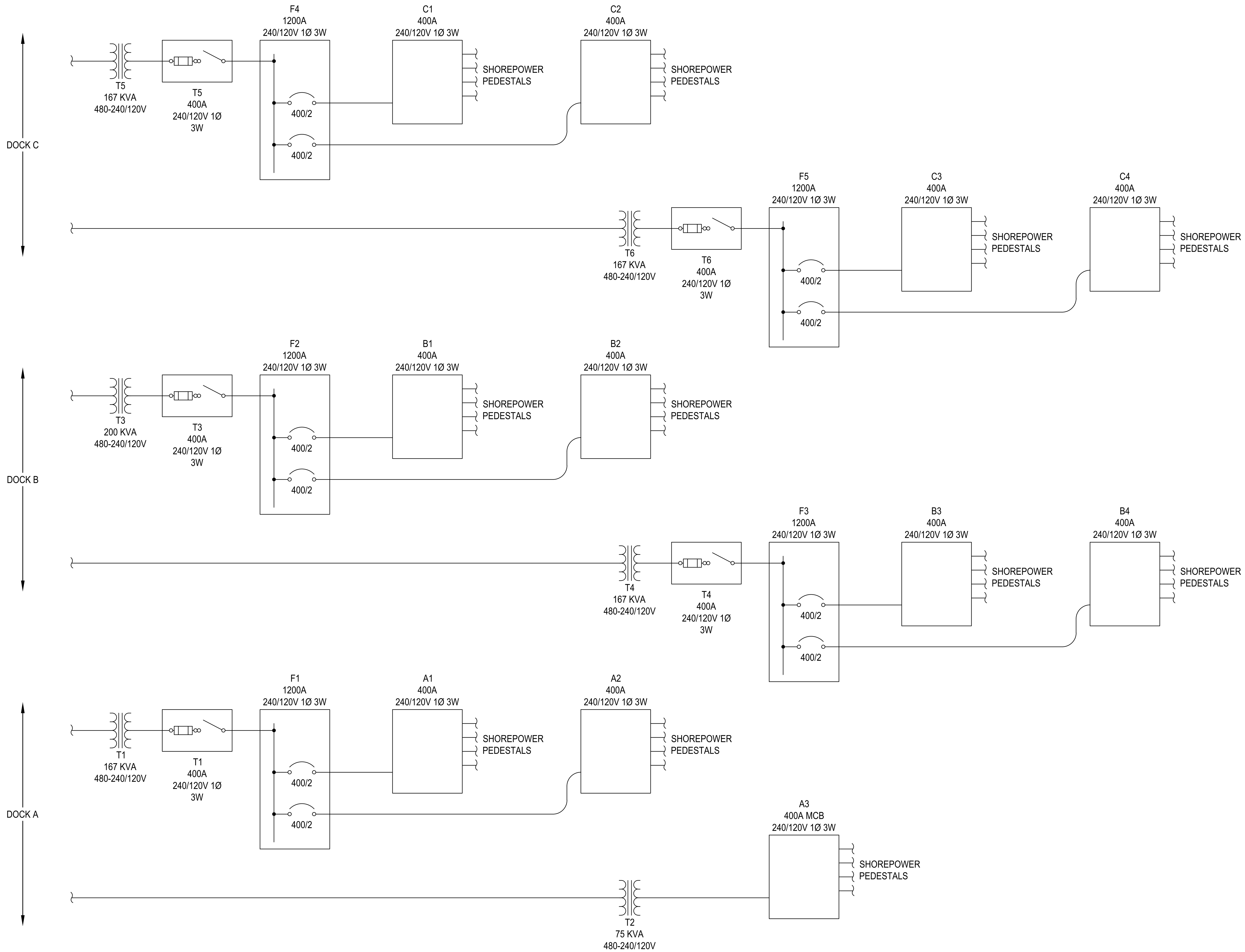
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION ONE–LINE DIAGRAM SERVICES
OPTION 1 ROOF REPLACEMENT

SCALE NONE
REVISION
DATE OCTOBER 2024
DRAWING NO.
DE10.51

CONCEPT DESIGN SUBMITTAL



GENERAL NOTES

1. DEMOLISH ALL EQUIPMENT SHOWN UNLESS NOTED OTHERWISE.

NOTE TO REVIEWER

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PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

DEMOLITION ONE–LINE DIAGRAM DOCKS A, B, C
OPTION 1 ROOF REPLACEMENT

SCALE NONE
REVISION
DATE OCTOBER 2024
DRAWING NO.
DE10.52

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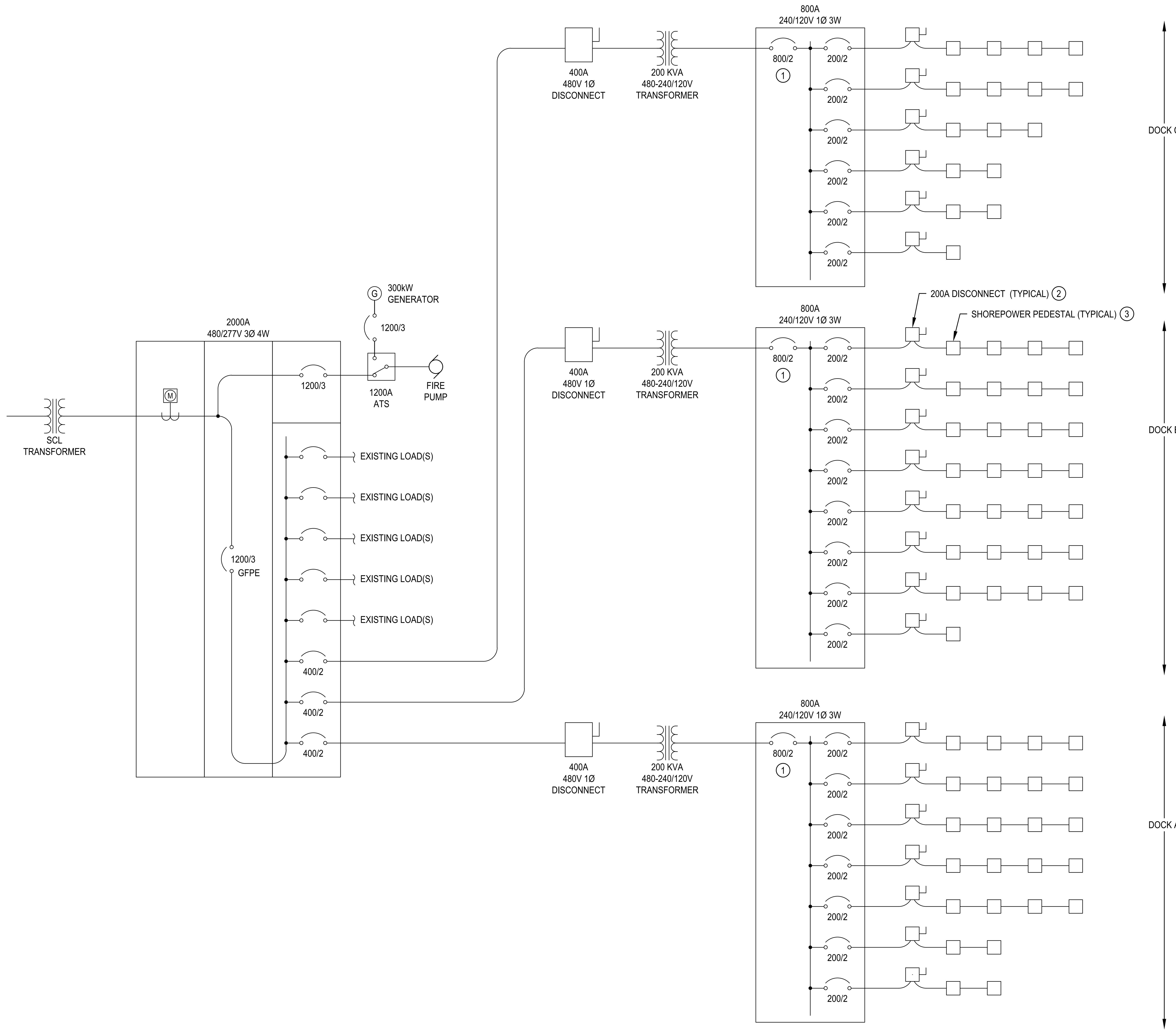

GENERAL NOTES

1. PROVIDE ALL EQUIPMENT SHOWN UNLESS NOTED OTHERWISE.

KEYED NOTES

1. PROVIDE GROUND-FAULT PROTECTION OF EQUIPMENT (GFPE) RATED AT 100mA PER NEC 555.35(A).
2. PROVIDE 200A DISCONNECT WITH "EMERGENCY SHUTOFF" LABEL WITHIN 50' OF ALL DOWNSTREAM MARINA POWER OUTLETS PER NEC 555.36(C).
3. PROVIDE GROUND-FAULT PROTECTION OF EQUIPMENT (GFPE) RATED AT 30mA FOR EACH MARINA POWER OUTLET PER NEC 555.35(B).

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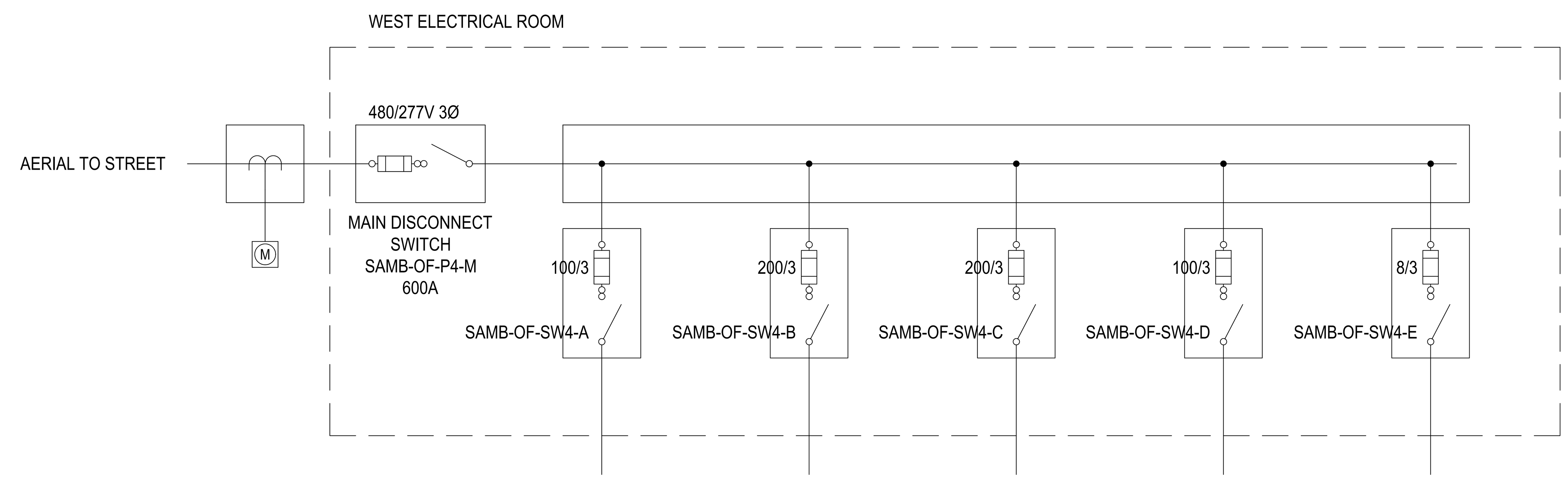
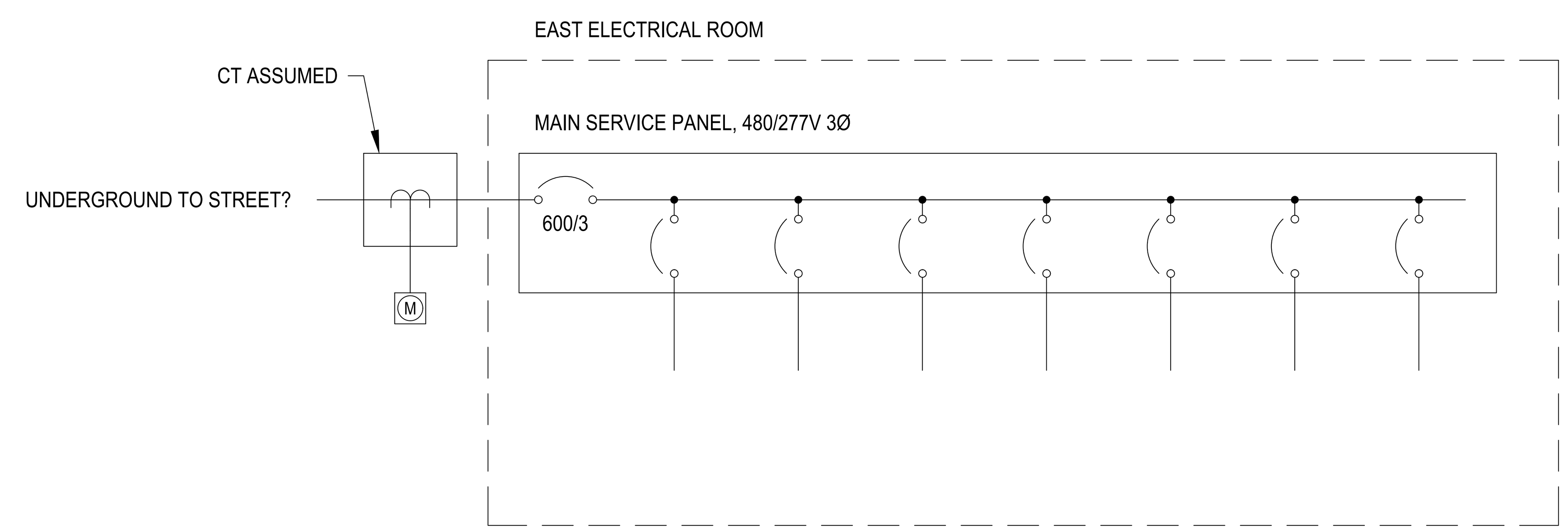
DRAWN BY CMS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY DKS	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR DKS	CONSTRUCTION ONE–LINE DIAGRAM – OPTION 1 ROOF REPLACEMENT	E10.53	

CONCEPT DESIGN SUBMITTAL

GENERAL NOTES

1. ALL EQUIPMENT SHOWN IS EXISTING TO REMAIN UNLESS NOTED OTHERWISE.





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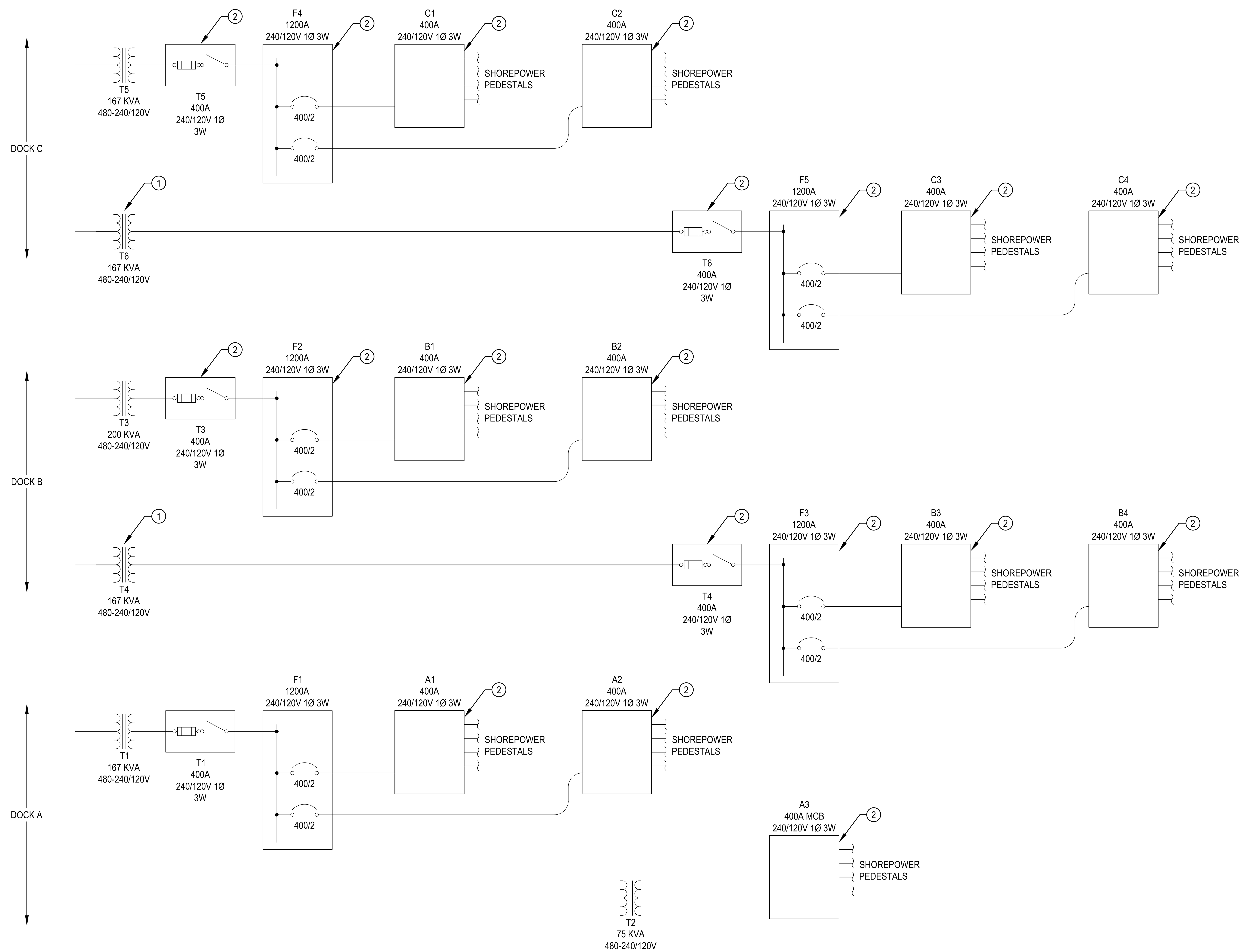
DRAWN BY CMS	SALMON BAY MARINA	DATE OCTOBER 2024	
CHECKED BY DKS	SALMON BAY MARINA DOCKS A–C ROOF SAFETY	DRAWING NO.	
PROJECT ENGR DKS	DEMOLITION ONE–LINE DIAGRAM SERVICES OPTION 2 ROOF REMOVAL	DE20.54	

CONCEPT DESIGN SUBMITTAL



GENERAL NOTES

1. ALL EQUIPMENT SHOWN IS EXISTING TO REMAIN UNLESS NOTED OTHERWISE.

KEYED NOTES

1. RELOCATE TRANSFORMER PER PLANS. NOTE TO REVIEWERS: INTERNAL CONDITION OF TRANSFORMER HAS NOT BEEN ASSESSED AND MAY NEED TO BE REPLACED WITH NEW TRANSFORMER IN FUTURE DRAWING SUBMITTALS.
2. REMOVE AND REMOUNT PANELBOARD / DISCONNECT PER PLANS.

NOTE TO REVIEWER

1. EXISTING ELECTRICAL INFORMATION IS BASED ON PORT'S 2023 ELECTRICAL CONDITION ASSESSMENT REPORT, NO OTHER AS-BUILT INFORMATION HAS BEEN PROVIDED TO DATE. ALL INTERCONNECTIONS SHOWN ARE ASSUMED AND HAVE NOT BEEN FIELD VERIFIED.

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PORT OF SEATTLE
MARINE FACILITIES

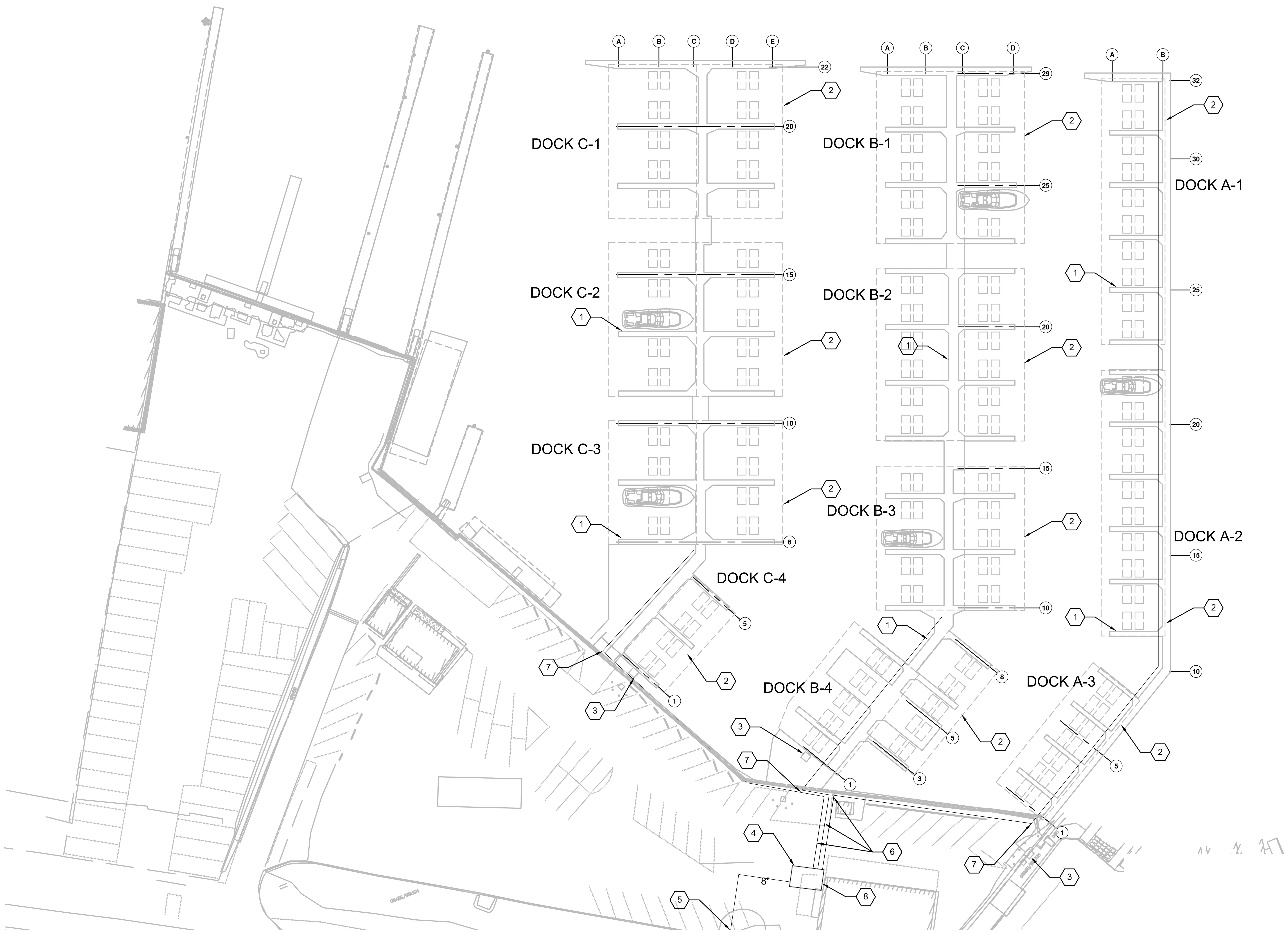
SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY
ONE–LINE DIAGRAM DOCKS A, B, C
OPTION 2 ROOF REMOVAL

SCALE NONE
REVISION
DATE OCTOBER 2024
DRAWING NO.
E20.55

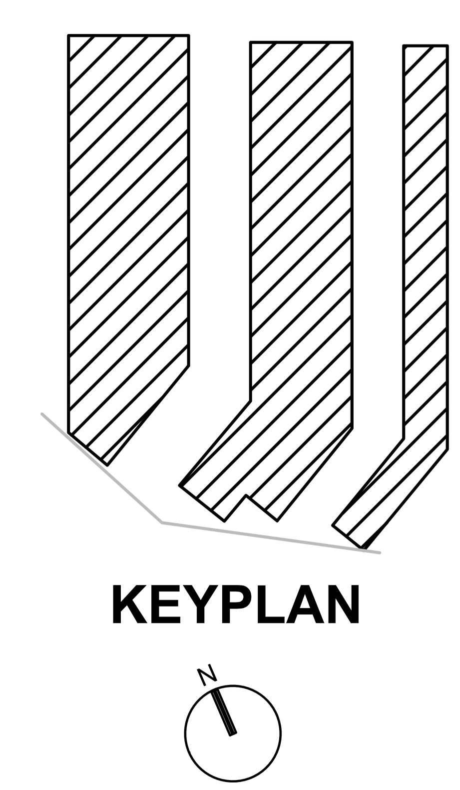
SHEET KEYNOTES

1. NEW DECK
2. OUTLINE OF THE NEW ROOF ABOVE
3. PROPOSED ELECTRICAL TRANSFORMER LOCATION
4. NEW FIRE PUMP ROOM WITH FIRE PUMP, FIRE PUMP CONTROLLER, AUTOMATIC TRANSFER SWITCH, AND ASSOCIATED APPURTENANCES. PROVIDE THREE (3) DRY-PIPE RISER ASSEMBLIES FOR PROTECTION OF EACH PIER.
5. CONNECT TO EXISTING UNDERGROUND WATER SUPPLY IN WEST COMMODORE WAY AND PROVIDE 8-INCH WATER SUPPLY TO FIRE PUMP ROOM
6. 8-INCH SPRINKLER SYSTEM RISER SUPPLY IN TRENCH
7. PROVIDE 8-INCH SEISMIC SEPARATION ASSEMBLY AT SHORE/PIER TRANSITION
8. PROVIDE FIRE ALARM CONTROL PANEL FOR SUPERVISION OF FIRE PUMP AND SPRINKLER SYSTEM EQUIPMENT



OVERALL DOCK PLAN (OPTION 1 ROOF REPLACEMENT)

1/32" = 1'-0"



KEYPLAN

0 32 64 96
1"= 32'

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SALMON BAY MARINA
DOCKS A–C ROOF SAFETY

DESIGNED BY J. CAMPBELL
DRAWN BY P. SILVA
CHECKED BY J. DELUCA
PROJECT ENGR X

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

SALMON BAY MARINA DOCKS A–C ROOF SAFETY

OVERALL DOCK PLAN
(OPTION 1 ROOF REPLACEMENT)

SCALE 1/32"=1'-0"
DATE OCTOBER 2024
REVISION

DRAWING NO.
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CONCEPT DESIGN SUBMITTAL

Appendix B. Conceptual Basis of Design

Conceptual Basis of Design

Document no: W3Y17302–REP–02
Version: R03

Port of Seattle

Salmon Bay Marina Docks A–C Roof Safety
December 23, 2024

Conceptual Basis of Design

Client name:	Port of Seattle		
Project name:	Salmon Bay Marina Docks A–C Roof Safety		
Document no:	W3Y17302–REP–02	**Project no:**	W3Y17302
Version:	R03	**Project manager:**	Aldo Ferrufino
Date:	December 23, 2024	**Prepared by:**	Discipline Leads

Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
R00	May 30, 2024	First Draft	Amir Lotfi, Connie Kuney–Pitts, Curtis Smith, Jack Campbell, Erika Shook, Betsi Phoebus	Richard Hills	Philippa Carter	Aldo Ferrufino
R01	July 30, 2024	Reissue to address Port comments and include sub-structure	Amir Lotfi, Connie Kuney–Pitts, Curtis Smith, Jack Campbell, Erika Shook, Betsi Phoebus	Vu Phan Kent Soelberg	John De Luca Philippa Carter	Aldo Ferrufino
R02	October 09, 2024	Reissue to address Port comments	Amir Lotfi, Connie Kuney–Pitts, Curtis Smith, Jack Campbell, Erika Shook, Betsi Phoebus	Vu Phan Kent Soelberg John De Luca	Richard Hills Philippa Carter	Aldo Ferrufino
R03	December 23, 2024	Reissue to address Port comments	Amir Lotfi, Connie Kuney–Pitts, Curtis Smith, Jack Campbell, Erika Shook, Betsi Phoebus	Vu Phan Kent Soelberg John De Luca	Richard Hills Philippa Carter	Aldo Ferrufino

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Contents

Appendices

Tables

Figures

1 Introduction

1.1 Description of Facility

Salmon Bay Marina (SaBM), originally built in 1961, was acquired by the Port of Seattle in 2018. Situated between the Ballard Locks (approximately 3,500 feet away) and the Ballard Bridge (about 1,400 feet away), it is located on the north side of Seattle along the south shore of the Lake Washington Ship Canal, northwest of Fishermen's Terminal. The marina spans five Docks (A–E) with a total of 181 slips. The scope of this study includes Docks A–C only (Refer to Figure 1), which currently offer c.132 slips (Refer to Figure 2) and c.26,000 square feet of covered moorage. The marina accommodates recreational boats, floating on–water residences (FOWRs), and liveaboards; the liveaboards have moorage agreements and are not considered tenants. Existing utilities include domestic water and electrical supply, as well as a manual dry standpipe system for fire protection. The existing telephone or cable TV wiring are understood to no longer be active.

The current marina structure consists of timber walkways and a timber–supported roof, all supported by continuous creosote timber piles.

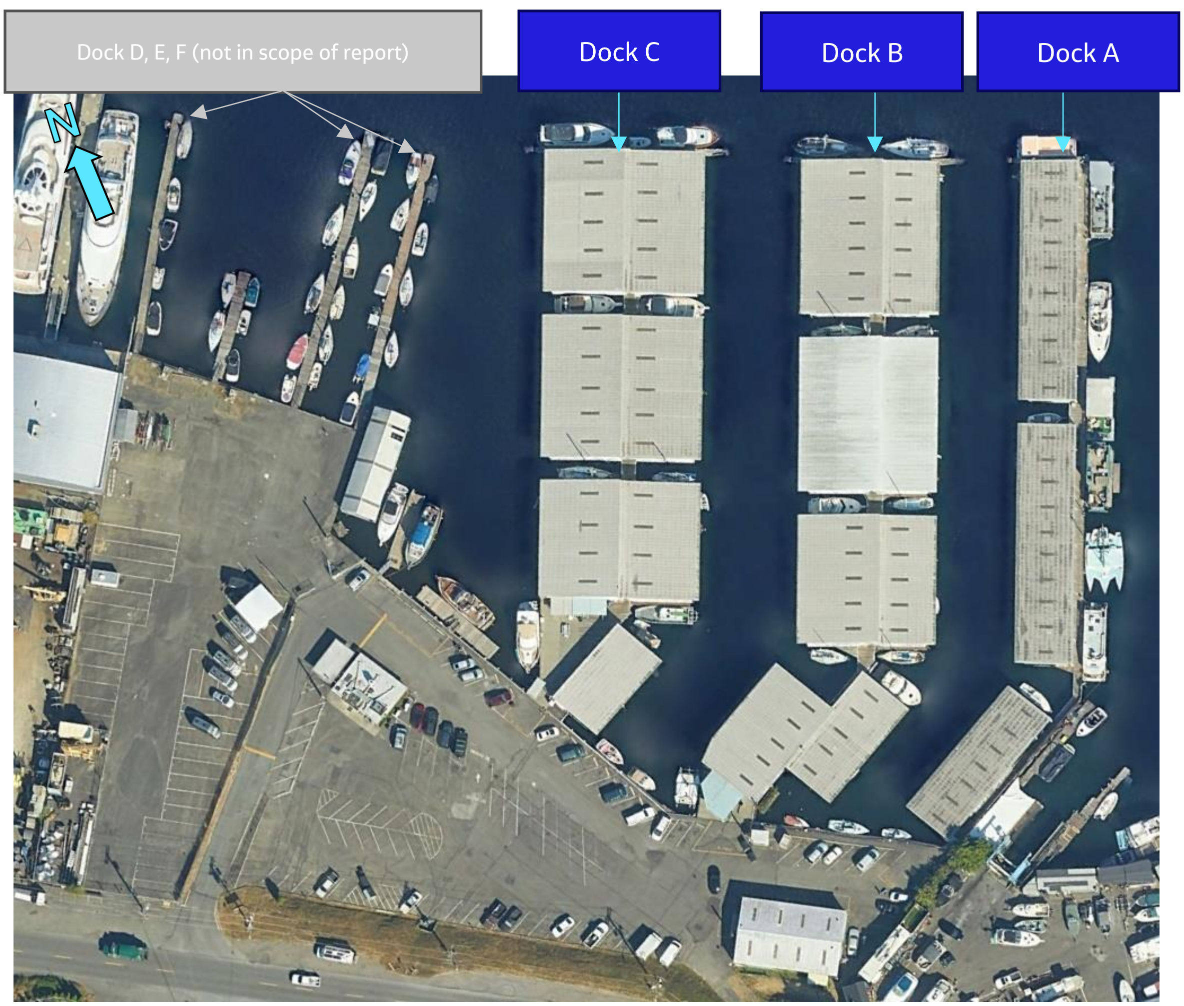

Figure 1 – Plan View showing Dock A, B, and C at Salmon Bay Marina (SaBM)

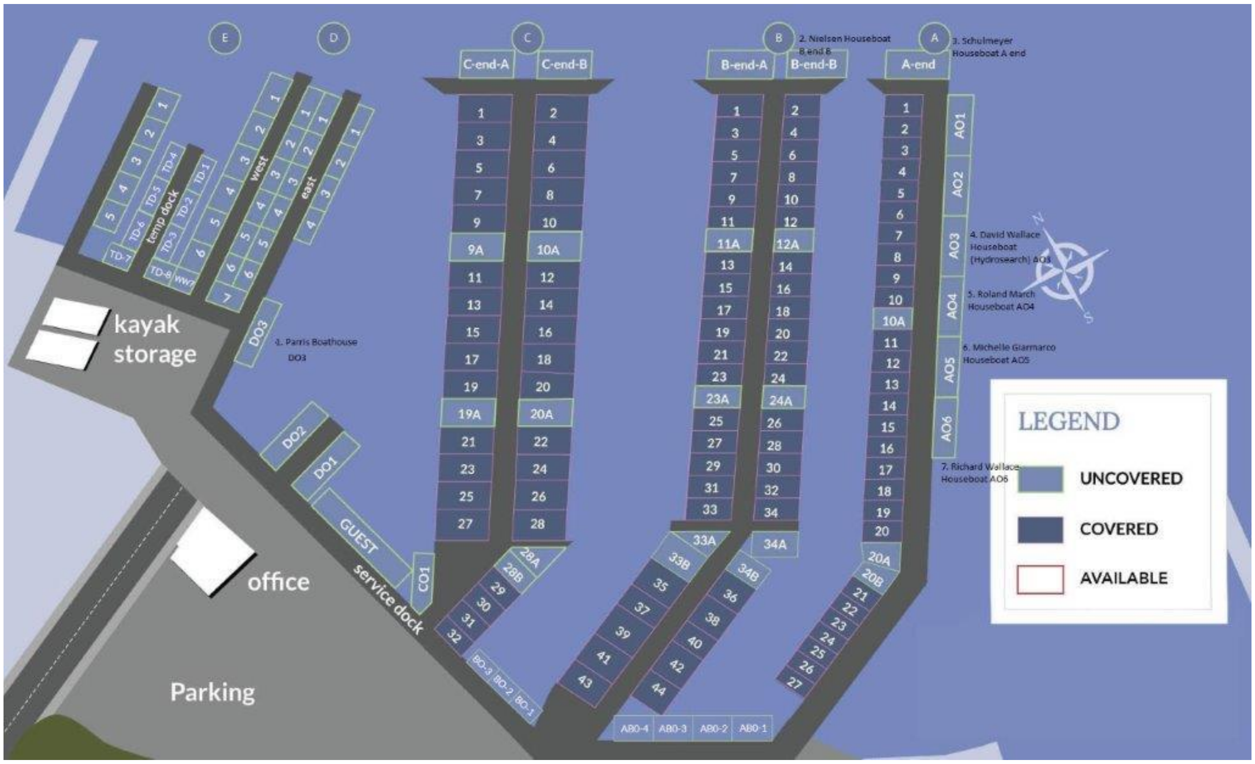

Figure 2 – SaBM Slip Information, as provided by the Port on 8-14-2024

The key cross-sectional elements of the existing covered moorage are shown in Figure 3.

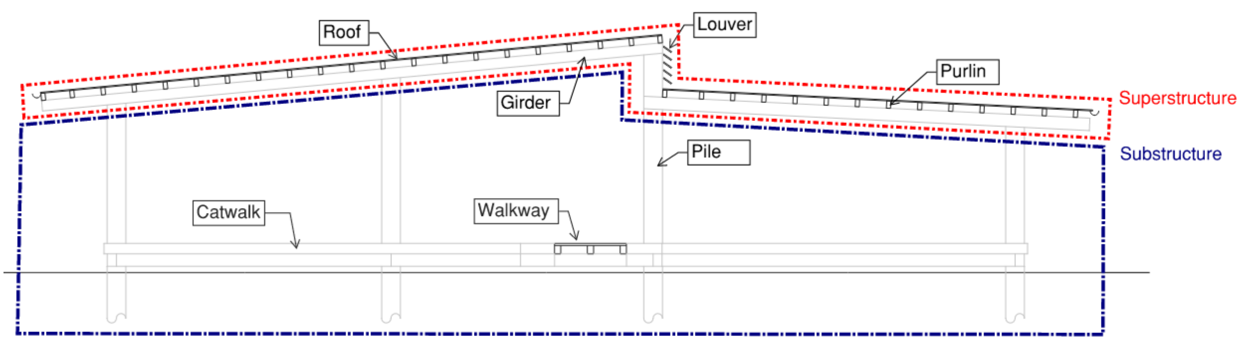

Figure 3 – Cross Sectional Elements of the Existing Covered Moorage of Dock A-C

1.2 Project Location

A Vicinity Map of the project site is provided in Figure 4.

Figure 4 – Project Vicinity Map

1.3 Project Objective

Based on the studies undertaken to date, the two main objectives are to address roof safety issues and fire suppression safety. The Port is concerned about the condition of the existing deteriorated roof structure, which is leaking and rusting, and creates a safety barrier to perform maintenance or repair. In addition, the current roof structure does not contain a fire suppression system, which poses fire safety, compliance, life safety, and liability risks. The Port is also concerned about access and maintenance issues, especially because the existing electrical infrastructure located within the roof is very difficult to access.

The Port is undertaking a feasibility assessment to support development of the concept design for two options: 1. Roof Replacement, and 2. Permanent Roof Removal. This feasibility assessment includes the respective technical and code considerations for these options. The outcome of this design effort will help inform the path forward selected by the Port.

1.4 Purpose of Document

The purpose of this Conceptual Basis of Design (BoD) is to document the codes, standards, guidelines, and assumptions that will be used for the concept design of the following two options for Docks A–C of SaBM:

- Option 1: Roof Replacement
- Option 2: Permanent Roof Removal

This BoD is to support conceptual design and it is not intended to be a complete BoD document for design. The contents and assumptions made in this document have been made at the time of this

document development and as such can be modified at any given time based on the requirements of the project.

1.5 Codes, Standards and Guidelines Version

The latest adopted version (as of June 2024) of the listed codes, standards and guidelines have been used in this BoD document. This is with the exception of the 2021 Seattle Codes that were in draft until their adoption on 15th November 2024, and include the 2021 Seattle Building Code (SBC) and 2021 Seattle Existing Building Code (SEBC).

2 Structural

2.1 Codes and Standards

The following codes and standards shall be used for this design:

- Seattle Existing Building Code 2021 (refer to Section 1.5)
- Seattle Building Code 2021 (refer to Section 1.5)
- American Society of Civil Engineers (ASCE) 7–16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- American Wood Council National Design Specification (NDS) for Wood Construction 2024/NDS Supplement 2024
- International Code Council, International Building Code (IBC), 2021
- US Army Corps of Engineers, United Facilities Criteria (UFC) Design: Piers and Wharves 4-152-01, 2017
- International Code Council, California Building Code, Chapter 31F - Marine Oil Terminal Engineering & Maintenance Standards (MOTEMS), 2019
- American Society of Civil Engineers (ASCE) 61-14 Seismic Design of Piers and Wharves, 2014
- American Society of Civil Engineers (ASCE) 41-17 Seismic Evaluation and Retrofit of Existing Buildings, 2017
- American Concrete Institute (ACI) 318-14 Building Code Requirements for Structural Concrete, 2014
- American Institute of Steel (AISC) 360-16 Specifications for Structural Steel Buildings, 2016
- Occupational Safety and Health Administration (OSHA) Standard,1970
- American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice (MOP) Number 50 - Planning and Design Guidelines for Small Craft Harbors, Third Edition, 2020

2.2 Design Criteria

The loads stated in this section shall be used for Option 1 unless otherwise stated.

The following design loads were used in the original construction per the 1960 Covered Moorage Permit Drawings:

- Live load roof = 25 psf
- Catwalks = 25 psf
- Walkways = 50 psf

Dead Loads shall include the following based on industry standards:

- Self-weight of the pier
- Timber unit weight = 60 pcf
- Steel unit weight = 490 pcf

The design loads for a new roof structure shall be based on ASCE 7–16, the Seattle Building Code, and Fisherman's Terminal Geotechnical Memorandum (dated 11–17–2022). These loads shall include the following:

- Live Loads:
  - Roof:
    - Concentrated = 300 lbs. (Seattle Building Code, Table 1607.1, 27 – Roofs subject to maintenance workers)
    - Uniform = 20 psf (Seattle Building Code Table, 1607.1–26 – Ordinary roofs that are not occupiable)
    - Fall protection anchorage = accommodate 5,000 lbs. anchor load acting in any direction (OSHA 1926.501 and 1926.502)
  - Catwalks = 40 psf (Seattle Building Code Table, 1607.1–6 – Catwalk)
  - Walkways (assumed to be considered exit way) = 100 psf (Seattle Building Code Table, 1607.1–30 – Stairs and exits, other)
- Rain:
  - Roof =1 in/hour (Seattle Building Code, Figure 1611.1)
  - Catwalks =1 in/hour (Seattle Building Code, Figure 1611.1)
  - Walkways = 1 in/hour (Seattle Building Code, Figure 1611.1)
- Snow:
  - Roof = 25 psf (Seattle Building Code, Section 1608.1)
  - Catwalks = 25 psf (Seattle Building Code, Section 1608.1)
  - Walkways = 25 psf (Seattle Building Code, Section 1608.1)
- Wind:
  - Risk Category = II (Seattle Building Code, Table 1604.5 - Building is not an essential facility and does not constitute a substantial risk to human life or cause substantial economic impact in the event of an extreme wind event)
  - Enclosure Classification = Open Building (ASCE 7-16, 26.12)
  - Design Wind Speed = 98 mph (interpolated from Seattle Building Code, Figure 1609.3(1))
  - Exposure Category = D (ASCE 7-16, 26.7.3)
- Seismic (for Option 1 Only):
  - Site Class = E (Fisherman's Terminal Geotechnical Memorandum)
  - Risk Category = II (Seattle Building Code, Table 1604.5 - Building is not an essential facility and does not constitute a substantial risk to human life or cause substantial economic impact in the event of an extreme seismic event)
  - Design short-period seismic parameter, S_{DS} =0.718 g (Fisherman's Terminal Geotechnical Memorandum)

- Design 1-second seismic parameter, S_{D1} = 1 g (Fisherman's Terminal Geotechnical Memorandum)
- Seismic Loads are combined with 10% of live load demands and mass per ASCE 61-14.
- Response Spectrum = See Table 1 (Fisherman's Terminal Geotechnical Memorandum)
- Lateral spreading = 1.3 lbs./in^2 at mudline to 5 lbs./in^2 at top of glacially consolidated soil (Fisherman's Terminal Geotechnical Memorandum). It should be noted that the data is from a site which is located approximately 2,000 ft from the Salmon Bay site.
- Where seismic lateral spreading demands are considered, 25% of the structure inertial demand is combined with the lateral spreading demand.

Table 1. MCE_R Response Spectrum

T (s)	0	0.1	0.2	0.3	0.4	0.5	0.75	1	1.5	2	3	4	5
MCE_R Sa (g)	0.45	0.66	0.89	1.08	1.08	1.08	1.08	1.08	1	0.75	0.5	0.37	0.3

Where:

g = gravity

MCE_R = risk-targeted maximum considered earthquake

s = seconds

Sa = spectral acceleration

T = period

- Berthing/Mooring:
  - In lieu of berthing and mooring specific demands based on vessel geometry, speed, draft, angle of impact, energy dissipation mechanism, and mooring line properties, the demand is instead evaluated as an impact load on the pile.
  - 10 kips of impact load is used for analysis.
  - The mooring cleats shall be based on the line capacity, meaning that th lines securing the boat will fail before the cleat fails. The cleats will also be designed to fail before the structure fails.
- Photovoltaics (not included in design as this stage):
  - The Port requested that photovoltaic panel loading be considered. The following loads were used to ensure design can support any photovoltaic panels in the future:
    - 5 psf
    - The loads will vary by manufacturer. Based on Sistine Solar, solar panel equipment can range from 2.5 psf to 5 psf (accessed on 12/3/2024, https://sistinesolar.com/how-much-do-residential-solar-panels-weigh/).

For structural design, Load and Resistance Factor Design (LRFD) will be used. Therefore, all structures shall be designed to resist the most critical effects resulting from the following code required combinations of factored loads (section 1605.2 of the 2021 Seattle Building Code):

Load Combination 1 (LC1): 1.4 (D + F)

Load Combination 2 (LC2):1.2 (D + F) + 1.6 (L +H) + 0.5 (Lr or S or R)

Load Combination 3 (LC3):1.2 (D + F) + 1.6 (L_r or S or R) + 1.6H + (f_1L or 0.5 W)

Load Combination 4 (LC4): 1.2 (D + F) + 1.0 W + f_1L + 1.6H + 0.5 (L_r or S or R)

Load Combination 5 (LC5): 1.2 (D + F) + 1.0 E + f_1L + 1.6 H + f_2S

Load Combination 6 (LC6): 0.9 D + 1.0 W + 1.6 H

Load Combination 7 (LC7): 0.9 (D + F) + 1.0 E + 1.6 H

From UFC:

Load Combination 8 (LC8): 1.2D+1.6L+1.6H+1.6Be

Load Combination 9 (LC9): 1.2D+1.6L+1.6H+1.6M

where:

D = Dead load.

E = Earthquake load.

F = Load due to fluids with well–defined pressures and maximum heights.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Live load.

L_r = Roof live load.

R = Rain load.

S = Snow load.

W = Load due to wind pressure.

f_1 = 1 for places of public assembly live loads in excess of 100 psf, and parking garages; and 0.5 for other live loads.

f_2 = 0.7 for roof configurations that do not shed snow off the structure, and 0.2 for other roof configurations.

Be = Berthing load.

M = Mooring/Breasting load.

According to the National Weather Service, Seattle typically sees maximum high temperatures below 100°F.

The reference datum shall be the North American Vertical Datum of 1988 (NAVD 88) for both Options 1 and 2. The original permit drawings do not state what datum is referenced. It states that the water level is 21.8 ft (refer to Figure 5) which matches the US Army Corps of Engineers (USACE) historical Ordinary High Water (OHW) level for Lake Washington. The official Lake Washington water levels are measured at the Ballard Locks. This is measured using the Corps of Engineers (COE) datum. The USACE provides a table with conversions between COE, MLLW, and NAVD 88 (Refer to Figure 6). The Locks maintain the water level of Lake Washington, so it remains between 20 ft to 22 ft (COE) which is equivalent to 16.78 ft to 18.78 ft (NAVD 88).

ORDINARY HIGH WATER DATUM FOR SOME FRESHWATERBODIES
IN THE SEATTLE DISTRICT
19 March 1981

Waterway	Ordinary High Water (OHW)[1] in feet	Datum
Lakes:		
Capital Lake	14.5	MLLW
Coeur d'Alene Lake	2128.0	NGVD
Lake Chelan	1100.0	NGVD
Lake Pend Oreille	2062.5	NGVD[3]
Lake Koocanusa	2459.0	NGVD
Lake Sammamish	27.0	NGVD[4]
Lake Washington	21.8	C.O.E.[5]
Flathead Lake	2893.0	NGVD

Figure 5 – USACE Historical Ordinary High Water, extracted from USACE

Note: The USACE Historical Ordinary High Water levels shown in Figure 5 above were accessed on 10/01/2024, at the following web address: https://www.nws.usace.army.mil/Portals/27/docs/regulatory/permit%20guidebook/OHW%20Datums.pdf

Relation Between Various Datum Planes					
Datum Plane	MLLW	NGVD 29	NAVD 88	Corps of Engineers	City
Highest Estimated Tide					
Mean Higher High Water	11.35	5.25	8.83	12.05	-0.88
Mean High Water	10.49	4.39	7.97	11.19	-1.74
Mean (Half) Tide Level	6.66	0.56	4.14	7.36	-5.57
NGVD	6.10	0.00	3.58	6.80	-6.13
Mean Low Water	2.83	-3.27	0.31	3.53	-9.40
Mean Lower Low Water	0.00	-6.10	-2.52	0.70	-12.23
Lowest Estimated Tide					

Figure 6 – USACE Datum Planes Conversions Table, extracted from USACE

Note: The USACE Datum Planes Conversions Table shown in Figure 6 above was accessed on 10/01/2024, at the following web address; https://www.nws.usace.army.mil/About/Offices/Engineering/Hydraulics-and-Hydrology/Historical-Datum-Regions/North-Puget-Sound/Hiram-M-Chittenden-Locks/

Table 2. Datum Conversions

Datum	C.O.E.	NAVD 88
Conversion	0 ft	-0.7-2.52=-3.22 ft
Ordinary High Water (OHW)	21.8 ft	18.58 ft

2.3 Materials

2.3.1 Original Construction Materials

The following materials were used in the original superstructure construction per the 1960 Covered Moorage Permit Drawings:

- Timber – Douglas Fir, Fiber Stress in Bending (Fb) = 1500 psi
- Concrete, Compressive Strength of Concrete (fc) = 1220 psi
- Roofing– 0.034" Aluminum panels

Preliminary analysis shows that the existing girders and purlins are structurally deficient. New materials will be required if the roof is replaced. Refer to the Feasibility Assessment Report, Jacobs 2024, for the preliminary analysis results.

The following information on the existing piles was taken from the 1960 Covered Moorage Permit Drawings:

- Material: Douglas Fir–Larch
- Fiber Stress in Bending (Fb) = 1500 psi
- Minimum butt diameter: 12"
- Minimum tip diameter: 7"
- Minimum test bearing: 7 tons
- Test pile lengths from tip to lake surface elevation:
    - Test 1: 58'
    - Test 2: 50'
    - Test 3: 25'

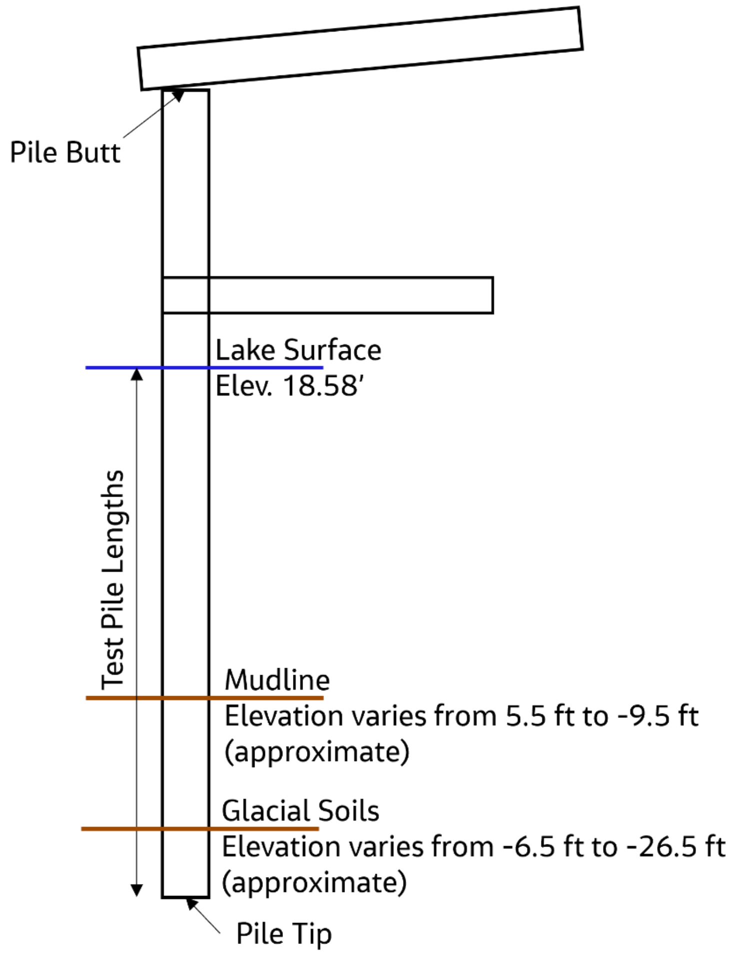

Figure 7 – Illustration of the Original Test Piles (Datum is NAVD 88 for All Elevations)

Preliminary analysis shows that the existing piles are structurally deficient for supporting a new roof. New materials will be required if the roof is replaced. See the Feasibility Assessment Report, Jacobs 2024, for the preliminary analysis results.

2.3.2 New Construction Superstructure Materials for Option 1

Materials for primary framing members (beams, girders, and purlins) will likely consist of one or more of the following:

- Sawn Lumber – Douglas Fir or Alaska Cedar (treated for marine environment)
- Glulam – Douglas Fir or Alaska Cedar (treated for marine environment)

These materials typically provide the strength, durability, and ease of fabrication and handling desired in this installation environment. Alternative materials considered include steel and plastic. Steel is less desirable in this application because of the significant upkeep demands of the coatings. Fiberglass and plastics are less desirable in this application because they are relatively less strong per unit weight. A larger section would be required to carry the same load as timber.

For analysis purposes, architectural roof decking is anticipated to be light gage coated carbon steel or aluminum.

Framing connection hardware will likely consist of one or more of the following types of materials:

- Coated zinc–galvanized steel
- Stainless steel

2.3.3 New Substructure Materials (Option 1 Only)

The following materials will be considered for the new piles:

- Concrete
- Steel (galvanized and epoxy paint coated)
- Timber
- Fiberglass/plastics

Steel is recommended for this application because it is an industry standard that provides higher capacity, deeper embedment, and options for corrosion protection. Concrete is also suitable but precast concrete is limited by length and drivability. Timber requires larger sections and is also limited on service life and drivability. Fiberglass would also require larger sections to accommodate the same loads. The main factor considered is that the pile used needs to be driven to within the glacial till beneath the soft liquefiable soils. Glacial till is a strong compacted material, so timber and concrete are a challenge to drive into this solid layer. The steel pile would be galvanized with epoxy coatings at the splash zones to provide another layer of corrosion protection.

Materials for primary framing members (beams, girders, and purlins) at the catwalks and walkways will likely consist of one of the following for the same reasons as discussed in Section 2.3.2:

- Sawn Lumber – Douglas Fir (treated for marine environments)
- Sawn Lumber – Alaskan Cedar (treated for marine environments)

All timber treatment shall not include pentachlorophenol, creosote, chromate copper arsenate (CCA) or comparably toxic compounds in accordance with SMC 23.60A.187.E.5.

The walkway surfaces (i.e., deck planks) could be sawn lumber, composite decking, or steel grating. Composite decking is made of recycled materials and has lower maintenance requirements compared to timber decking. It is typically more expensive than timber. Steel gratings would allow for light permeability to the water below.

2.4 Structural Summary and Recommendations

2.4.1 Option 1 – Roof Replacement

Preliminary analysis with current codes and standards determined that the existing roof girders and purlins where deficient under roof loading combinations including live, dead, snow, and wind demands. Various members in the roof structural framing are also warped and deteriorated, reducing structural capacity. Preliminary analysis recommends replacement of the roof structural framing with higher capacity timber materials. Under the Seattle Existing Building Code Section 311, modification of the roof also triggers seismic evaluation of the marina dock. Preliminary seismic evaluation using geotechnical

information for the nearby Fisherman's Terminal site determined that the existing timber piles were also structurally deficient. The predominate demand on the system was not the inertial seismic mass from the superstructure of the dock, but lateral spreading demands in the upper layers of soil surrounding all piles due to the presence of potentially liquefiable soils during a seismic event. Galvanized steel pipe piles embedded below the liquefiable soil layers are recommended. Piles are coated in multiple layers of epoxy paint and designed for a sacrificial loss in thickness as additional measures for corrosion resistance on the piles. Because new piles are driven, the existing timber walkway would also require replacement. Preliminary analysis determined the walkway structural members were deficient due to increased live loading in the current Seattle Building Code. The walkway members will be composed of steel grating panels to allow for some light to reach the water under the walkways.

2.4.2 Option 2 – Permanent Roof Removal

Under the option to remove timber roof structure and metal roof sheeting, the Seattle Existing Building Code Section 311 was deemed to not trigger seismic evaluation of the existing marina dock including the existing timber piles. Removal of the roof lowers dead, live, wind, and inertial seismic demands on the existing timber piles. Therefore, no change will be made that would require replacement of the existing timber piles and walkway. It should be noted, however, that seismic lateral spreading demands due to the potential presence of liquefaction in the soil still puts the marina dock at risk of permanent pile deformation or collapse under the design seismic event. The roof removal option does not increase demands on any existing member but also does not improve structural members current design criteria, particularly seismic design criteria in liquefiable soils.

3 Architectural

3.1 Applicable Codes, Standards, and Regulations

This section covers life safety codes and standards to be used during project design. This list is not inclusive of all code requirements and other sections of this document will include additional discipline and subject–specific code requirements.

This section covers codes specific to Life Safety and are generally applied locally for construction permitting and federally as legal requirements.

- 2021 Seattle Building Code (SBC)
- 2021 Seattle Existing Building Code (SEBC)

3.2 Other Codes and Standards

The following additional codes and standards apply:

- City of Seattle Municipal Code (SMC), including the Shoreline Master Program, in Chapter 23.60A SMC
- State Shoreline Management Act of 1971
- Washington State Hydraulic Code (Chapter 77.55 RCW and WAC 220-660)
- OSHA Compliance Requirements (confined spaces, fall protection, emergency response, and environmental documentations) and as augmented by the Washington Industrial Safety and Health Act (WISHA).
- 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design
- United States Access Board; Accessible boating facilities 2003

3.3 Option 1 – Roof Replacement

Based on the structural summary presented for this option in with Section2 above, the roof replacement triggers seismic evaluation which in turn requires the replacement of both the substructure and the superstructure. Thus, this option triggers code requirements for new construction.

3.4 Option 2 – Permanent Roof Removal

Based on the structural summary presented for this option in Section 2, there is no code triggered replacement of the substructure for the removal of the existing roof. Thus, this option does not trigger code requirements for new construction.

4 Fire Protection

4.1 Codes and Standards

The following codes and standards shall be used for this design:

- Seattle Building Code 2021 (refer to Section 1.5)
- Seattle Fire Code 2021
- Seattle Electrical Code 2023
- National Fire Protection Association (NFPA) 13: Standard for the Installation of Sprinkler Systems
- National Fire Protection Association (NFPA) 14: Standard for the Installation of Standpipe and Hose Systems
- National Fire Protection Association (NFPA) 20: Standard for the Installation of Stationary Pumps for Fire Protection
- National Fire Protection Association (NFPA) 24: Standard for the Installation of Private Fire Mains and Their Appurtenances
- National Fire Protection Association (NFPA) 70: National Electrical Code 2023 with Washington Administrative Code and Seattle Electrical Code amendments
- National Fire Protection Association (NFPA) 72: National Fire Alarm and Signaling Code

4.2 General

Currently the existing piers are provided with approved (based on the Fire Marshal letter dated July 21, 2014) manual dry standpipes, with hose valve connections spaced along the length of each pier. Fire department connections are freestanding mounted at the entrance to each pier.

Fire extinguishers are cabinet mounted on columns along the length of each pier, with locations identified by signage.

4.2.1 Option 1 – Roof Replacement

Fire Suppression System Requirements

In accordance with Seattle Building Code, Section 429.9, sprinklers must be provided for boat moorings with combustible structures. The existing piers are not provided with sprinkler protection, and sprinkler systems must be added to meet current code requirements. The sprinkler systems must be designed to protect NFPA 13 hazard classification Extra Hazard – Group 2. Dry–pipe sprinkler systems comprised of black steel and compressed nitrogen are recommended in lieu of wet–pipe sprinkler systems with heat trace and insulation due to cost considerations and life of system maintenance in a marine environment. Dry–pipe system demand area calculations must be increased 30 percent in accordance with NFPA 13. Based on the required demand area increase and Extra Hazard – Group 2 requirements, the design/area density must be calculated at 0.40 gpm/sf over the most remote 3,250 sf with a hose stream of 500 gpm.

Based on proximal water supply information provided by the City of Seattle and preliminary calculations (refer to Appendix A and Appendix B respectively) conducted by Jacobs, the available water supply in the

vicinity is not adequate to supply the estimated sprinkler system demand and a fire pump will be required. The estimated fire pump size required is 1,500 gpm at 100 psi. A more localized water flow test should be performed to provide a higher degree of accuracy for pump sizing.

The fire pump room will be located onshore, and a new underground water supply line will be necessary to provide water service to the fire pump. The new service line for pier fire suppression systems will connect from the existing water main located on W Commodore Way to the fire pump room. The available electrical service is not considered “reliable” as defined by NFPA 20, and as such the fire pump must be provided with emergency power via generator if electric powered, or the fire pump must be diesel powered.

The fire pump room is permitted to house fire protection equipment and domestic water. Additional utilities will need to be provided within the structure in adjacent rooms. Sprinkler system risers to each pier will be located within the fire pump room and will extend to each pier. Trenching and bracing of sprinkler system piping will be required onshore, and seismic separation assemblies will be required at the transition from the shore to the piers. The sprinkler system on–pier piping will be braced as required for seismic zone “D.”

Fire Alarm System Requirements

In structures provided with an automatic suppression system, a fire alarm system must be provided for monitoring of the suppression system. The fire alarm control panel will be located within the fire pump room. A means for fire alarm system reporting is required, such as phone lines or radio transceiver equipment, to report to a supervising station. Further investigation is required to determine if existing infrastructure is in place for landline transmission or if radio transmission is feasible.

4.2.2 Option 2 – Permanent Roof Removal

In accordance with SBC, Section 429.8, a manual Class I or Class III standpipe system must be provided for piers where the most remote accessible part of the pier exceeds 150 feet from fire department apparatus access. Therefore, the existing manual standpipe system will be retained on each pier, along with the existing fire extinguishers. No additional fire protection systems are required as part of the removal of the pier roof structures.

5 Electrical & Instrumentation and Controls

5.1 Codes and Standards

The following codes and standards shall be used for this design:

- NFPA 70 National Electrical Code 2023 with Washington Administrative Code and Seattle Electrical Code amendments
- Seattle Municipal Code, including 23.60A Seattle Shoreline Master Program Regulations – Artificial night lighting requirements
- Seattle Energy Code 2018 (with 2021 code in effect November 2024)

5.2 AC Distribution Electric Service

Per the Port's Electrical Condition Assessment Report from 2023, reference WP#106016 / SABM–M2301, and from visual inspection, the electrical components currently in use were installed approximately 20 years ago. No electrical as–built drawings are known to exist for this project site, and the existing electrical capacity is unknown. Most of the electrical distribution is routed below each dock and shorepower pedestals are secured to pilings adjacent to each slip.

5.2.1 Option 1 – Roof Replacement

All existing dock infrastructure (including the roof, piles, curtain walls, and walkways) shall be removed under this option requiring the replacement of all electrical equipment, conduit, and wire. No grandfathered equipment shall remain, all construction shall meet the current Electrical Code, in particular ground fault protection and distribution requirements. Should the required fire pump be installed with an electrical power source, an emergency generator and automatic transfer switch will be provided as typically only connections with Seattle City Light's networked areas of the U-District and downtown have the reliability to not require a backup power source.

5.2.2 Option 2 – Permanent Roof Removal

A majority of the electrical distribution equipment shall remain in place and can keep its legacied status. Two rafter-mounted transformers will need to be relocated and placed either on shore or on top of new deck structures within existing slips.

5.3 Grounding

5.3.1 Option 1 – Roof Replacement

All existing dock infrastructure (including both the superstructure and substructure, i.e. the roof, piles, curtain walls, and walkways) shall be removed under this option requiring the replacement of all equipment, conduit, and wire. All new grounding shall be provided to meet the current Electrical Code.

5.3.2 Option 2 – Permanent Roof Removal

Per the Port's Electrical Condition Assessment Report, all panelboards appear to be properly grounded.

Per the study and visual inspection, dock transformers do not appear to have separately derived grounds. All new grounding for relocated transformers shall include separately derived grounds to meet current

code. Additional transformers not to be relocated or replaced may also require separately derived grounds to meet current code but are beyond the scope of this project.

5.4 Circuit Protection

5.4.1 Option 1 – Roof Replacement

All dock structure shall be removed under this option requiring the replacement of all electrical equipment, conduit, and wire. All new dock feeders and shorepower receptacles shall include ground fault protection to meet the current Electrical Code.

5.4.2 Option 2 – Permanent Roof Removal

Per the Port's Electrical Condition Assessment Report, it does not appear that the dock mounted transformers have secondary protection. All replaced or relocated transformers shall have code–compliant secondary protection. Additional transformers not to be relocated or replaced may also require secondary protection to meet current code but are beyond the scope of this project.

Existing 120/240-volt panelboards and shorepower pedestals do not appear to have any ground–fault protection of equipment (GFPE). All relocated or replaced 120/240-volt panelboards and shorepower pedestals shall have circuit breakers replaced with code–compliant GFPE circuit breakers. Additional panelboards and shorepower pedestals not to be relocated or replaced may also require GFPE circuit breakers to meet current code but are beyond the scope of this project.

5.5 Lighting

All dock lighting and lighting conduits are supported by the existing roof structure and covered moorage walls. Most luminaires and above deck lighting conduit is in poor condition and nearing their end of service life and shall not be reused.

Due to the replacement of roof structure, all lighting and lighting conduits shall be replaced. All new lighting shall meet the 23.60A Seattle Shoreline Master Program Regulations and minimize the amount of light directed into the water.

Per SMC 23.60A.152.Q. artificial night lighting shall first be avoided. If that is infeasible, lighting should minimize night light impacts on the aquatic environment by focusing the light on the pier surface, using shades that minimize illumination of the surrounding environment and using lights that minimize penetration into the water, to the maximum extent feasible, considering the activities that occur at the site at night.

5.6 Communications

Most communications wiring is in part routed through the existing roof structure. As of this time the Port does not believe any of this wiring is still active. All wiring shall be demolished and not replaced. Further as-built assessment is needed to determine if any new Fire Alarm hardware additions or revisions are required.

6 Other Utilities

The following utilities are considered at a high-level for costing purposes to support the feasibility and concept studies:

- Provision of potable water supply replacement to slips within dock A, B and C for roof replacement option.
- Based on 2021 SBC, which refers to the Seattle Stormwater Code (Seattle Municipal Code chapter 22.800), it is assumed that for both options, with the docks over water, the rainwater will discharge into the waterway directly which supports the objective of maintaining natural drainage patterns.

The following utilities are not included within the scope and are not included within this BoD:

- Provision of new telecommunications infrastructure or modifications to existing systems, applicable to both landside and waterside cables and associated infrastructure to each slip within docks A, B and C, including wireless systems. This appears likely it could be provided independent of roof replacement/removal construction. Discuss whether to add this to the scope after the concept drawings or if it should be handled directly between the Port and wireless consultant separate from this project.
- There is no pump-out facility currently, so it is assumed that there will be no new provision for this in the proposed options. No additional landside provision for foul / wastewater infrastructure to each dock (A, B and C), have been included.
- Drainage from the new buildings situated on land will need be developed and tied in with the existing in the next stage of design. Based on 2021 SBC, which refers to the Seattle Stormwater Code, the new buildings would trigger water quality treatment if the new plus replaced pollution-generating hard surface (PGHS) is greater than 5,000 square feet.
- Any Supervisory Control and Data Acquisition (SCADA), Closed-Circuit Television (CCTV), security, and other control systems, including any monitoring equipment and devices. This appears likely it could be provided independent of roof replacement/removal construction. Discuss whether to add this to the scope after the concept drawings or if it should be handled directly between the Port and security consultant separate from this project.

Appendix A. SPU Water Flow Test Data

Seattle Public Utilities

Development Services Office

Fire Flow Availability Report

4228 24th Ave W

The purpose of this report is to establish the water system's safe fire flow yield per hydrant per hydrant flow test and hydraulic modeling data information.

Feature Key

5126716-Test2

*TEST DATA	TEST HYD	WITNESS
Hydrant Location	HYDRANT 4224 24TH AVE W - E41	HYDRANT 4200 24TH AVE W - E41
Approximate Hydrant Elevation (ft.)	71	70
Day and Time	6/8/2020 10:30 PM	
Water main Diameter, inches, install year	8" | CI | 1958	
Pressure Zone Overflow Elevation (NAVD – 88) (ft.)	MG330	
Hydrant Static Pressure (psi)	110	110
Hydrant Residual Pressure (psi)	32	70
Hydrant Port Opening Status	Wide Open	
Average Pitot pressure (psi)	22	
Observed Hydrant Flow	**1590 gpm**	
*Estimated Hyd Capacity @ 20 psi Residual Pressure	**1720 gpm**	
System Capacity @ 20 psi Residual Pressure	**2460 gpm**	

Flow from Pitotless 4 "Nozzle ™"

Comments

** Hydrant Capacity is estimated because it is calculated using "C-values", which vary with age and current condition of the pipe.*

** Test data varies due to daily operations, seasonal and system changes. Design engineer should consider these changes and include a factor of safety in calculating and designing fire systems.*

SEE PAGE 2 FOR MAP OF HYDRANT LOCATIONS TESTED

Prepared by: Schriner, Jake

Email: SPU_DSO@seattle.gov

Prepared for: King County DNRP, Wastewater Treatment Division, KSC NR

Date Report: 6/12/2020

Hydrant Flow Test Report

Project Name:	Salmon Bay Marina		
Project Location:	Seattle, WA		
Test Performed by:	Seattle Public Utilities	Date:	June 8, 2020
Representative of:		Time:	10:30AM
Witnessed by:			

Purpose: Determine available flow and pressure for fire suppression sprinkler systems

Notes: Height from gauge hydrant to building finished floor elevation: 50 feet

	ID	Outlet Size	Outlet Coefficient
Gauge Hydrant:	B	2.5	0.70
Flow Hydrant 1 (F1):	A1	4.0	0.70
Flow Hydrant 2 (F2):	A2	2.5	0.70
Flow Hydrant 3 (F3):	N/A	2.5	0.90

Coefficient Note: Hydrant outlet discharge coefficients shall be determined per NFPA 291 -

Outlet with flow tube (stream straightener): 0.95
Outlet smooth and rounded: 0.90
Outlet square and sharp: 0.80
Outlet square and projecting into barrel: 0.70

Static Pressure:	(before test)	110 psig
Static Pressure:	(after test)	110 psig

Residual Pressure:	(one hydrant flowing)	32 psig
	(two hydrants flowing)	0 psig
	(three hydrants flowing)	0 psig

	Pitot Reading	Calculated Flow
Hydrant Flow Rate F1	22 psig	1,567 gpm
Hydrant Flow Rate F2	0 psig	0 gpm
Hydrant Flow Rate F3	0 psig	0 gpm
	Total Flow:	1,567 gpm
	Available Flow @ 20 psig:	1,693 gpm

Appendix B. Preliminary Sprinkler System Water Demand Calculation

Preliminary Sprinkler Calculations

Project Name: Salmon Bay Marina
Project Location: Seattle, WA
Calcs Performed by: Seattle Public Utilities   Date: June 8, 2020

Hydrant Flow Test Results

Static Pressure	Residual Pressure	@	Hydrant Flow	Water Outlet Size
110 psig	32 psig		1,567 gpm	4.0 inch

Note: The sprinkler contractor will be required to perform their own hydrant flow test, in order to verify that the available pressure is similar to the above hydrant flow test results.

Sprinkler System Requirements

Sprinkler Starting Pressure	Full Pressure	@	Required Flow
-8.9 psi	35.2 psi		2,060 gpm

Summary of Sprinkler System Requirements

Design Requirements: NFPA 13 - 2019 Edition

Sprinkler System Demand Flow Estimate

				Notes
A. Overhead Requirement				
Design Density (D)	=	0.40	1,300 gpm	NFPA 13 Hazard
Area of Operation	=	3,250 sqft		UFC Hazard
Overflow Factor	=	20%	260 gpm	
Total flow	=		1,560 gpm	
B. Hose Stream Demand				
		Inside:	0 gpm	For Information Only -
		Outside:	500 gpm	Outside hose not included in flow estimate, but considered for available pressure
C. In-Rack Sprinkler Requirement				
Sprinkler k-factor	=	0.0	0 gpm	
Flow per Sprinkler	=	0 gpm		
Number of Sprinklers	=	0		
Overflow Factor	=	0%	0 gpm	
D. Total Flow Required:			2,060 gpm	

Preliminary Sprinkler Calculations

Sprinkler System Demand Pressure Estimate				
1. Start / End Head Pressure:		12.8 psi	End pressure based on	
			Area per sprinkler:	100 sqft
2. Elevation Loss:		-21.7 psi	Flow per sprinkler:	40.0 gpm
	Friction Loss Factor: 0.433 psi/ft		Sprinkler K-factor:	11.2
	Elevation Distance: -50.0 ft			
	Pressure required to start:	-8.9 psi		
3. Estimated Friction Loss in Pipe				
Building		16.2 psi		
	Safety Factor: 20%			
	Estimate Flow: 1,560 gpm			
	C-factor: 120			
	Diameter of Pipe: 8.0 inches			
	Friction Loss Factor: 0.021 psi/ft			
	Pipe Distance: 650.0 ft			
		20 psi	Estimated Branchline Loss	
Underground		1.9 psi		
	Safety Factor: 20%			
	Estimate Flow: 1,560 gpm			
	C-factor: 140			
	Diameter of Pipe: 8.0 inches			
	Friction Loss Factor: 0.016 psi/ft			
	Pipe Distance: 100.0 ft			
	Pressure Loss in Pipe:	38.1 psi		
4. Backflow Preventer Loss:		6.0 psi	UFC 3-600-01 Para. 9-6.3.5	
5. Total Pressure Required:		35.2 psi		

Demand Pressure with Available Water Supply Pressure		
Sprinkler Demand:	1,560 gpm	
Outside Hose Demand:	500 gpm	
Available Pressure at Sprinkler Demand:	32.6 psi	
Available Pressure at Sprinkler/Hose Demand:	-19.4 psi	
Total Estimated Pressure Required:	35.2 psi	
Safety Factor:	-54.6 psi	Fire Pump Required

Preliminary Sprinkler Calculations

Summary of Fire Pump Requirements

Design Requirements: NFPA 20 2019 Edition

Fire Pump Estimated Size

a. Fire Pump Pressure Rating

Calculated:	54.6	psi	
Selected:	100.0	psi	Minimum available

b. Fire Pump Flow Rating

Maximum Demand:	140	%	Maximum 140% per
Calculated:	1,471	gpm	UFC 3-600-01 Section 9-5.1.7
Selected:	1,500	gpm	
Rated Capacity:	137.3	%	

c. Fire Pump Curve

Churn:	120.0	psi	@	0	gpm
100%:	100.0	psi	@	1,500	gpm
150%:	65.0	psi	@	2,250	gpm
Supply Can Provide:	110.0	psi	@	0	gpm
	38.1	psi	@	1,500	gpm
	-42.3	psi	@	2,250	gpm
Combined Supply/Pump:	230.0	psi	@	0	gpm
	138.1	psi	@	1,500	gpm
	22.7	psi	@	2,250	gpm

d. Fire Pump Horsepower

Calculated Hydraulic Horsepower:	87.7	hp	
Design Range:	186	hp	UL Fire Protection Equipment Directory

e. Jockey Pump Rating

Rating:	110.0	psi	@	15	gpm	NFPA 20 Section A.4.27.1.1

f. Pump Start/Stop

Jockey Pump Start:	220	psi	NFPA 20 Section A.14.2.6 (4)
Fire Pump Start:	215	psi	
Jockey Pump Stop:	230	psi	
Fire Pump Stop:	220	psi	NFPA 20 10.5.4.1 UFC 3-600-01 Section 9-5.3.2

Preliminary Sprinkler Calculations

Water Tank Capacity			
Sprinkler Demand:	1,560	gpm	
Hose Demand:	500	gpm	
Duration:	60	minutes	
Required Tank Size:	123,600	gallons	
Actual Tank Size:	#	gallons	Tank Adequate

Appendix C. Seismic and Other Lateral Analysis Tehnical Memo

Seismic and Other Lateral Analysis Technical Memorandum

Document no: W3Y17302-TNE-04
Version: R00

Port of Seattle

Salmon Bay Marina Docks A-C Roof Safety
October 17, 2024

Seismic and Other Lateral Analysis Technical Memorandum

Client name:	Port of Seattle		
Project name:	Salmon Bay Marina Docks A-C Roof Safety		
Document no:	W3Y17302-TNE-04	**Project no:**	W3Y17302
Version:	R00	**Project manager:**	Aldo Ferrufino
Date:	October 17, 2024	**Prepared by:**	Connie Kuney-Pitts

Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
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1. Introduction

Salmon Bay Marina (SaBM) was originally built in 1961 and acquired by the Port of Seattle in 2018. The marina consists of five Docks (A-E). The scope of this study includes Docks A-C only (refer to Figure 1). The site is located on the north side of Seattle along the south shore of the Lake Washington Ship Canal, northwest of Fishermen's Terminal (approximately 2,000 feet away).

Each Dock consists of a series of areas, which can accommodate between 37 to 53 recreational boats, floating on–water residences (FOWRs), and liveaboards at a time. The dock is connected by a continuous timber walkway that is attached to the existing creosote-coated timber piles. The existing roof structure comprise of metal roofing material spanning over sawn-timber purlins supported by sawn-timber girders. The girders are connected to the piles in two different typical connections. The first connection comprise of a girder bearing on the timber pile, with no visible positive hardware-based anchorage, while the second connection has parallel timber girders on each side of the pile connected with through-bolts. Both of the connections do not provide sufficient fixity to allow moments to transfer. There are also no significant lateral bracing elements. The piles, acting as cantilevers extending out of the mud, resist the lateral loads.

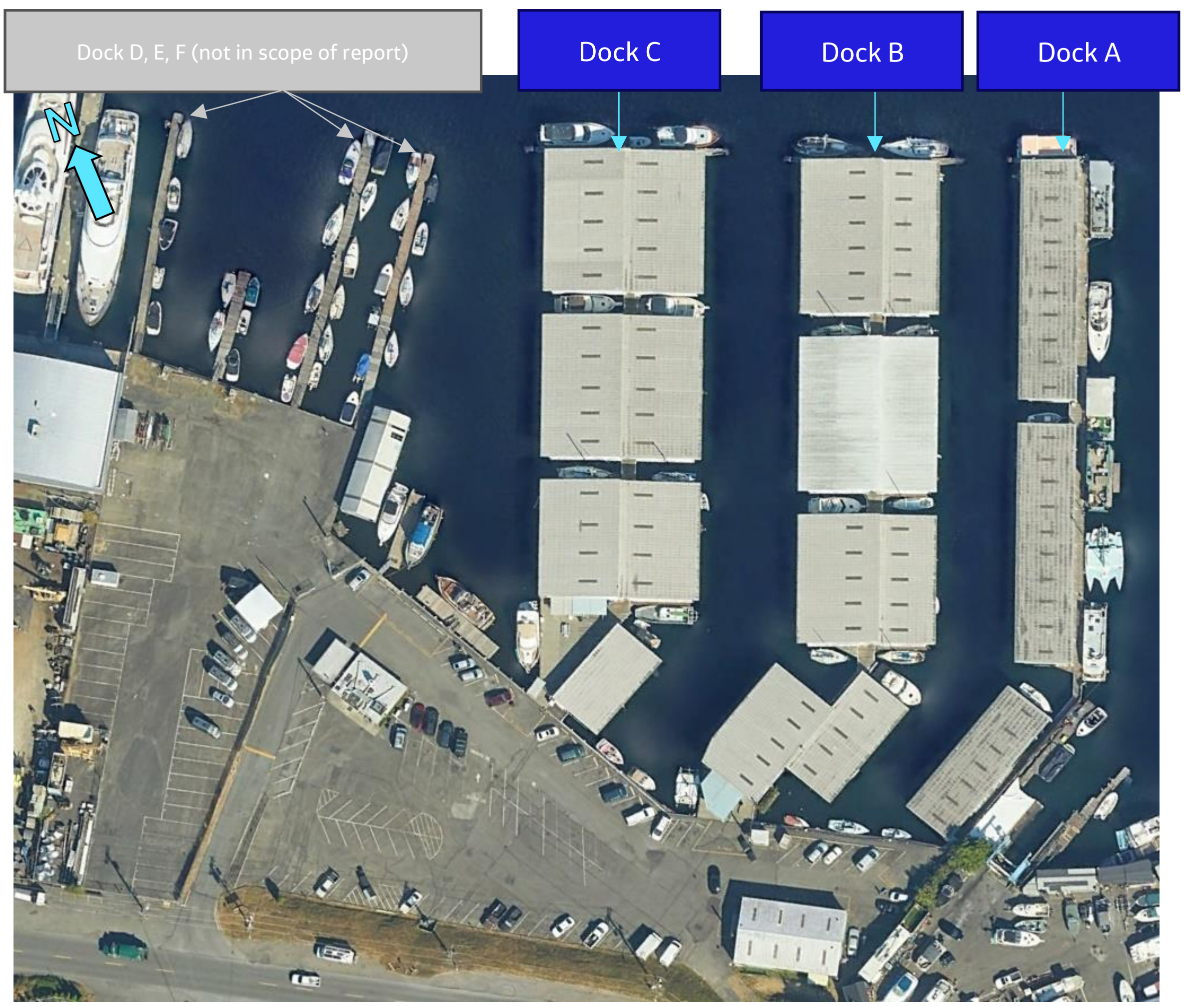

Figure 1 Plan View showing Dock A, B, and C at Salmon Bay Marina (SaBM)

The Port is investigating the replacement of the marina roof as an option to address roof safety issues. It is assumed that this option would be classified as a "substantial alteration" per the Seattle Existing Building Code (SEBC) Section 311. This section triggers the need for a seismic evaluation report specifying the building's seismic deficiencies and proposed measures to provide an acceptable degree of seismic safety. Preliminary seismic and other lateral load analysis of the existing structure must be done to determine if the existing structure is sufficient or if a new structure is required for conceptual design.

1.1 Purpose of Document

This technical memorandum aims to present the preliminary analysis of the existing structural system in relation to seismic and other lateral loads, and to present a summary of the findings and recommendations.

The contents and assumptions outlined in this document are accurate as of the report's development date and may be subject to modification as project requirements evolve. The purpose of this report is to document the technical details and design considerations for the substructure at conceptual design.

2. Evaluation Criteria and Methodology

2.1 Performance Requirements

The preliminary analysis will follow guidelines detailed in the Draft 2021 Seattle Existing Building Code (SEBC), ASCE 41 – Seismic Evaluation and Retrofit of Existing Buildings (ASCE 41), ASCE 7-16 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7), and the Draft 2021 Seattle Building Code (SBC).

For the purpose of this analysis, a displacement-based analysis was not used since this is a wooden structure. A combination of force-based analysis and stability checks were used to analyze this structure. While multiple piles were modeled, the tallest pile was used for all capacity analyses in order to consider the most conservative condition.

2.2 Geotechnical Data

Due to the absence of geotechnical data at or near the site, conservative assumptions were made in the substructure analysis. The substructure design may be revised based on new data obtained from forthcoming geotechnical investigations or insights gathered during the installation process. While these assumptions may be validated in situ during the installation phase, any discrepancies between actual site conditions and the assumptions made could result in design modifications. Hence to perform this substructure analysis, geotechnical data from Fisherman's Terminal was used due to its proximity to the site. Revised Geotechnical Report for Fisherman's Terminal Marine Innovation Center by Landau Associates (Landau) dated 9/17/2022 provides soil conditions, a seismic response spectrum, and liquefaction recommendations.

Section 2.3 of the Landau (2022) report describes the subsurface conditions found at Fisherman's Terminal (refer to Appendix A. That site's ground level is located at Elevation 26 ft and the strong glacial soil is located at Elevation -29 feet. SaBM's mudline varies from Elevation -7 at its deepest to +18 ft at its shallowest based on water depth data charts. It will be assumed that the distance from mudline to pile tip will remain the same while the water depth varies, with the soil levels running parallel to the mudline (see Figure 2). The water level shown on the existing SaBM permit drawings is 21.8 feet (See Appendix B) which matches the historical Ordinary High-Water elevation of the Corps of Engineers datum. The permit

drawings show test pile data that measure the bottom of the pile to the water surface. Figure 1 shows a summary of the test pile data and assumed geotechnical soil conditions.

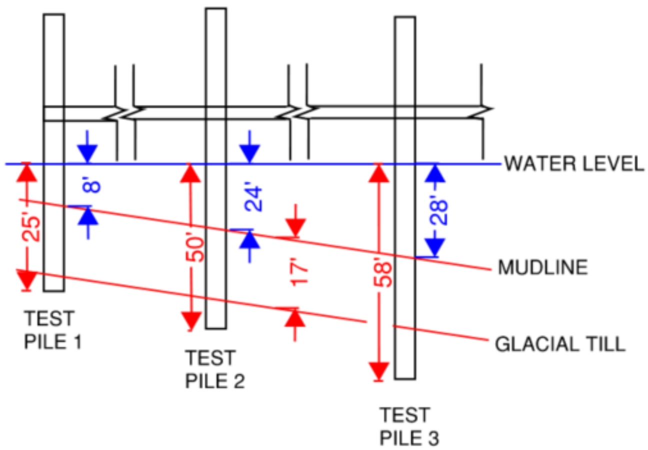

Figure 2. Summary of Test Pile Data and Geotechnical Assumptions (Datum is MLLW)

It is recommended that a site-specific geotechnical analysis is performed to confirm the assumptions used in this analysis, as the soil conditions could vary significantly.

2.2.1 Seismic Response Spectra

The Landau (2022) report provides a risk targeted maximum considered earthquake (MCE_R) response spectrum that is based on a previous geotechnical report by PanGeo in 2010 (included in the Landau report as Appendix B). The Landau report states, "PanGeo recommended a design response spectrum approximately equivalent to the minimum allowed by the seismic code [ASCE 7-16, Section 21.3] (80 percent of the default Site Class E response spectrum)." The recommended response spectrum is shown in Table 1.

Table 1. MCE_R Response Spectrum from Landau Report

T (s)	0	0.1	0.2	0.3	0.4	0.5	0.75	1	1.5	2	3	4	5
MCE_R Sa (g)	0.45	0.66	0.89	1.08	1.08	1.08	1.08	1.08	1	0.75	0.5	0.37	0.3

Where;

g = gravity

MCE_R = risk-targeted maximum considered earthquake

s = seconds

Sa = spectral acceleration

T = period

2.2.2 Liquefaction

The Landau (2022) report Section 3.1.2 discusses the liquefaction analysis done at the Fisherman's Terminal site. Lateral spreading occurs in the event of liquefaction. Liquefaction is where the water-saturated soil begins to act as a liquid due to the movement cause by the earthquake and is analyzed separately from the response spectrum.

For this analysis, it is assumed that the depth of liquifiable soils remain the same for every pile location, sloping with the change in mudline elevation (refer to Figure 2). In reality, the actual site conditions and depth of liquefiable soils could vary.

2.3 Seismic Evaluation Methodology

Seismic evaluation of SaBM will look at the forces acting on the pile caused by both the MCE_R response spectrum and the lateral spreading loads. The maximum lateral forces between the two cases will be compared to the capacity of the existing timber piles.

2.4 Other Lateral Pile Loading

The other lateral loads considered in this analysis include wind, and water (including wave, tsunami, and current) loads.

2.4.1 Wind Loads

The wind loads were determined using a wind speed of 98 miles-per-hour, per ASCE 7-16 (Chapter 26), and applied in both longitudinal and transverse directions. The load is applied to the portion of the structure that is above the water. Since the impacted area of a pile is relatively small, the resulting forces do not govern over seismic forces.

2.4.2 Water Loads

Due to the nature of the structure's location, wave, tsunami, and current loads will not govern over seismic forces. The channel has relatively calmer water conditions since it is a controlled lake. The main source of wave loads is the wakes of passing vessels that would push against the pile. The impacted area of a pile is small enough that the forces would not govern over the forces on the pile from liquefaction, which both pushes on the pile and reduces the embedment into solid soil.

3. Modeling and Seismic Analysis

3.1 Modeling

To perform a seismic response spectrum analysis on Docks A-C, each Dock was modeled in CSI SAP2000 2024 up to the diagonal section to determine representative maximum demands acting on the pile. It was not in the scope to model each pier to the bulkhead. Figure 3 illustrates of the modeling limits, all test pile locations, and the assumed pile zones that determine what test pile length was used.

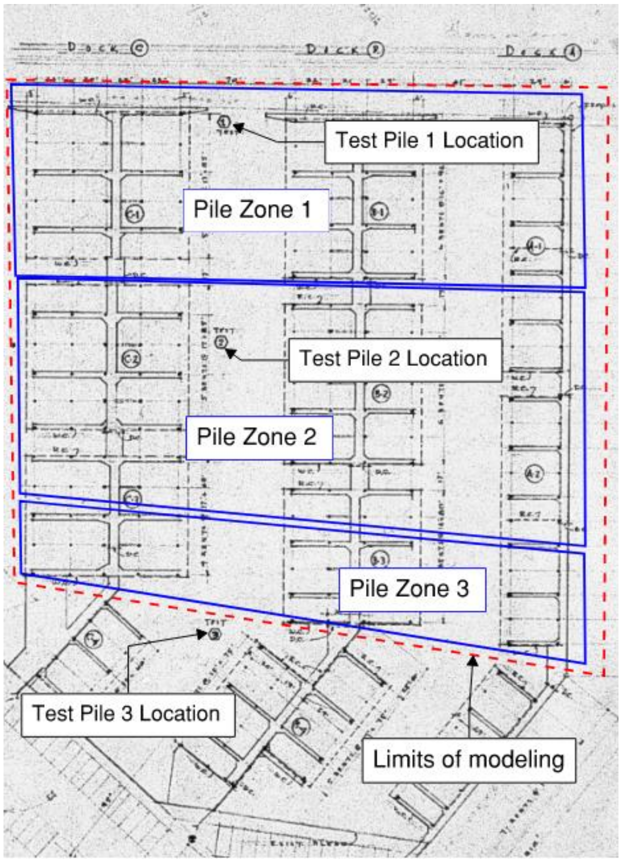

Figure 3 Modeling Limits, Test Pile Locations, and Pile Zones

The piles, walkways, girders, and purlins are modeled as frame elements. The existing permit drawings do not provide detailed information about the existing piles; however, they do provide the depths below the water level (See Figure 2). Based on this information, the embedment of the piles are assumed to fall within 3 different zones that are correspond to the available test piles. It is assumed that the piles are embedded five times the pile diameter (5D) feet below mudline, where the depth to fixity is assumed to be, and the support condition is assumed to be fixed. The piles are pinned to the girders with the moments released, since no positive hardware-based anchorage was observed to transfer moments caused by lateral loading. Refer to Figure 4 for an isometric view of the model.

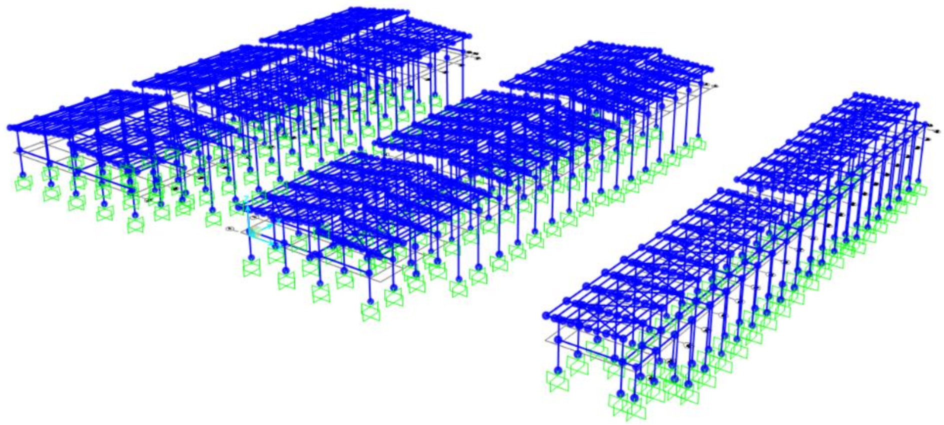

Figure 4 SAP2000 Model

3.2 Response Spectrum Analysis

The response spectrum is used in the model to determine how the mass of the structure will respond during a risk targeted MCE_R. The mass of the roof sitting on the piles will shake during the simulated earthquake and cause lateral forces acting on the piles. The purpose of the CSI SAP2000 model is to determine the forces acting on the piles due to the movement of the roof mass which would be used in the capacity analysis of the piles. The results of the model show that the loads due to the response spectrum are lower than the loads caused by lateral spreading, discussed in Section 3.3.

3.3 Lateral Spreading Analysis

Lateral spreading occurs when a seismic event causes liquefaction in soil layers and causes the soils to act as a load on the piles. Lateral spreading loads were determined based on Figure 4 of the Landau (2022) report (Refer to Appendix A). The figure provides kinematic soil linear loads for 24" diameter piles so the loads were converted to apply to the existing 8" diameter piles. The soil profile was also adjusted to match the mudline elevations of the Salmon Bay site. It was assumed that soil layer elevations remain the same, but the top of mudline varies depending on the depth of the water. Figure 5 illustrates how the soil profile and load locations were adjusted vertically. It should be noted that this drawing is not to scale, and the kinematic soil loads still reflect the 24" diameter piles.

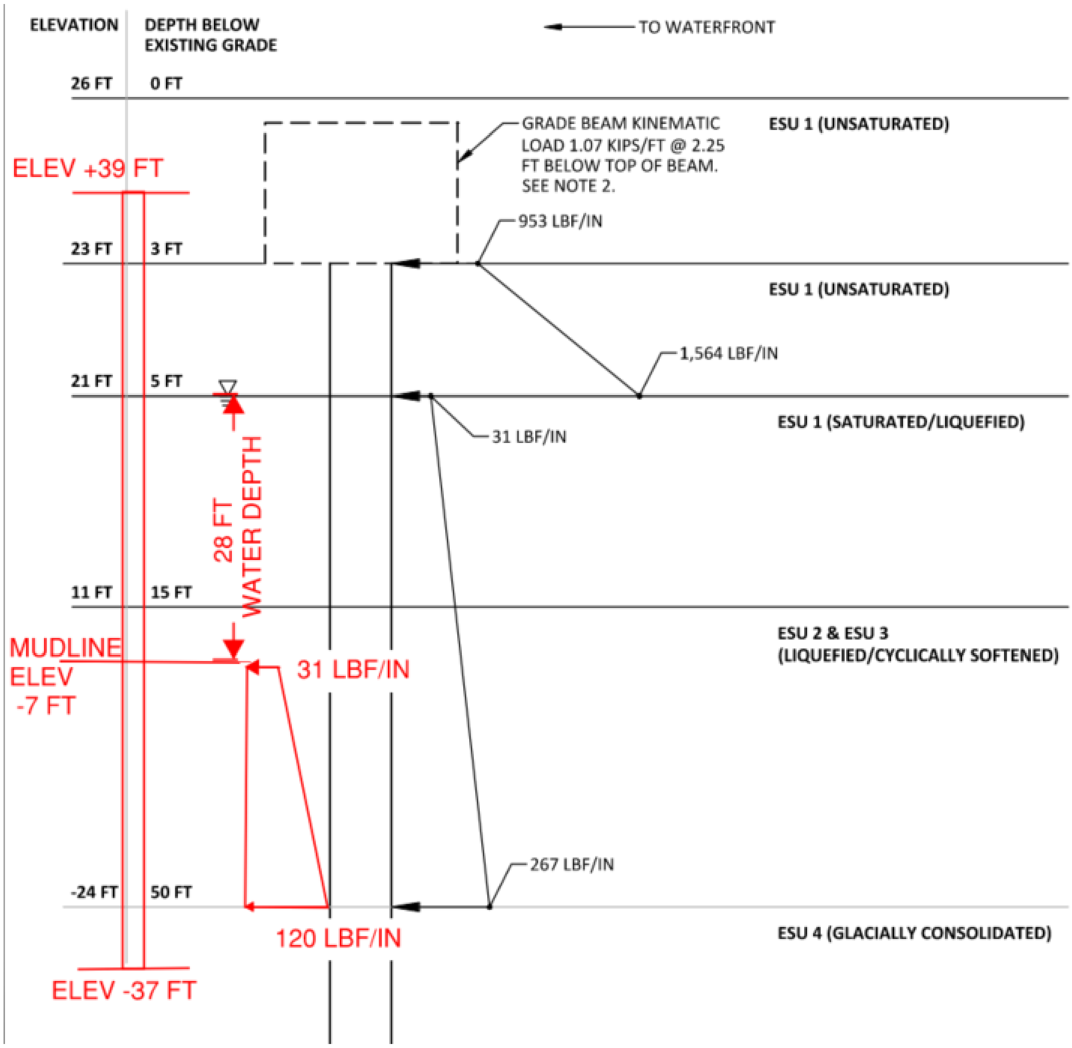

Figure 5. Kinematic Load Adjustment Example for Test Pile 1

Once the soil loads are converted to the existing 8" diameter piles, the lateral load begins at 10.33 pound-per-inch (plf) and increases to 40 plf over 17 feet. These loads are applied to a single cantilevered pile to determine the resulting lateral forces.

4. Structural Capacity Analysis

The capacity of a representative pile is divided into two parts:

1. Stability Analysis – determining if the pile is embedded far enough into soils to maintain fixity.
2. Elastic Capacity Analysis – a force/elastic based approach that determines if the pile can sustain the demanding loads.

4.1 Stability Analysis

A stability analysis was performed using soil parameters from the Landau report that were inputted into the program Ensoft LPILE. Using the soil information and pile section properties, LPILE determines the

point of fixity in the piles and confirm that the piles are embedded far enough into the solid soil (strong glacial soils). Liquefied P-Y parameters from Landau's Report, shown in Table 2, were entered to Ensoft LPILE. Only the soil layers that occur below the lowest mudline of Elevation -7 were considered for this stability analysis.

Table 2 - Liquified P-Y Parameters with Values taken from Landau's Report

Soil Layer	Soil Description	Density/ Consistency	Elevation (ft)		P-Y Model	P-Y Model Parameters
			Top	Bottom		
3	Native fine-grained	Very soft	-7	-24	Soft clay (Matlock 1970)	γ'=30 pcf, c = 250 psf, ε_{50} = 0.02
4	Weak glacial soils	Medium dense/stiff	-24	-29	API Sand	γ'=61 pcf, ϕ = 34 deg, k = 70 pci
5	Strong glacial soils	Very dense/hard	-29	<-29	API Sand	γ'=65 pcf, ϕ = 40 deg, k = 150 pci

ϕ = friction angle; API = American Petroleum Institute; Bot = bottom; ε_{50}= strain factor; ft = feet; k = soil modulus; pcf = pounds per cubic foot; pci = pounds per cubic inch; psf = pounds per square foot; γ' = effective unit weight

4.2 Elastic Capacity Analysis

The capacity of the existing structure was determined using the American Wood Council's National Design Standard (NDS) 2018 Section 6 Round Timber Poles and Piles. A reference design stress value of 1500 psi was provided by the existing permit drawings. This reference design stress is assumed to be a bending stress value, which is typical for Douglas Fir.

Per the NDS, the reference design value shall be multiplied by the adjustment factors specified in NDS 2018 Table 6.3.1 to determine the adjusted design value which is then compared to the load demands on the pile. The bending stress can utilize the following adjustment factors for analysis: temperature factor, conditions treatment factor, size factor, and load sharing factor. Since this analysis uses LRFD, the following adjustment factors are also used: format conversion factor, resistance factor, and time effect factor.

Temperature factor, C_t, is dependent on the in-service moisture conditions and the temperature the element will be exposed to. The site will experience sustained exposure to temperatures less than 100 F. Due to the marine environment, the in-service moisture condition is considered "wet." A factor of 1.00 is applied to the referenced design value.

Conditions treatment factor, C_{ct}, depends on how the wood was conditioned before any preservative treatment. Since no information about the type of conditioning used, it is assumed that the wood was air dried prior to preservative treatment, which means C_{ct} is 1.

Size factor, C_F, applies if the diameter of the pile exceeds 13.5 inches. The existing piles are called out to be 8-inch diameter which means C_F does not apply.

Load sharing factor, C_{ls}, increases if multiple piles are connected by equivalent force distributing elements. It is conservative to not account for multiple piles, so C_{ls} does not apply for this analysis.

Format conversion factor, K_F, is determined using NDS 2018 Table 2.3.6 and is dependent on the stress type. Since this analysis looks at bending stress, a value of 2.54 is used.

Resistance factor, ϕ, is determined using NDS 2018 Table 2.3.6 and is dependent on the stress type. Since this analysis looks at bending stress, a value of 0.85 is used.

Time effect factor, λ, is dependent on the load combination used to calculate the demand and determined using NDS 2018 Table N3. The demand is using earthquake loads which means a factor 1 is used.

The above factors are multiplied with the reference design stress value to get the adjusted design stress value. This adjusted design stress value is then compared to the stress induced by the maximum moment demand, which for this case is due to lateral spreading.

5. Summary of Findings

Lateral spreading controls demands with a maximum moment of approximately 50 kip-ft. For the existing 8″ diameter timber piles, the lateral spreading causes a stress of approximately 12,000 psi. From an NDS timber capacity analysis, the piles can handle a bending stress of 3,240 psi. The existing piles are overstressed, with a D/C ratio of 3.7, noting that a D/C ratio exceed 1.00 is considered over capacity. This indicates that the existing piles will fail due to bending if a design seismic event occurs.

The LPILE analysis indicates that the existing timber piles may be embedded far enough into the solid soil to remain stable during a seismic event. But they will not withstand the bending forces that are caused by that same seismic event.

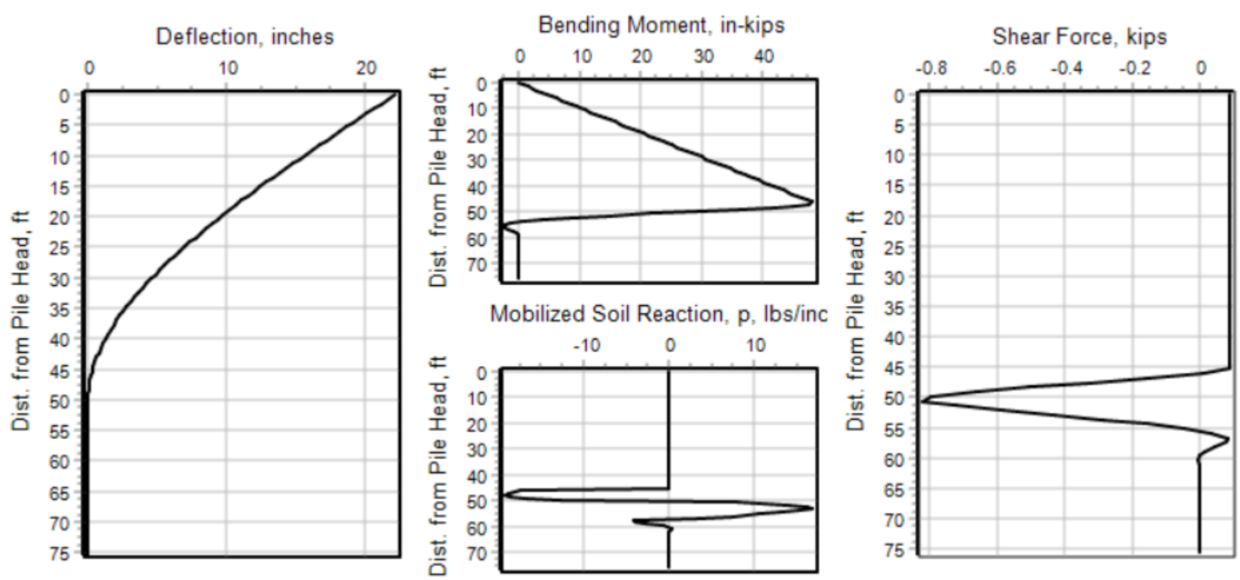

Figure 6 - LPILE Results

6. Recommendations

Considering that replacement of the roof at SaBM triggers a seismic evaluation of the structure, based on the geotechnical information, and the findings presented in this technical note, it is recommended that the existing timber piles are replaced with new piles designed in line with the latest standards which, by inspection, will require higher capacity and increased embedment into the soil. This is due to the lateral spreading demand on the system.

It is also highly recommended that a site-specific geotechnical investigation and analysis be done in order to verify the assumptions and the results of this preliminary analysis.

Appendix A. Geotechnical Report

Revised Geotechnical Engineering Report
Fishermen's Terminal Maritime Innovation Center
1900 West Emerson Place
Seattle, Washington

November 17, 2022

Prepared for

Port of Seattle
2711 Alaskan Way
Seattle, Washington 98121

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Revised Geotechnical Engineering Report
Fishermen's Terminal Maritime Innovation Center
1900 West Emerson Place
Seattle, Washington

This document was prepared by, or under the direct supervision of, the undersigned, whose seal is affixed below.

Name: Daniel Simpson, PE
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Date: November 17, 2022

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11/17/2022

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Quality Reviewer

Date: November 17, 2022
Project No.: 1423011.010.013
File path: Y:\1423\011.010\R\Geotech\Signature Page.docx
Project Coordinator: MCS

LANDAU ASSOCIATES

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LIST OF ABBREVIATIONS AND ACRONYMS

ϕ .... friction angle
API .... American Petroleum Institute
bgs .... below ground surface
c .... cohesion
ε_{50} .... strain factor
ESU .... engineering stratigraphic unit
ft .... foot/feet
FT .... Fishermen’s Terminal
k .... soil modulus
ksi .... kips per square inch
LAI .... Landau Associates, Inc.
LEM .... limit equilibrium method
MInC .... Maritime Innovation Center
NGVD 29 .... North American Vertical Datum of 1929
pci .... pounds per cubic inch
p_m .... p-multiplier
PND .... PND Engineers
Port .... Port of Seattle
psf .... pounds per square foot
SDCI .... Seattle Department of Construction and Inspections
SPT .... standard penetration test
WSDOT .... Washington State Department of Transportation
γ' .... effective unit weight

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1.0 INTRODUCTION

This report summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (LAI) in support of the Fishermen's Terminal (FT) Maritime Innovation Center (MInC) project, located at 1900 West Emerson Place in Seattle, Washington (site; Figure 1). Services were provided in accordance with the scope outlined in purchase order number 15950 between LAI and BRPH Architects-Engineers, Inc. (prime engineer). This report has been prepared to facilitate the project's progress from 60% design to bid-ready documents.

1.1 Project Understanding

The Port of Seattle (Port, project owner) proposes to redevelop historical building C-9, converting the building into a business incubator with light industrial spaces, meeting rooms, classrooms, and event space.

The existing timber pile foundation system will not provide adequate support of the proposed improvements. As such, the design team proposes temporary relocation of the building while a new, pile-supported structural slab is constructed. Existing timber piles will be cut to facilitate construction of the new foundation. The following details are noted on PND Engineers' (PND, structural engineer) 60% design drawings:

- The proposed foundation system consists of a piled structural slab. Piles are generally spaced 19 to 25 feet (ft) on center and connected with pile caps and grade beams. The bottom of the pile cap is installed 3 ft below the finished floor and approximately 2.75 ft below adjacent finished grade.
- The proposed piles consist of steel pipes, each 24 inches in diameter and 90 ft long. Pipe walls measure ½ inch thick and transition to ⅜ inch thick 40 ft below the bottom of the pile cap.
- PND provides the following service-level loads:
    - 300 kips compression (static), 340 kips compression (seismic).
    - 40 kips lateral shear (seismic) with a free head condition.

2.0 BACKGROUND INFORMATION AND SITE CONDITIONS

LAI used the following subsurface and seismic data to complete engineering analyses:

1. Converse Ward Davis Dixon, Inc. 1981. Report on Geotechnical Exploration: Replacement Docks 3 and 4, Fisherman's Terminal, Seattle, Washington.
2. LAI. 2021. Report of Findings: Fishermen's Terminal Maritime Innovation Center, 1900 West Emerson Place, Seattle, Washington. Landau Associates, Inc.
3. Metropolitan Engineers. 1968. Final Report: Phase II, Predesign Soils Investigation, Northwest Corridor, Seattle Rapid Transit Study, Seattle, Washington.
4. PanGeo, Inc. 2020. Site-Specific Seismic Ground Response Analysis (2nd Revision), Fisherman's Terminal Redevelopment, Seattle, Washington.
5. PanGeo, Inc. 2017. Preliminary Geotechnical Report, Fisherman's Terminal Phase 1 Redevelopment, Seattle, Washington.
6. PanGeo, Inc. 2002. Geotechnical Report: Fisherman's Terminal, South Wall Repair Final Design, Port of Seattle, Washington.
7. PanGeo, Inc. 2000. Geotechnical Report, Fisherman's Terminal, South Wall Repair, Port of Seattle, Washington.
8. Rittenhouse-Zeman & Associates, Inc. 1977. Soils and Foundation Investigation, Shop Building Site, 1510 West Thurman, Seattle, Washington.
9. Shannon & Wilson, Inc. 1987. Geotechnical Report: Fisherman's Terminal, Port of Seattle, Seattle, Washington.

Figure 2 provides an aerial view of the site and the surrounding area and shows the approximate locations of the soil borings noted in the sources above. Copies of the boring logs are provided in Appendix A.

2.1 Site History and Current Conditions

The site was an intertidal marsh, until completion of the Ballard Locks around 1917. The locks restricted tidal fluctuations and permanently raised the water surface elevation to provide a navigable channel to Lake Washington. Salmon Bay is located north of the site. A more detailed site history is provided in Pinnacle GeoSciences, Inc.'s 2009 report.

The C-9 building was originally constructed in 1918 and is underlain by fill retained by a wharf and bulkhead located approximately 8 ft to the north. The wharf and bulkhead were replaced in 2002 as part of the Port's Project FT-0102 ("the south wall repair project"). Figure 3 shows a typical section of the old and new wharves. The south wall repair project was completed using National Geodetic Vertical Datum NGVD of 1929 (NGVD 29); current project datum is the US Army Corps of Engineers Lake Washington and Lake Union Datum (NGVD 29 + 6.84 ft). The existing grade around the proposed FT MInC building is approximately 26 ft.

2.2 Regional Geology and Seismicity

The site is underlain by Holocene-age tideflat deposits (Qtf), a unit that consists of loose to moderately dense "silt, sand, and organic sediment and detritus" that are "historically exposed in broad coastal benches at low tide but [are] now fill covered." Glacially consolidated deposits also are mapped near the site and likely underlay the tideflat deposits (Booth et al. 2005). The site is located in the Seattle Basin, an approximately 1,800-ft-deep, sediment-filled basin.

The site could experience strong ground motions as the result of a seismic event. In its 2017 geotechnical report, PanGeo provides a detailed assessment of potential seismic hazards as well as a site-specific response analysis.

According to the Seattle Department of Construction and Inspections (SDCI; accessed October 13, 2021), the site is situated in an Environmentally Critical Area prone to soil liquefaction.

2.3 Subsurface Conditions

LAI reviewed boring logs prepared by others (Figure 2, Appendix A) to evaluate site subsurface conditions. The results of LAI's recent shallow environmental explorations were also considered (2021). Soils in the vicinity of the proposed FT MInC building were categorized into four engineering stratigraphic units (ESUs):

- **ESU 1 – Fill.** ESU 1 extends from ground surface to approximately 15 ft below ground surface (bgs) and consists of predominantly loose to medium dense, coarse-grained soils with variable fines, wood debris, and other deleterious content. ESU 1 appears to be heterogeneous laterally and vertically. Debris, voids, and timber have been encountered in fill in other areas of the site. LAI's 2021 direct-push borings extended 15 ft bgs; soils encountered in the borings were classified as SP, SP-SM, and SM.
- **ESU 2 – Tideflat Deposit.** ESU 2 begins beneath ESU 1 and extends to approximately 50 ft bgs. ESU 2 is described differently by the consultants whose studies LAI reviewed. PanGeo (2001, 2017) describes ESU 2 as a fat clay; however, it does not provide Atterberg limits data. The field dilatancy tests completed on most standard penetration test (SPT) samples show varying degrees of dilatancy.

  In its 1987 geotechnical report, Shannon and Wilson provides the results of four Atterberg limits tests, indicating plasticity indices on the order of 20 to 30 and an *in situ* water content greater than the liquid limit. Shannon and Wilson subdivide ESU 2 into sandy and clayey layers and do not provide Atterberg limits or grain size distribution data for the sandier layers.

  Typical field SPT N-values measured in ESU 2 are less than 4 and commonly 0 (weight of rod). ESU 2 frequently contains organics, with peat layers noted on some boring logs.
- **ESU 3 – Weak Glacial Soils.** ESU 3 begins below ESU 2 and is about 5 ft thick. ESU 3 typically consists of medium dense to dense sand to silty sand to silt and is interpreted as recessional outwash (non-glacially consolidated) or weathered glacially consolidated soils. Though present in the vicinity of the proposed FT MInC building, ESU 3 does not appear to be laterally continuous across the site.

- **ESU 4 – Strong Glacial Soils.** ESU 4 is present beneath ESU 3 and is the deepest unit encountered in the boring logs reviewed. ESU 4 is likely glacially consolidated and consists of very dense silty sand to hard silt with sand.

Groundwater typically is encountered between 4 and 6 ft bgs, at elevations that approximate the water surface elevation of nearby Salmon Bay. The Salmon Bay water surface elevation is controlled by the Ballard Locks and varies between approximately 20 and 22 ft. For engineering analysis, LAI has assumed a groundwater elevation of 21 ft. Other factors, such as precipitation or regional groundwater flows, could cause groundwater levels to rise temporarily above the high water mark. Given its homogeneous nature, ESU 1 is prone to layers of perched groundwater, which could be encountered during construction.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The main factors that will inform geotechnical design are the presence of soft soils and potentially contaminated and liquefiable soils. As a result of these factors, pile support is recommended for the building.

Potentially contaminated site soil and groundwater may increase the cost of construction excavation and dewatering. The project design should minimize dewatering and excavation to the extent practical.

Prior to project permitting or bidding, LAI should be asked to review the plan set for consistency with the recommendations herein.

3.1 Seismic Design Considerations

The extent of liquefiable soil at the proposed building site is uncertain. There is good constraint on the maximum vertical extent of liquefaction (i.e., liquefaction can occur only in ESU 1 through ESU 3, because the water table provides an upper elevation limit, and the glacially consolidated soil provides a lower elevation limit). Beyond these limits, the geotechnical design approach is relatively insensitive to the degree of liquefaction that could occur in ESU 1 through ESU 3, given the approach to lateral spreading evaluation. Lateral spreading is analyzed using an upper-bound, simplified force-based approach (e.g., Cubrinovski and Ishihara 2004) is employed for pile response to lateral spread.

3.1.1 Seismic Design Parameters

Based on the results of its site-specific seismic ground response analysis (2020), PanGeo recommended a design response spectrum approximately equivalent to the minimum allowed by the seismic code (80 percent of the default Site Class E response spectrum). The designer should refer to PanGeo's analysis (2020) for recommended seismic design parameters (Appendix B).

The risk-targeted maximum considered earthquake (MCE_R) response spectrum recommended by PanGeo (2020) is reproduced in Table 1.

Table 1. MCE_R Response Spectrum

T (s)	0	0.1	0.2	0.3	0.4	0.5	0.75	1	1.5	2	3	4	5
MCE_R Sa (g)	0.45	0.66	0.89	1.08	1.08	1.08	1.08	1.08	1	0.75	0.5	0.37	0.3

g = gravity
MCE_R = risk-targeted maximum considered earthquake
s = seconds
Sa = spectral acceleration
T = period

The algorithm in Section 21.4 of the American Society of Civil Engineers' *Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE/SEI 7-16* (ASCE 7-16) was applied to the response spectrum to calculate the MCE_R and the design spectral coefficients in Table 2. Table 2 also includes the code-mapped value of S_1 for use in Equations 12.8-6, 15.4-2, and 15.4-4. For limitations on the use of these values, PND should refer to the second paragraph in Section 21.4 of ASCE 7-16.

Table 2. Seismic Design Parameters

S_{MS} (g)	S_{M1} (g)	S_{DS} (g)	S_{D1} (g)	Mapped S_1 (g)
1.08	1.5	0.718	1	0.467

g = gravity
S_1 = mapped 1-second spectral ordinate
S_{D1} = design 1-second seismic parameter
S_{DS} = design short-period seismic parameter
S_{M1} =MCE_R 1-second seismic parameter
S_{MS} = MCE_R short-period seismic parameter

Based on the peak ground acceleration seismic hazard disaggregation at the site (US Geological Survey; accessed September 9, 2021), more than 57 percent of the seismic hazard originates from sources capable of producing a moment magnitude 7 or greater event. Larger magnitude events typically have a longer duration of shaking. As a result, cyclic response of soil, which typically requires several loading cycles to manifest (e.g., liquefaction, lateral spreading, soil strength loss), can co-occur with strong ground motion. Therefore, geotechnical seismic analysis includes both seismic inertial forces and the effects of soil liquefaction. Recommendations regarding the combination of seismic inertial loading and soil kinematic loading are provided in Section 3.2.3.

3.1.2 Liquefaction Analysis

Liquefaction susceptibility was determined using guidelines established by Bray and Sancio (2006). Because limited plasticity data are available, engineering judgment was also used to evaluate liquefaction susceptibility. In general, soils with assigned field descriptors of "sandy," "exhibiting dilatancy," or "low plasticity" were considered susceptible to liquefaction. Logs of two cone penetrometer test soundings advanced near the proposed FT MInC building show that ESU 2 contains significant soil layers with soil behavior type (Ic) less than approximately 2.6, indicative of liquefaction susceptibility.

Liquefaction-triggering calculations were performed using the empirical approach established by Boulanger and Idriss (2014). Based on PanGeo's site-specific seismic ground response analysis (2020), liquefaction-triggering calculations used 80 percent of the risk-targeted maximum considered earthquake site-adjusted peak ground acceleration (PGA_M; i.e., 80 percent PGA_M = 0.57g). Because site soils are either very weak or very strong, using 100 percent of the PGA_M results in no significant change to liquefaction-triggering.

Results of the liquefaction analysis indicate that saturated ESU 1 will liquefy during a design-level earthquake. ESU 2 appears to contain layers of predominantly coarse-grained or low-plasticity, fine-grained soil that are likely to liquefy. Where not susceptible to liquefaction, ESU 2 has a very soft consistency and is subject to cyclic softening during strong ground motions.

3.1.3 Liquefaction-Induced Settlement

LAI used procedures established by Boulanger and Idriss (2014) to evaluate the potential for liquefaction-induced settlement. Based on LAI's calculations, soil liquefaction could result in 2 inches to 2 ft of settlement.

3.1.4 Seismic Soil Strength Loss

During liquefaction, susceptible soils may experience reduced shear strength caused by a decrease in effective stress. Therefore, seismic calculations include a residual shear strength estimated in accordance with Boulanger and Idriss (2014). Strong ground motions can cause cyclic softening of non-liquefiable material. Seismic calculations for these soil layers include a 15 percent reduction in shear strength.

3.1.5 Lateral Spreading

Lateral spreading estimates were developed using empirical methods published by Youd et al. (2002) and Zhang et al. (2004). Based on these methods, LAI anticipates that lateral spreading on the order of ½ ft to more than 10 ft could occur in the vicinity of the proposed FT MInC building.

The empirical methods noted above do not explicitly account for the recent south wall replacement project. LAI used a limit equilibrium method (LEM) slope stability model to complete a first-order approximation and estimate the effect of the south wall on lateral spreading. The model included residual/cyclically softened soil shear strengths. The model also included a lateral pressure on the free face of the wall equal to the seismic earth pressure used to design the wall (PanGeo 2002; Figure 3). The LEM calculations indicate safety factors on the order of 1.05 to 1.25 for post-seismic conditions (i.e., flow failure does not appear likely) and less than 1.0 for pseudo-static conditions (i.e., the wall does not completely arrest lateral spreading).

3.2 Pile Foundations

The following sections include pile design recommendations for 24-inch-diameter open-end pipe piles with an inside-fit driving shoe. LAI recommends using a driving shoe to drive through old timber piles, consistent with the pile-driving performance for the south wall project.

3.2.1 Axial Pile Resistance

The nominal axial resistances in Table 3 are based on the results of the test pile program completed for the nearby south wall repair project. Static pile design methodologies were used to estimated pile resistance below the test pile depth.

Table 3. 24-inch-diameter Open-End Pile Nominal Axial Resistance

Pile Tip Elevation (ft)	Depth Below Existing Grade (ft)	Approx. Penetration into ESU 4 (ft)	Non-Liquefied Condition		Liquefied Condition	
			Compression (kips)	Tension (kips)	Compression (kips)	Tension (kips)
-29	55	0	250	100	150	0
-39	65	10	500	250	400	150
-49	75	20	670	370	570	270
-59	85	30	840	490	740	390
-69	95	40	1,000	600	900	500

Note: Values are based on a minimum of 10 ft of impact driving at the end of pile installation.
Approx. = approximate
ESU = engineering stratigraphic unit
ft = feet

Where load combinations include kinematic loads, pile design should include a 60-kip downdrag load (i.e., downdrag should be considered a kinematic load). Downdrag loads should be added to structure loads to check pile capacity. The safety factors in Table 4 can be used to compute allowable pile resistance.

Table 4. Pile Axial Resistance Safety Factors

Static	Seismic
2	1.5

3.2.2 Lateral Pile Resistance

Tables 5 and 6 include soil p-y spring parameters for modelling pile response to lateral loads. Table 7 includes recommended p-multipliers to account for the effects of closely spaced piles on the soil p-y response.

Table 5. Non-liquefied P-Y Parameters

Soil Layer	Soil Description	Density/ Consistency	Elevation (ft)		P-Y Model	P-Y Model Parameters
			Top	Bot		
1	ESU 1 Fill (unsaturated)	Loose	26	21	API Sand	γ' = 120 pcf, ϕ = 33 deg, k = 60 pci
2	ESU 1 Fill/native (saturated)	Loose	21	11	API Sand	γ' = 53 pcf, ϕ = 30 deg, k = 20 pci
3	ESU 2 Native fine-grained	Very soft	11	-24	Soft clay (Matlock 1970)	γ' = 30 pcf, c = 300 psf, ε_{50} = 0.02
4	ESU 3 Weak glacial soils	Medium dense/stiff	-24	-29	API Sand	γ' = 61 pcf, ϕ = 34 deg, k = 70 pci
5	ESU 4 Strong glacial soils	Very dense/hard	-29	< -29	API Sand	γ' = 65 pcf, ϕ = 40 deg, k = 150 pci

ϕ = friction angle; API = American Petroleum Institute; Bot = bottom; ε_{50} = strain factor; ESU = engineering stratigraphic unit; ft = feet; k = soil modulus; pcf = pounds per cubic foot; pci = pounds per cubic inch; psf = pounds per square foot; γ' = effective unit weight

Table 6. Liquefied P-Y Parameters

Soil Layer	Soil Description	Density/ Consistency	Elevation (ft)		P-Y Model	P-Y Model Parameters
			Top	Bot		
1	ESU 1 Fill (unsaturated)	Loose	26	21	API Sand	γ' = 120 pcf, ϕ = 33 deg, k = 60 pci
2	ESU 1 Fill/native (saturated)	Loose	21	11	Liquefied sand (Rollins et al. 2005)	γ' = 53 pcf
3	ESU 2 Native fine-grained	Very soft	11	-24	Soft clay (Matlock 1970)	γ' = 30 pcf, c = 250 psf, ε_{50} = 0.02
4	ESU 3 Weak glacial soils	Medium dense/stiff	-24	-29	API Sand	γ' = 61 pcf, ϕ = 34 deg, k = 70 pci
5	ESU 4 Strong glacial soils	Very dense/hard	-29	< -29	API Sand	γ' = 65 pcf, ϕ = 40 deg, k = 150 pci

ϕ = friction angle; API = American Petroleum Institute; Bot = bottom; ε_{50} = strain factor; ESU = engineering stratigraphic unit; ft = feet; k = soil modulus; pcf = pounds per cubic foot; pci = pounds per cubic inch; psf = pounds per square foot; γ' = effective unit weight

Table 7. Lateral Pile P-multipliers

Leading Row (6D≥C≥4D)	Trailing Rows (6D≥C≥4D)	Leading Row (4D>C≥2D)	Trailing Rows (4D>C≥2D)
p_m = 0.8	p_m = 0.4	p_m = 0.4	p_m = 0.2

Note: Use p-multipliers for pile spacing of less than 6 pile diameters. LAI should be contacted for additional recommendations if pile spacing is less than 4 diameters.
Row = Piles aligned perpendicularly to direction of anticipated pile group displacement.
Leading row = First row of piles in direction of anticipated pile group displacement.
Trailing rows = Rows behind leading row.
C = pile center-to-center spacing
D = pile diameter
p_m = p-multiplier

3.2.3 Lateral Spreading and Seismic Load Cases

Based on the results of LAI's analysis, lateral spreading is likely to occur at the site, and ground deformations could be on the order of several feet. Pile design should account for the effects of lateral spreading (soil kinematic loading). Kinematic loading can be approximated using a simplified force-based approach (Cubrinovski and Ishihara 2004) with the information shown on Figure 4. The designer should consider kinematic loads on grade beams, piles, and the elevator pit. Design considerations for the elevator pit are provided in Section 3.3.

As noted in Section 3.1, strong ground motions may coincide with liquefaction effects. The following seismic load cases should be considered:

1. Non-liquefied soil conditions with 100 percent of the structure inertial loads.
2. Liquefied soil conditions with 100 percent of the structure inertial loads.
3. Liquefied soil conditions with 100 percent kinematic soil loads and 25 percent of the structure inertial loads.

3.2.4 Pile Design and Construction Considerations

The following key points should be considered when developing pile design plans and specifications:

- The plans and specifications should list the required ultimate pile capacity, the minimum tip elevation, the expected tip elevation for achieving ultimate capacity, and estimated overdriving. The minimum tip elevation is that required for geotechnical/lateral fixity, and the expected tip elevation is that required for ultimate pile capacity.
- Overdriving is likely to be required if minimum tip elevation is deeper than expected tip elevation. The values in Table 1 can be used to estimate overdriving requirements.
- The plans and specifications should require at least 10 ft of impact driving at the end of installation. Predrilling, jetting, and drilling ahead of the pile should not be allowed.
- Dynamic driving stresses were estimated at up to 55 kips per square inch (ksi) for a 24-inch-diameter pile with ⅜-inch-thick walls. Higher driving stresses are likely when driving through debris obstructions. Actual driving stresses will depend on pile-driving equipment, efficiency,

and soil conditions. Based on discussion with PND, LAI understands that driving stresses of up 60 ksi may be tolerable. Given the potential for debris to be encountered in the soil, LAI recommends that pile walls are upsized to ½ inch thick for full depth, rather than the ⅜-inch-thick walls below 40 ft shown on the 60% design plans.

- The contractor should be required to submit a wave equation analysis of piles, demonstrating that the proposed pile-driving equipment will not cause driving stresses more than 90 percent of the steel yield strength. The analysis should be stamped by a licensed professional engineer.
- Obstructions within ESU 1 fill may slow or refuse pile driving. The south wall repair project included a test pile program in which a 24-inch-diameter pipe pile with inside-fit driving shoe was successfully driven through an old timber pile with an APE 200 vibratory hammer and a D-62 open-end diesel impact hammer.
- As a contingency, piles should be lengthened 5 ft to account for variable soil conditions and damaged pile top cutoff.
- Provided existing timber piles are not mechanically connected to the new building foundation, no modification or degradation of new steel pile axial or lateral capacity will be required.
- The recommendations herein do not account for corrosion or corrosion protection. The project design team should consider whether additional wall thickness or pile treatment is required.
- A minimum of three production piles should include dynamic load testing with signal matching. The load test should be performed on a pile that was driven at least 3 days prior to the load test. The load test should measure capacity within the initial 3 inches of restrike driving and after 2 ft of additional driving. The load test should be performed at, or near, the expected tip elevation. The load testing firm should submit a report with the load test results. The report should be stamped by a professional engineer.
- Pile driving may cause vibration and ground settlement, which could damage adjacent buildings and utilities. The test pile program for the south wall replacement project documented up to ½ inch of settlement and peak particle velocities of up to 0.5 inch/second 15 ft from the pile. LAI recommends that the Port reviews records of construction damage from the south wall repair project and anticipates a similar level of vibration- and settlement-related damage during construction of the FT MInC.
- At a minimum, LAI recommends that the contractor is required to perform a precondition survey of utilities and buildings adjacent to the site. The survey should include photographic and elevation measurements. If the Port is concerned about vibration damage to adjacent infrastructure, LAI recommends vibration monitoring is implemented during pile driving.

3.3 Elevator Pit

The proposed FT MInC building includes an elevator pit. LAI understands that the structural design approach will be to consider the pit “suspended” from adjacent, pile-supported grade beams. The pit will attract and dissipate soil loads. The free-body diagram on Figure 5 can be used to compute earth pressures acting on the pit.

3.4 Earthwork

Earthwork is anticipated to consist of grade beam excavation and utility trenching. Excavations will generally be 4 ft deep or less. The following key points should be considered when developing plans and specifications:

- Pockets of perched groundwater could be encountered above 4 ft bgs. The contractor should be responsible for excavation stability and groundwater control.
- Grade beam excavations should be backfilled to provide a suitable working platform for beam and slab formwork.
- Utility trench excavations should extend at least 1 ft below the bottom of the utility. A separation geotextile should be placed at the bottom of the excavations and covered with at least 8 inches of permeable backfill and bedding sand.
- Where utility trench excavations extend below groundwater, but bedding sand is above groundwater, trenching can be completed in accordance with the recommendations in the previous bullet. Bedding sand should not be placed below water, and trenches should be temporarily dewatered prior to bedding sand placement, if needed.
- LAI recommends using a non-woven polypropylene geotextile with a minimum and maximum apparent opening size of No. 100 and No. 30 US Sieve, respectively, and a minimum grab tensile strength of 500 pounds, such as the TenCate Mirafi® HP270 or an engineer-approved equivalent.
- Permeable backfill should consist of a crushed 2.5-inch minus rock with no more than 5 percent passing the No. 4 sieve, such as Permeable Ballast per Section 9-03.9(2) of the Washington State Department of Transportation's 2021 *Standard Specifications for Road, Bridge, and Municipal Construction* (*2021 WSDOT Standard Specifications*) or other engineer-approved equivalent.
- Pipe bedding should consist of Gravel Backfill for Pipe Zone Bedding, in accordance with the requirements in Section 9-03.12(3) of the *2021 WSDOT Standard Specifications.*
- Utility trench backfill should consist of Gravel Backfill for Pipe Zone Bedding to a depth at least 6 inches above the utility, and then of Gravel Backfill for Pipe Zone Bedding or Gravel Borrow, per Section 9-03.14(1) of the *2021 WSDOT Standard Specifications.*
- Utility trench backfill should be placed and compacted in accordance with the pipe manufacturer's recommendations.
- Below-grade vaults should be designed for submerged at-rest earth pressures using an equivalent fluid density of 26 pounds per cubic foot. Hydrostatic pressure should be included, with groundwater assumed at ground surface. Hydrostatic uplift resistance can be computed by multiplying the at-rest earth pressure by a friction coefficient of 0.25 for precast concrete structures and 0.2 for steel and plastic structures.

3.5 Pavement

Pavement throughout Fishermen's Terminal suffers from deterioration due to settlement of the subgrade. Subgrade settlement is likely a result of organics and debris in ESUs 1 and 2. There are few,

if any, economical remedies that will significantly increase pavement life. LAI understands that the Port prefers more frequent pavement maintenance/repaving to a permanent remedy.

The proposed parking lot adjacent to the FT MInC building should be consistent with other pavement sections used by the Port. LAI is available to provide more specific pavement design recommendations, if needed.

LAI understands that geothermal wells may be installed beneath the parking lot. To minimize the risk of differential settlement caused by installation of the geothermal wells, the following should be incorporated into the well design:

- The top of the geothermal wells should be more than 3 ft below grade, and no manhole, monument, junction box, etc. should be placed above the well.
- The wells should not include permanent casings. The wells should be backfilled with sand/bentonite grout **without** cement.
- Borehole diameters for the wells should measure less than 8 inches.
- Geothermal plumbing should consist of flexible pipe.

3.6 Seattle Department of Construction and Inspections Requirements

The following key points are provided to satisfy SDCI Rule 5-2016:

- The project environmental engineering report (LAI 2021) provides documentation and recommendations regarding potentially contaminated soils.
- In LAI's judgment, all portions of the site and adjacent properties that are disturbed or impacted by the proposed project will be stable or stabilized during construction, and will continue to be stable after construction, provided the recommendations in this report are followed.
- The site is not at risk for erosion after construction because the entire site is flat and paved, and will be paved after construction. Erosion risk may present during limited construction windows (e.g., grade beam excavation). Temporary erosion and sediment control are the responsibility of the contractor.
- The geotechnical elements of seismic design have been evaluated in accordance with the criteria and ground motions prescribed by the current version of the Seattle Building Code.
- The site is flat and paved and consists of the building area and adjacent parking lot. The entire site appears to be equally stable, and the preferred building location is the site of the existing building.

4.0 USE OF THIS REPORT

Landau Associates has prepared this report for the exclusive use of the Port of Seattle and BRPH Architects-Engineers, Inc. for specific application to the Fishermen's Terminal Maritime Innovation Center project in Seattle, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Reuse of the information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that, within the limitations of scope, schedule, and budget, its services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality, under similar conditions as this project. Landau Associates makes no other warranty, either express or implied.

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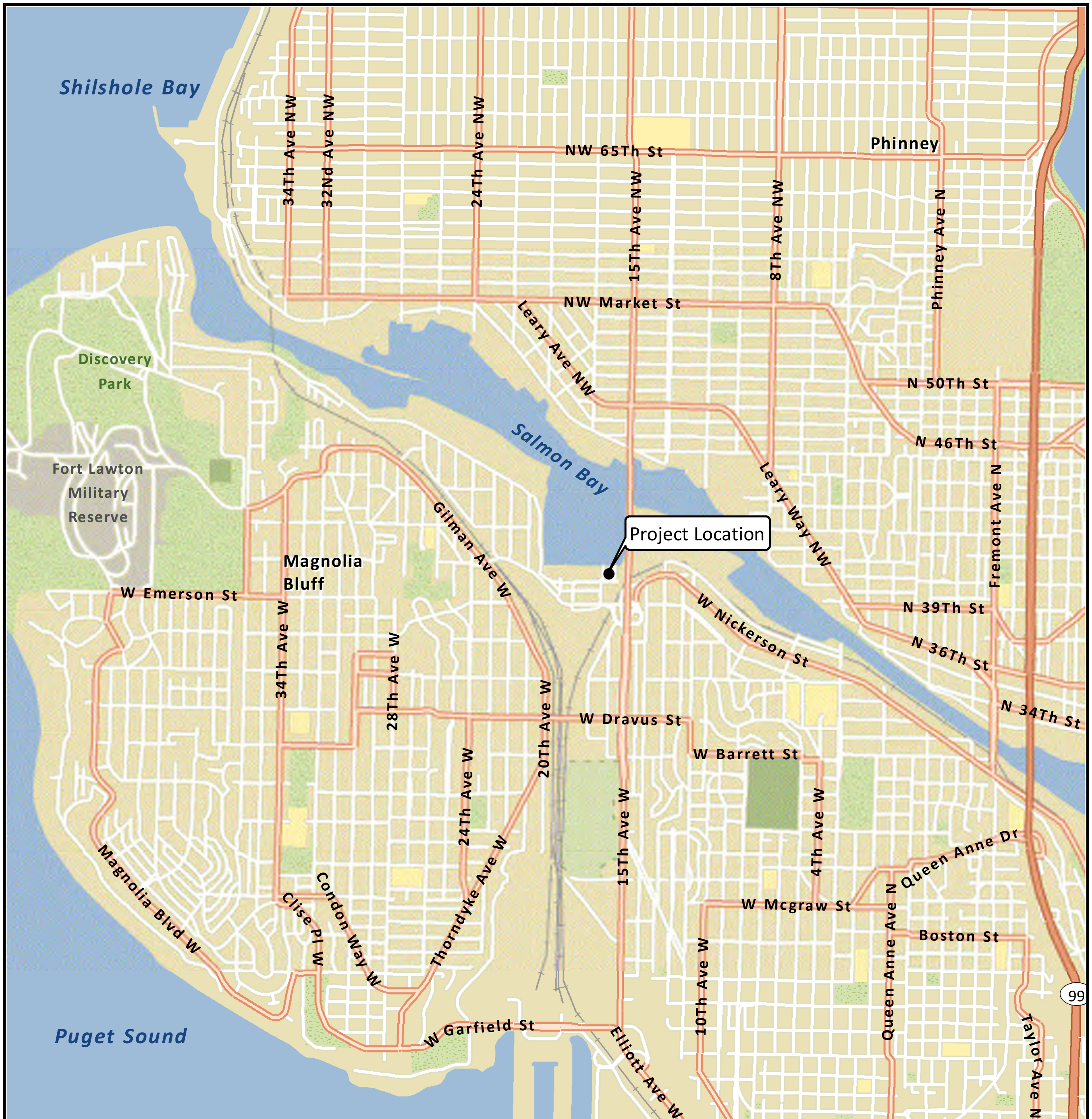

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Fishermen's Terminal Maritime Innovation Center (FTMInC) Seattle, Washington	**Vicinity Map**	Figure 1

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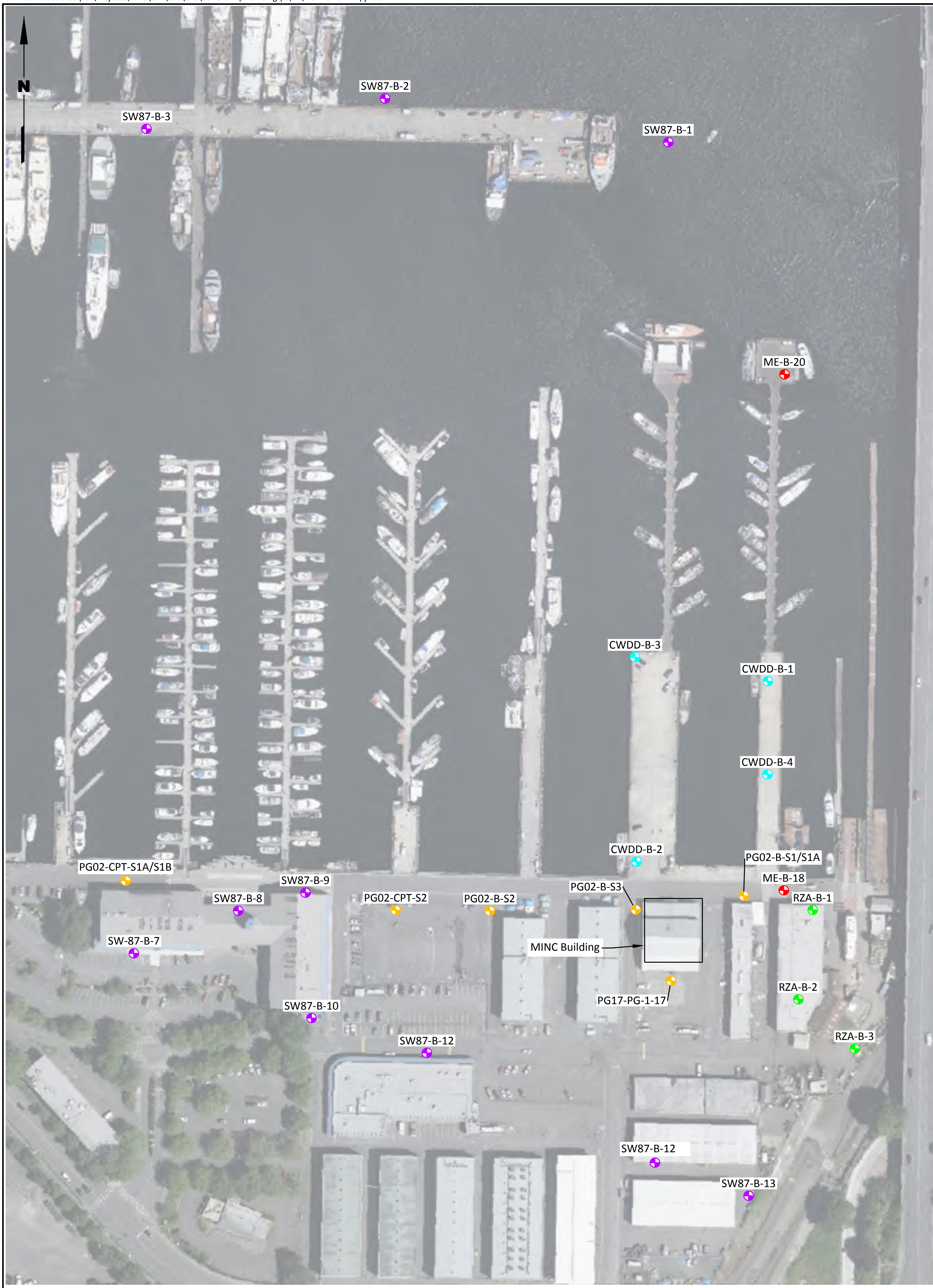

Legend

Boring Location and Designation:

ME Metropolitan Engineers (1968)

RZA Rittenhouse-Zeman & Associates, Inc. (1977)

CWDD Converse Ward Davis Dixon, Inc. (1981)

SW87 Shannon & Wilson, Inc. (1987)

PG02 / PG17 PanGEO (2002 / 2017)

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 150 300

Scale in Feet

Source: Bing Aerial Imagery, 2021

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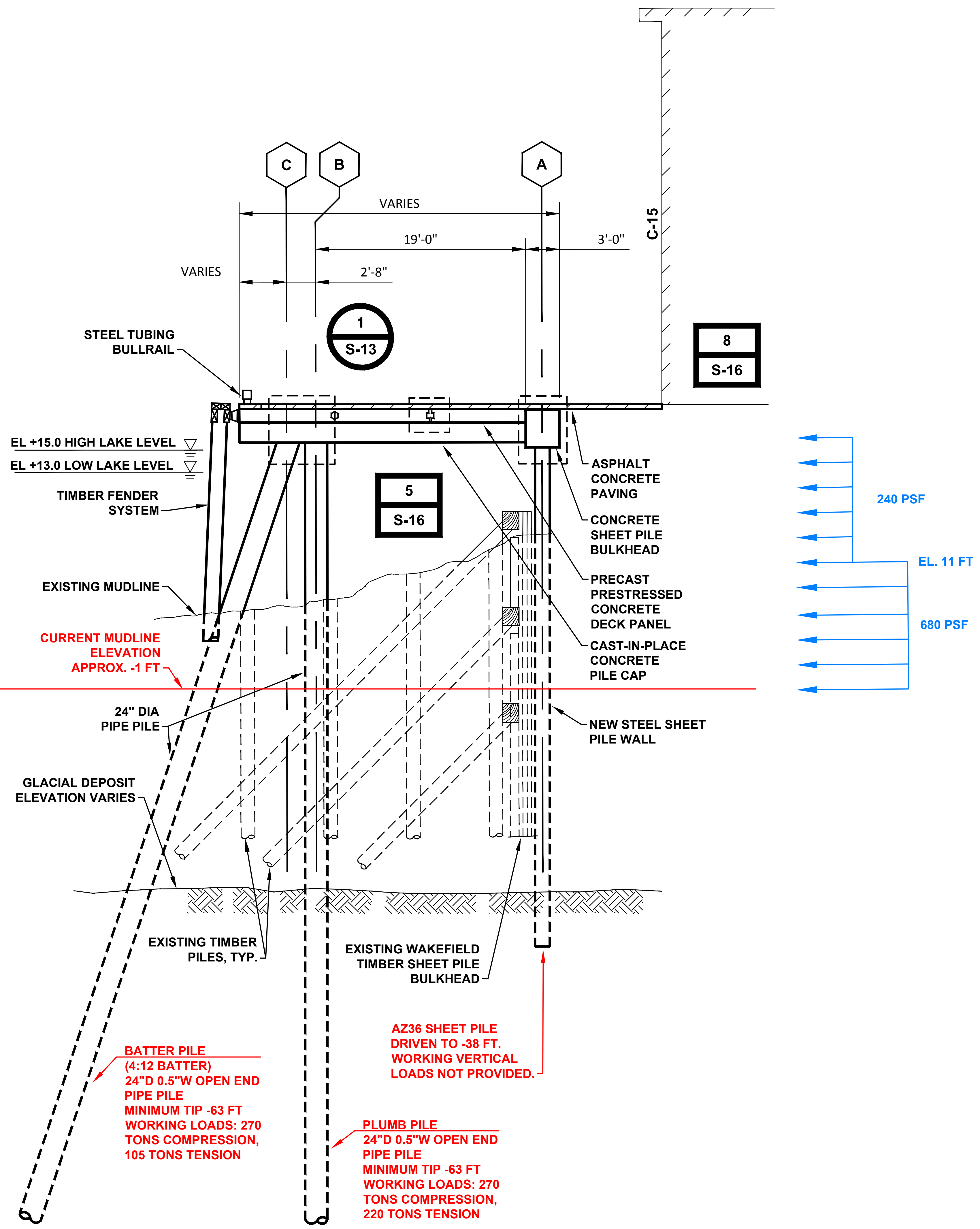
Fishermen's Terminal Maritime Innovation Center (FTMInC) Seattle, Washington	**Site and Exploration Plan**	Figure 2



NOTES

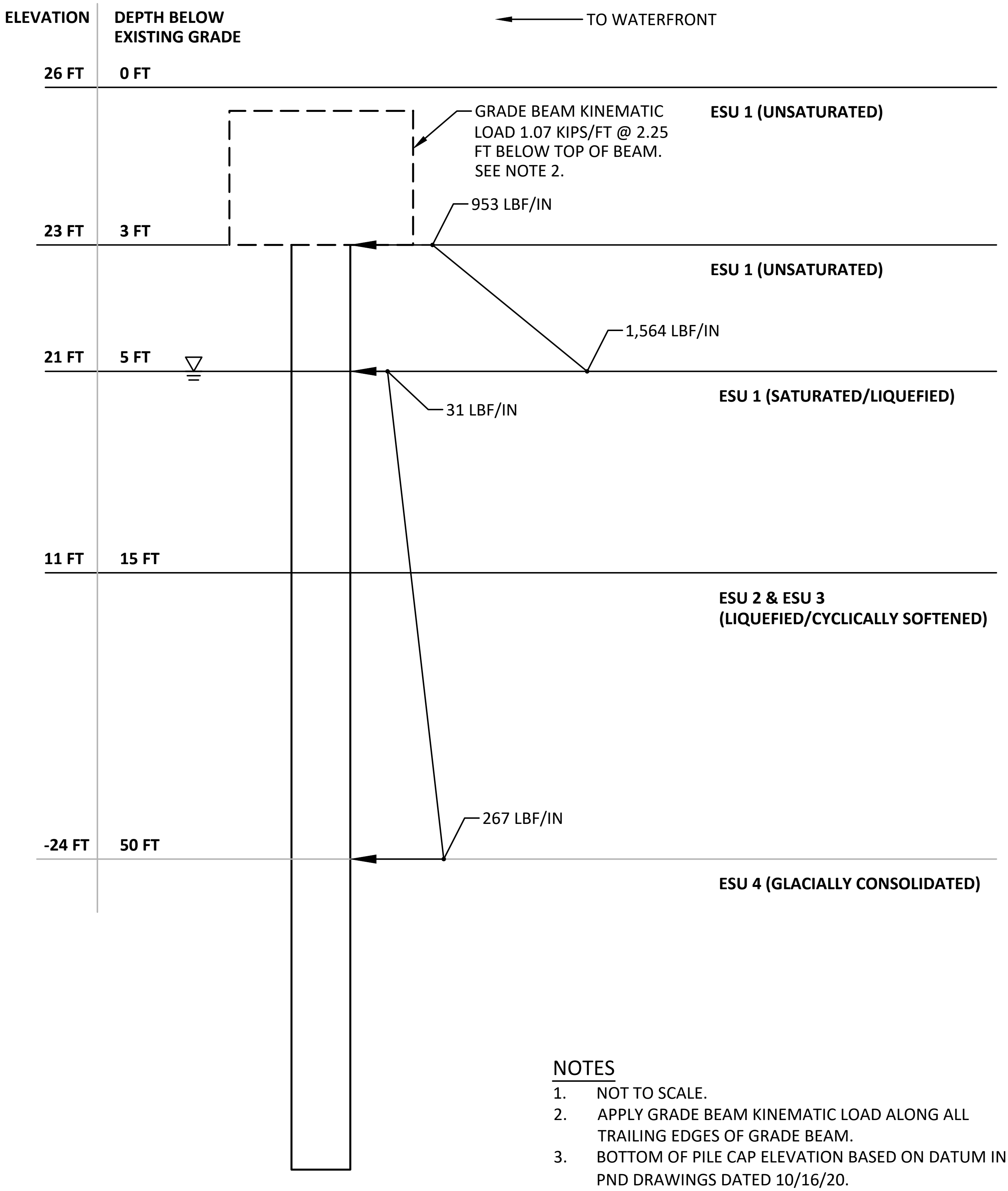
1. DETAIL DRAWING FROM SOUTH WALL REPAIR PROJECT (PORT PROJECT NO. FT-0102) DRAWING NO. FT-0102-S-13. DETAIL IS REPRESENTATIVE OF AS-BUILT CONDITIONS NEAR THE MINC BUILDING BASED ON CIVIL AND STRUCTURAL LAYOUT AS-BUILT DRAWINGS FROM FT-0102.
2. RED MARKUPS ADDED BY LAI TO PROVIDE ADDITIONAL RELEVANT WHARF DESIGN INFORMATION AND ARE BASED ON FT-0102 DESIGN DRAWINGS AND CALCULATIONS.
3. BLUE PRESSURE DIAGRAM ADDED BY LAI AND IS BASED ON THE RECOMMENDED SEISMIC DESIGN PRESSURES IN PANGEO (2002). THE PRESSURE IS DESCRIBED AS TOTAL (STATIC + SEISMIC INCREMENT) BY PANGEO (2002). PRESSURES SHOWN INCLUDE ONLY THOSE APPLIED ABOVE MUDLINE.
4. ELEVATIONS SHOWN HERE USE NAVD 29 DATUM.

Source: Port of Seattle 2002

0 10 20
Scale in Feet

Fishermen's Terminal Maritime Innovation Center (FTMInC) Seattle, Washington	South Wall Typical Section	Figure 3

Landau Associates



NOTES

1. NOT TO SCALE.
2. APPLY GRADE BEAM KINEMATIC LOAD ALONG ALL TRAILING EDGES OF GRADE BEAM.
3. BOTTOM OF PILE CAP ELEVATION BASED ON DATUM IN PND DRAWINGS DATED 10/16/20.
4. REFER TO REPORT TEXT FOR INSTRUCTIONS ON INTERPRETATION OF THIS DIAGRAM.
5. VALUES SHOWN HERE ASSUME 24-INCH DIAMETER PIPE PILES AND 3 FT DEEP GRADE BEAMS.

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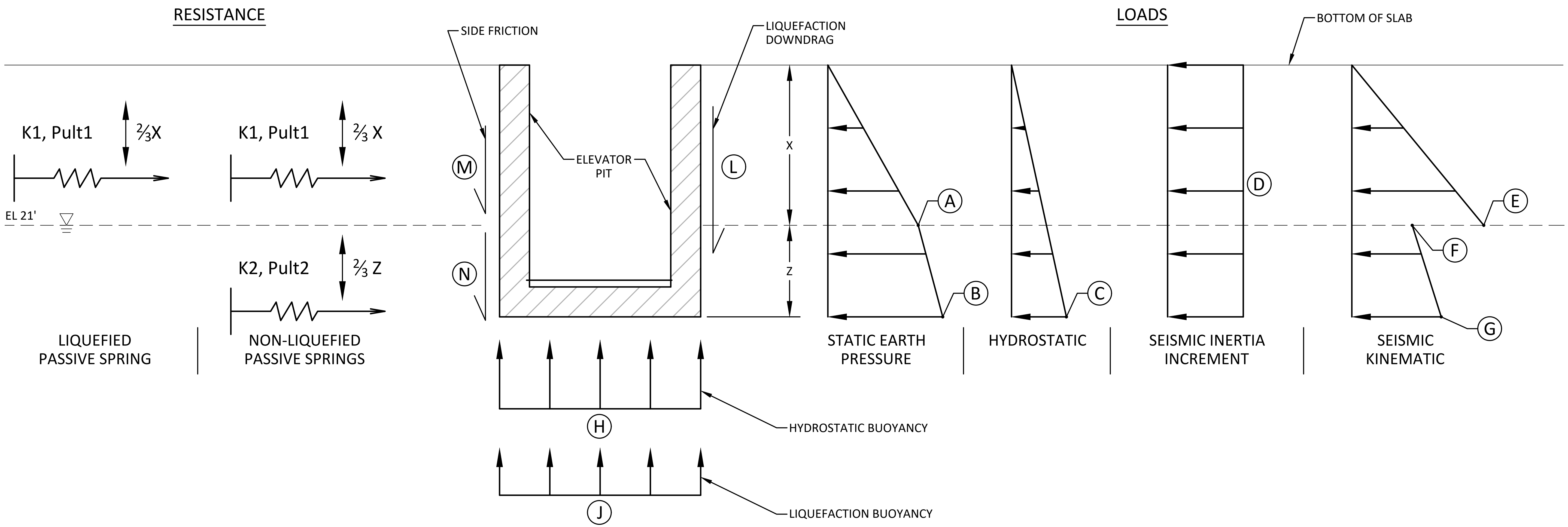
Fishermen's Terminal
Maritime Innovation Center
(FTMInC)
Seattle, Washington

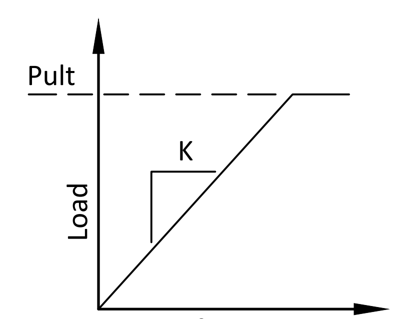
Kinematic Soil Loads on Foundation

Figure
4



NOTES

1. Refer to the table for loads associated with the diagrams above.
2. LAI recommends the following loading scenarios when considering pressures acting on the elevator pit.
   a. Static conditions: Static earth pressure and hydrostatic pressure applied along all vertical faces. Apply hydrostatic buoyancy pressure and use uplift side friction as a resisting force.
   b. Non-seismic lateral building loads: Same as scenario (a), except the non-liquefied passive springs should replace the static earth pressure on the leading face.
   c. Seismic, non-liquefied: Same as scenario (b), except include the seismic soil inertial incremental load on the trailing face.
   d. Seismic, liquefied: Same as scenario (c), except the liquefied passive spring should be used (neglect passive resistance below water); the liquefied buoyancy should be used; and uplift side friction below water should be neglected.
   e. Seismic, kinematic loading: Same as scenario (d), except the seismic kinematic soil load should replace the static earth pressure and 25 percent of the seismic inertia increment should be applied. Include the liquefaction downdrag on all faces instead of the uplift resistance.
3. LAI recommends computing hydrostatic pressures with groundwater at the bottom of the slab.
4. Recommendations are based on the assumption that the pit will be constructed with cast-in-place concrete.
5. All values are unfactored ultimate.
6. Resistance is provided by passive springs. Ultimate spring capacity (Pult) and stiffness (K) are provided in the table. Values are provided on a per-foot basis. Springs are bilinear in accordance with the diagram below.



TABLE

Item	Value	Units	Description
A	55x	psf	At-rest pressure
B	55x+26z	psf	Submerged at-rest pressure
C	64(x+z)	psf	Hydrostatic pressure
D	12(x+z)	psf	Seismic soil inertial pressure
E	407x	psf	Seismic soil kinematic pressure
F	36x	psf	Seismic liquefied soil kinematic pressure
G	36(x+z)	psf	Seismic liquefied soil kinematic pressure
H	64(x+z)	psf	Hydrostatic buoyancy pressure
J	120z	psf	Liquefied soil buoyancy pressure
L	$14x^2$	plf	Liquefaction downdrag
M	$14x^2$	plf	Uplift side friction
N	$14xz+7z^2$	plf	Uplift side friction, below water
K1	0.04x	plf/ft	Passive spring constant, above water
K2	0.04(x+z)	plf/ft	Passive spring constant, below water
Pult1	$204x^2$	plf	Passive spring ultimate resistance, above water
Pult2	$407xz+95z^2$	plf	Passive spring ultimate resistance, below water
Note: x and z in units of feet.			

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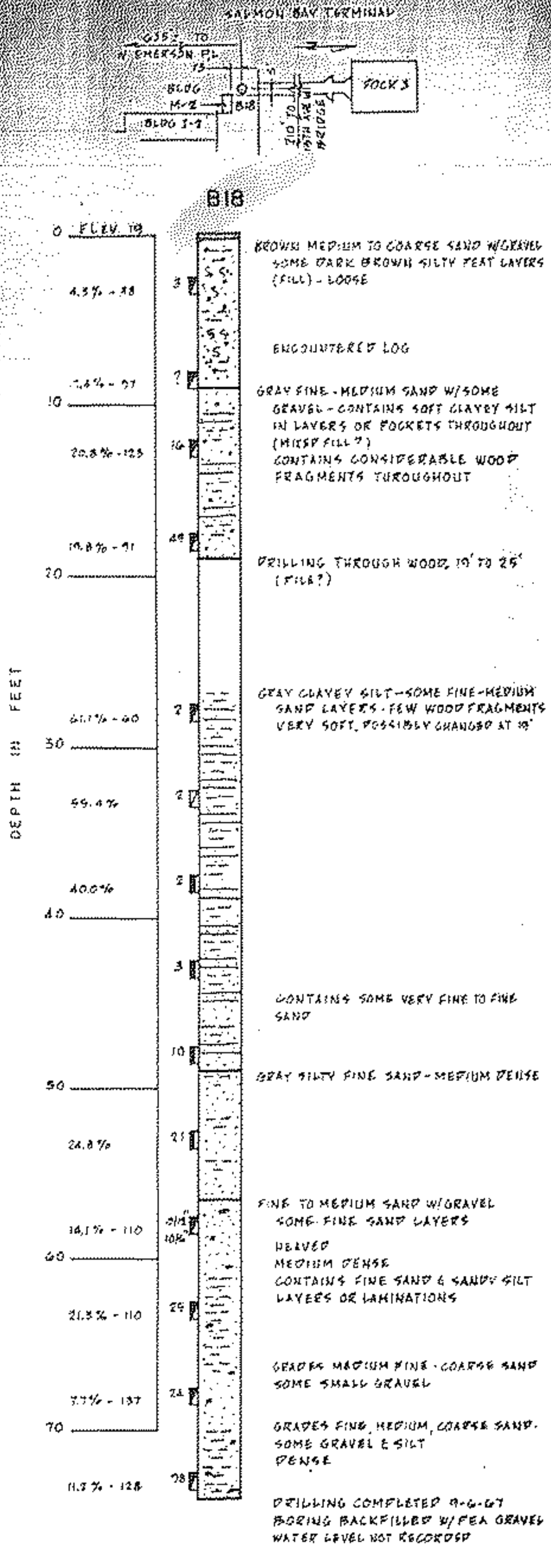
Fishermen's Terminal
Maritime Innovation Center
(FT MInC)
Seattle, Washington

Elevator Pit Soil Loads

Figure
5

APPENDIX A

Historical Boring Logs



SALMON BAY TERMINAL
635± TO W EMERSON PL
BLDG M-2
BLDG J-7
B18
DOCK 3
210 TO 15TH AVE W BRIDGE
B18
0 ELEV. 19
10
20
30
40
50
60
70
DEPTH IN FEET
4.3% - 88
20.8% - 125
19.8% - 91
61.1% - 60
55.4%
40.0%
24.8%
14.1% - 110
21.3% - 110
7.7% - 137
11.3% - 128
3
7
16
49
2
2
2
3
10
21
29
24
98
BROWN MEDIUM TO COARSE SAND W/GRAVEL SOME DARK BROWN SILTY PEAT LAYERS (FILL) - LOOSE
ENCOUNTERED LOG
GRAY FINE - MEDIUM SAND W/SOME GRAVEL - CONTAINS SOFT CLAYEY SILT IN LAYERS OR POCKETS THROUGHOUT (MIXED FILL ?)
CONTAINS CONSIDERABLE WOOD FRAGMENTS THROUGHOUT
DRILLING THROUGH WOOD, 19' TO 25' (FILL?)
GRAY CLAYEY SILT - SOME FINE-MEDIUM SAND LAYERS - FEW WOOD FRAGMENTS VERY SOFT, POSSIBLY CHANGED AT 19'
CONTAINS SOME VERY FINE TO FINE SAND
GRAY SILTY FINE SAND - MEDIUM DENSE
FINE TO MEDIUM SAND W/GRAVEL SOME FINE SAND LAYERS
HEAVED
MEDIUM DENSE
CONTAINS FINE SAND & SANDY SILT LAYERS OR LAMINATIONS
GRADES MEDIUM FINE - COARSE SAND SOME SMALL GRAVEL
GRADES FINE, MEDIUM, COARSE SAND. SOME GRAVEL & SILT
DENSE
DRILLING COMPLETED 9-6-67
BORING BACKFILLED W/ PEA GRAVEL
WATER LEVEL NOT RECORDED

DATE DRILLED: May 7, 1981

SUMMARY: BORING NO. [illegible]-2

ELEVATION: -7.5

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED

DEPTH IN FEET	SAMPLE NO.*	BLOWS/6"	OTHER TESTS**	FIELD MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	DESCRIPTION		SYMBOL	MOISTURE	CONSISTENCY	Elevation
						CLAYEY SILT	gray, little gravel, trace sand, occasional wood and peat fragments (possible fill).	MH	wet	medium stiff	-10
5	1X	2 1 7									
											-15
10	2X	1 0 1		339			grades with increasing gravel and numerous wood fragments.			very soft	
											-20
15	3X	0/18"					occasional brown sandy silt nodules.				
	4X	0/18"		117							
20											-25
	5A	8 17 19		57		SILTY CLAY	gray, occasional wood fragments.	CL	wet	very stiff	-30
25							interlayered, some gravel.				
	6A	8 20 7		66							
30						SAND	gray, fine to medium, little silt.	SP	wet	medium dense	-35
	7A	8 15 22		22							
35							¼"-½" laminations of of clayey silt.			dense	-40
	8A	16 27 21		18					very moist		-45
40											

* A. 2" split-spoon sampler
B. 3" O.D. thin-wall sampler C. 3-1/4" O.D. x 2-1/2" liner
D. 3-1/2" O.D. split barrel sampler X. sample not recovered

** A - Atterberg, C - consolidation, DS - direct shear, G - grain size, T - triaxial, P - permeability

water level
impervious seal
piezometer tip

REPLACEMENT DOCKS 3 and 4
Fisherman's Terminal - Seattle, Washington
for Bruce C. Olsen

Project No. 81-5140-01

Drawing No. 4

ConverseWardDavisDixon Geotechnical Consultants

DATE DRILLED: May 6, 1981

SUMMARY: BORING NO. [illegible]-3

ELEVATION: -12

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DEPTH IN FEET	SAMPLE NO.*	BLOWS/6"	OTHER TESTS**	FIELD MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	DESCRIPTION		SYMBOL	MOISTURE	CONSISTENCY	Elevation
0–10						SILTY CLAY	gray, with scattered nodules of brown silt, trace sand.	CL	wet	very soft	-15, -20
5	1A	0/18"		80							
10–25						CLAYEY SILT	gray, trace sand and organics, scattered nodules of brown silt, scattered ¼" layers of peat.	MH	wet	very soft	-25
10	2A	1 0 0 0		67							
15	3A	0/18"		60							-30
							alternating layers of hard and soft drilling at 17.5'.				
20	4A	3 1 1/12"		165							-35
25–40						SILTY SAND	gray, fine, trace clay, slight iron staining.	SM	wet	medium dense	
25	5A	5 10 12		52							-40
30	6A	4 12 14		39			fine to medium, occasional peat and wood fragments.				-45
35	7A	64		27			little silt, occasional wood fragments.			very dense	-50
40											

* A. 2" split-spoon sampler B. 3" O.D. thin-wall sampler C. 3-1/4" O.D. x 2-1/2" liner D. 3-1/2" O.D. split barrel sampler X. sample not recovered

** A - Atterberg, C - consolidation, DS - direct shear, G - grain size, T - triaxial, P - permeability

water level
impervious seal
piezometer tip

REPLACEMENT DOCKS 3 and 4
Fisherman's Terminal - Seattle, Washington
for Bruce C. Olsen

Project No. 81-5140-01

Drawing No 6

ConverseWardDavisDixon Geotechnical Consultants

DATE DRILLED: May 6, 1981

SUMMARY: BORING NO. _-3 cont

ELEVATION:

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DEPTH IN FEET	SAMPLE NO.*	BLOWS/6"	OTHER TESTS**	FIELD MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	DESCRIPTION		SYMBOL	MOISTURE	CONSISTENCY	Elevation
40	8A	42 60/5"		11		SILTY SAND (cont.)	some gravel.	SM	moist	very dense	
											-55
45	9A	36 60/5"		21			fine to medium, occasional iron stains		very moist		
											-60
50	10A	17 34 60/4"		29			alternating 1/8" laminations of sand and sandy silt.				
							occasional wood fragments.				-65
55	11A	60/4"		17		SILT	gray, some gravel, trace sand	ML	moist	hard	

Bottom of boring at depth 54.8'.
(Elevation -66.8'.)

* A. 2" split-spoon sampler
B. 3" O.D. thin-wall sampler C. 3-1/4" O.D. x 2-1/2" liner
D. 3-1/2" O.D. split barrel sampler X. sample not recovered

**A - Atterberg, C - consolidation, DS - direct shear,
G - grain size, T - triaxial, P - permeability

water level
impervious seal
piezometer tip

REPLACEMENT DOCKS 3 and 4
Fisherman's Terminal - Seattle, Washington
for Bruce C. Olsen

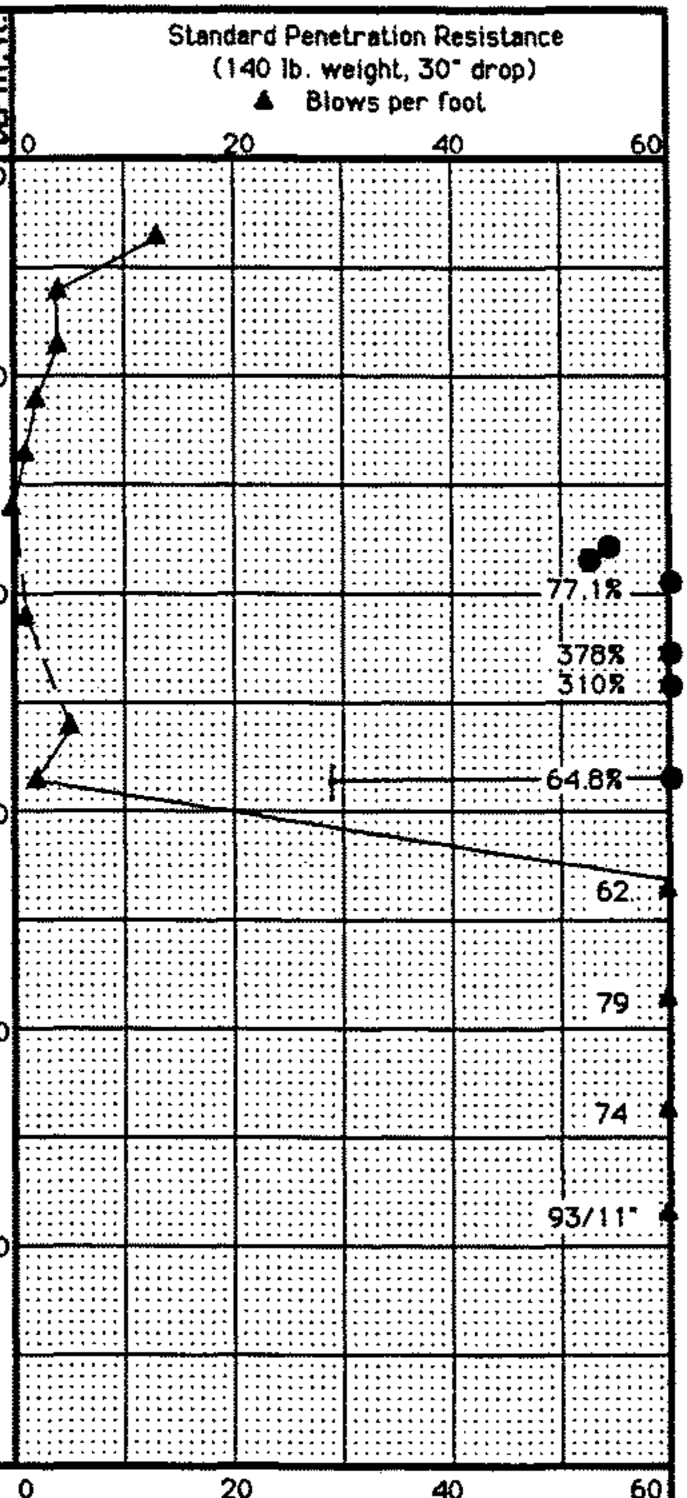
Project No.
81-5140-01

Drawing No.
7

ConverseWardDavisDixon Geotechnical Consultants

SOIL DESCRIPTION Surface Elevation: Approx. +20 Feet	DEPTH, ft.	SAMPLES
Medium dense, brown, slightly silty, fine SAND with scattered organics and petroleum odor. (Fill)	0	1
Very loose to loose, gray-brown, silty, fine SAND with scattered wood and shell fragments.	5	2, 3, 4
Very soft, gray, silty CLAY with scattered organics.	12	5, 6*, 7
Very soft to medium stiff, dark brown, PEAT.	21	8, 9, 10
Very soft, gray, silty CLAY with scattered organics and sand seams.	27	11
Very dense, gray, slightly silty to silty, fine to medium SAND with scattered coarse sand and gravel.	30	12, 13, 14, 15
BOTTOM OF BORING COMPLETED 3-3-87	49	

GROUND WATER: 3-24-87



LEGEND

- 2" O.D. split spoon sample
- 3" O.D. thin-wall sample
- * Sample not recovered
- Atterberg Limits: Liquid limit; Natural water content; Plastic limit
- Impervious seal
- Water level
- Slotted pipe
- P Sample pushed
- TV Torvane reading, tons/ft.^{2}
- PP Pocket penetrometer reading, tons/ft.^{2}
- ● % Water Content

NOTE: The stratification lines represent the approximate boundaries between soil types and the transition may be gradual.

PORT OF SEATTLE
Fishermen's Terminal, Seattle, Washington

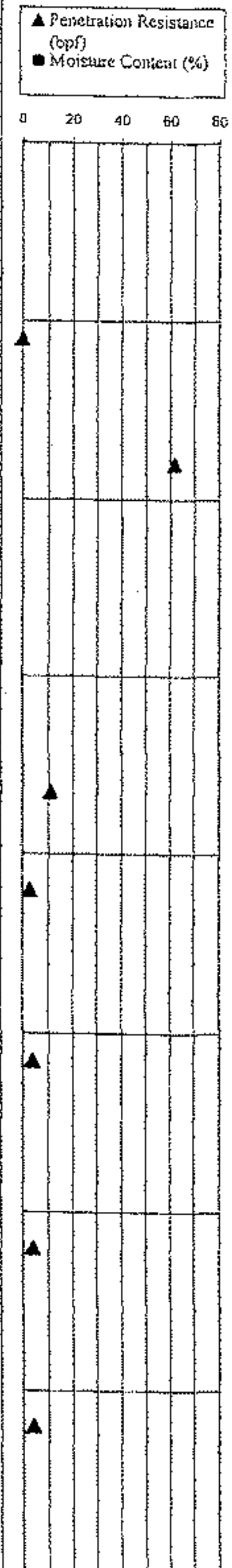
LOG OF BORING B-12

May 1987 W-4714-01

SHANNON & WILSON, INC.
Geotechnical Consultants

Figure A-12

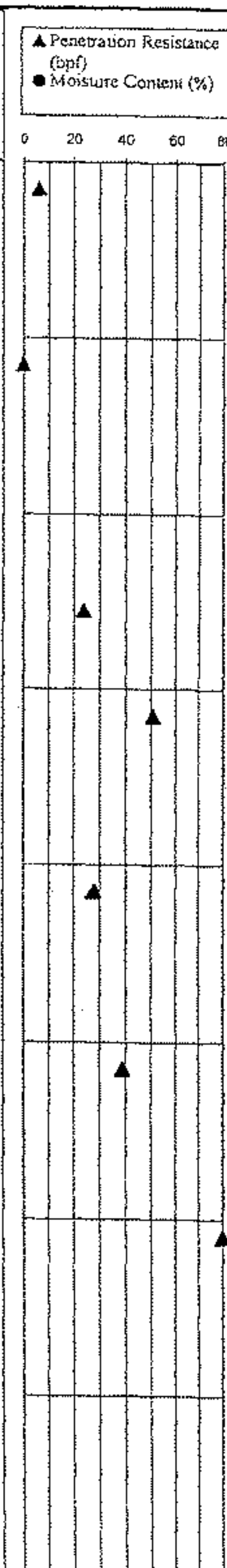
Depth (feet)	USCS Classification	Soil Description Ground Elevation = +19 feet	Sample Number	Blows/6"	Groundwater Level
	SP	Approximately 4 inches of ACP on brown, gravelly SAND with silt, moist.			
5	CH	Very soft, gray **CLAY**, wet. Trace sand.	S-1	0-0-0	ATD
	SM	Very loose, gray, silty, fine to medium **SAND**, wet.			
	wood	Approximately 8 inches of **Wood Decking**			
10		Refusal at about 10 feet (probably on wood), moved boring 2 feet west (B-S1A).	S-2	26-36	
	water	**Void Space** below wood decking			
15	SP	Loose to very loose, gray, fine to medium **SAND** with gravel and silt, wet. Trace organics and wood fragments.			
		Sample S-3 encountered wood.	S-3	3-4-7	
20			S-4	3-1-2	
		Sampling refusal at 24 feet (wood)	S-5	push	
25		Sample S-6 encountered wood.	S-6	8-2-2	
30	CH	Very soft, gray **CLAY**, wet. Trace sand and organics. Scattered sand layers.	S-7	0-0-4	
35			S-8	0-0-4	
40		Sample S-9 no recovery	S-9	push	



(continued on page 2)

Drilling Co.: Holocene Drilling
Equipment: Hollow Stem Auger, Mobile B-65
Hammer System: 140-lb, 30" drop, automatic trip
Sampling Method: 2" OD Split Spoon / Shelby Tube
Date Completed: July 17, 2000
Inspected By: Tan

Depth (feet)	Lithology	USCS Classification	Soil Description Ground Elevation = +19 feet	Samples	Sample Number	Blows/6"	Moisture Content	Other Laboratory Tests	Groundwater Level	Well Diagram
		ML	Loose, gray, fine sandy **SILT**, wet. Scattered sandy clay seams.		S-10	5-3-3				
45		CH	Very soft, gray **CLAY**, wet. Scattered shell fragments ad organics.		S-11	0-0-0				
50			Sample S-12 no recovery		S-12	push				
55		ML	Medium dense, gray, very sandy **SILT**, wet.		S-13	8-10-14				
		SM	Very dense, gray, silty fine **SAND**, wet.		S-14	14-21-30				
60		ML	Medium dense to dense, gray, sandy **SILT**, wet.		S-15	8-11-17				
			Probable gravel layer between 63 and 64 feet.							
65			Decreasing sand content with depth		S-16	9-11-28				
70		SM	Very dense, gray, silty, fine to medium **SAND** with gravel, wet.		S-17	32-50/6"				
75			Bottom of boring at approximately 71 feet below top of relieving platform							
80										



Drilling Co.: Holocene Drilling

Equipment: Hollow Stem Auger, Mobile B-65

Hammer System: 140-lb, 30" drop, automatic trip

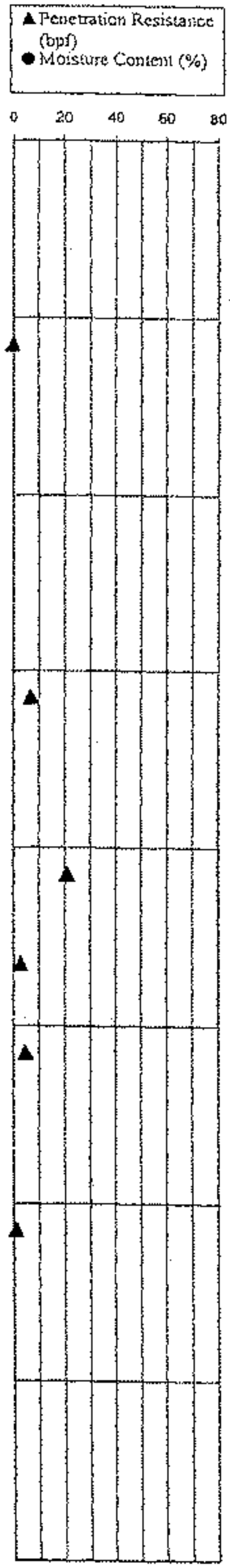
Sampling Method: 2" OD Split Spoon / Shelby Tube

Date Completed: July 17, 2000

Inspected By: Tan

Depth (feet)	USCS Classification	Soil Description Ground Elevation = +19 feet	Sample Number	Blows/6"	Groundwater Level
0	SP	Approximately 4 inches of ACP on gray, silty SAND with gravel, moist.			
5	CH	Very soft, gray CLAY, wet. Trace sand.	S-1	0-0-0	ATD
	wood	Approximately 8 inches of Wood Decking			
10	SP	Very loose, gray SAND, wet. (No void space beneath the decking detected)			
	wood	Approximately 6 to 8 inches of WOOD			
15	SP		S-2	6-4-3	
	wood	Approximately 12 inches of WOOD	S-3	28-50/4"	
20	SP		S-4	8-4-7	
	sawdust	Approximately 12" of SAWDUST			
25	SP		S-5	3-3-0	
			S-6	3-2-3	
30	CH	Very soft, gray CLAY, wet. Trace sand and organics.. Scattered sand layers.	S-7	1-0-1	
35		Sample S-8 (shelbey tube) no recovery. Pushed SPT spoon.	S-8	push	
40					

(continue on page 2)

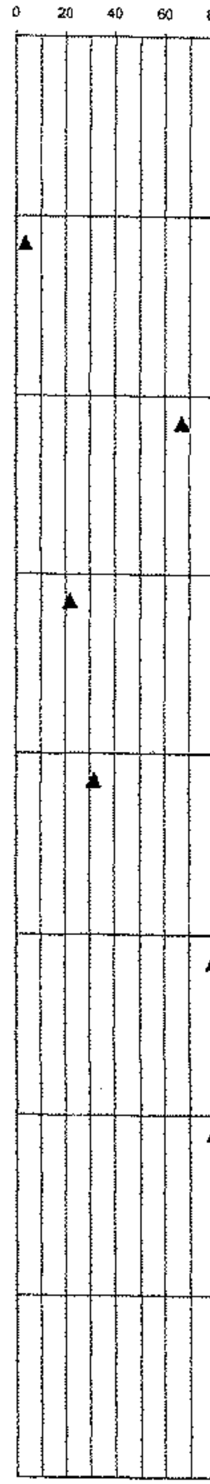


Drilling Co.: Holocene Drilling
Equipment: Hollow Stem Auger, Mobile B-65
Hammer System: 140-lb, 30" drop, automatic trip
Sampling Method: 2" and 3" OD Split Spoon / Shelby Tube
Date Completed: July 18, 2000
Inspected By: Tan

Depth (feet)	USCS Classification	Soil Description Ground Elevation = +19 feet	Sample Number	Blows/6"
	SM	Loose to very loose, gray, silty fine SAND, wet. Scattered silt interbeds.	S-9	5-3-2
45			S-10	0-0-4
50	SM	Very dense, gray, silty fine SAND, wet.	S-11	12-28-39
55		Grades to medium dense and contains scattered silt interbeds in sample S-12.	S-12	9-13-9
60	SP	Dense, gray, slightly gravelly, fine to medium SAND, wet.	S-13	6-8-24
65	SM	Very dense, gray, silty fine to medium SAND, wet. Scattered silty fine sand and silt interbeds.	S-14	14-40-50/4"
70			S-15	50/4"
75		No sample taken at 75 feet due to heaving		
80		Bottom of boring at approximately 75 feet below top of relieving platform		

Other column headings: Lithology, Samples, Moisture Content, Other Laboratory Tests, Groundwater Level, Well Diagram

▲ Penetration Resistance (bpf)
● Moisture Content (%)



Drilling Co.: Holocene Drilling
Equipment: Hollow Stem Auger, Mobile B-65
Hammer System: 140-lb, 30" drop, automatic trip
Sampling Method: 2" and 3" OD Split Spoon / Shelby Tube
Date Completed: July 18, 2000
Inspected By: Tan

PanGEO INCORPORATED

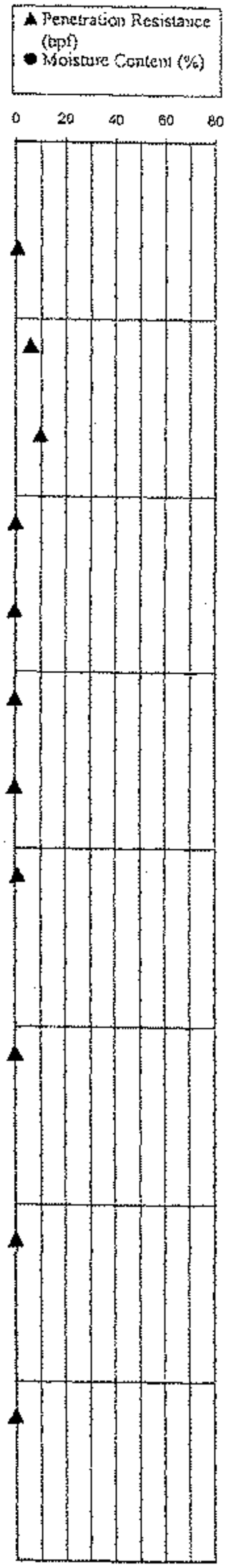
Fishermen's Terminal
South Wall Redevelopment
Port of Seattle, Washington

Log of Boring B-S2
page 2 of 2

Project No. 00-007-300

Figure A-3

Depth (feet)	Lithology	USCS Classification	Soil Description Ground Elevation = +19 feet	Samples	Sample Number	Blows/6"	Moisture Content	Other Laboratory Tests	Groundwater Level	Well Diagram
0–8		SP	Approximately 4 inches of ACP on gray, gravelly SAND with silt, moist.							
			Sample S-2 no recovery		S-1	1/18"			ATD	
5										
			Sample S-2 no recovery		S-2	2-4-2				
8–21		CH	Sample S-3 driving on wood, about 4" thick		S-3	0-0-10				
10			Very soft, gray CLAY, wet. Scattered sand seams. Trace of shell and wood fragments.							
					S-4	0-0-0				
			Sample S-4 no recovery							
					S-5	0-0-0				
15										
					S-6	0-0-0				
					S-7	0-0-0				
20										
21–22		SM	silty sand layer. Scattered fine gravel.		S-8	0-0-1				
25										
22–40		CH			S-9	0-0-0				
30										
					S-10	0-0-0				
35										
			Scattered silty sand seams in sample S-11		S-11	0-0-0				
40										



(continued on page 2)

Drilling Co.: Holocene Drilling
Equipment: Mud Rotary, Mobile B-65
Hammer System: 140-lb, 30" drop, automatic trip
Sampling Method: 2" and 3" OD Split Spoon
Date Completed: July 19, 2000
Inspected By: Tan

PanGEO INCORPORATED

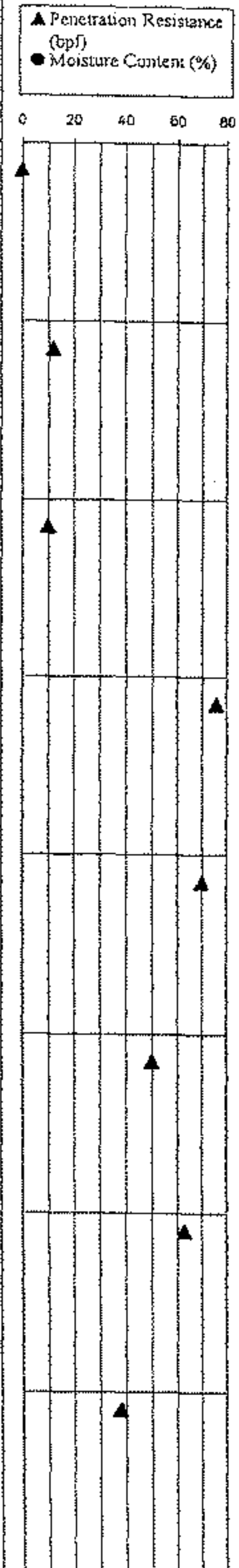
Fishermen's Terminal
South Wall Redevelopment
Port of Seattle, Washington

Log of Boring B-S3

Project No. 00-007-300

Figure A-4

Depth (feet)	Lithology	USCS Classification	Soil Description Ground Elevation = +19 feet	Samples	Sample Number	Blows/6"	Moisture Content	Other Laboratory Tests	Groundwater Level	Well Diagram
		CH	(see description on page 1)		S-12	0-0-0				
45		ML	Loose to medium dense, gray, sligtly sandy to sandy SILT, wet.		S-13	4-4-8				
50		CH	Very soft, gray CLAY, wet.		S-14	0-0-10				
55		SM	Very dense, gray, silty fine SAND, wet.		S-15	25-34-42				
60					S-16	29-34-36				
65		ML	Very dense, gray, sandy SILT, wet. Scattered fine sand seams.		S-17	17-21-29				
70		SM	Very dense, gray, silty fine SAND, wet.		S-18	26-31-32				
75		ML	Hard, gray, slightly sandy SILT, moist. Scattered fine gravel and fine sand seams. (Till-Like)		S-19	13-17-21				
80		SM	Very dense, silty gravelly SAND, wet. (Till-Like) (continue on page 3)							



Drilling Co.: Holocene Drilling
Equipment: Mud Rotary, Mobile B-65
Hammer System: 140-lb, 30" drop, automatic trip
Sampling Method: 2" and 3" OD Split Spoon
Date Completed: July 19, 2000
Inspected By: Tan

Depth (feet)	Lithology	USCS Classification	Soil Description Ground Elevation = +19 feet	Samples	Sample Number	Blows/6"	Moisture Content	Other Laboratory Tests	Groundwater Level	Well Diagram
		SM	(see description on page 2)		S-20	25-39-37				

Bottom of boring at 81.5 feet below existing pavement.

Depth scale: 85, 90, 95, 100, 105, 110, 115, 120

▲ Penetration Resistance (bpf)
● Moisture Content (%)

0 20 40 60 80

Drilling Co.: Holocene Drilling

Equipment: Mud Rotary, Mobile B-65

Hammer System: 140-lb, 30" drop, automatic trip

Sampling Method: 2" and 3" OD Split Spoon

Date Completed: July 19, 2000

Inspected By: Tan

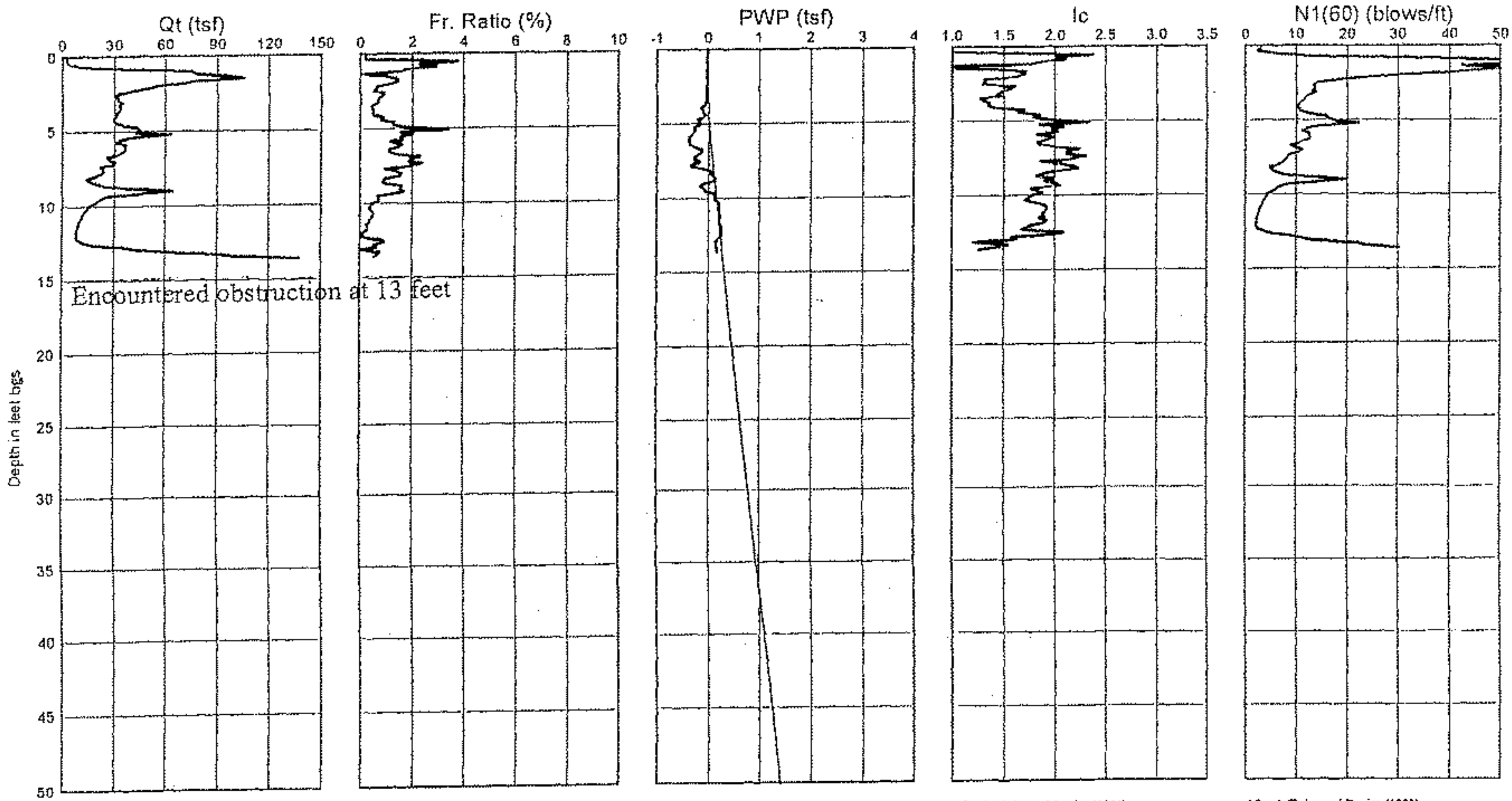
Cone Penetration Test - CPT-S1A

Test Date : Jul 20, 2000
Location : Fisherman's Terminal

Probe deflecting off buried obstruction at 13 feet.

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 18
Water Table Depth : 5.00



Qt normalized for unequal end area effects

Fr Ratio = 100*F/(Qt-Sigmav)
Gamma = 110.1 pcf

After Jefferies and Davies (1991)
Ic < 1.25 - Gravelly sands
1.25 < Ic < 1.90 - Clean to silty sand
1.90 < Ic < 2.54 - Silty sand to sandy silt
2.54 < Ic < 2.82 - Clayey silt to silty clay
2.82 < Ic < 3.22 - Clays

After Jefferies and Davies (1993)

Figure A-5

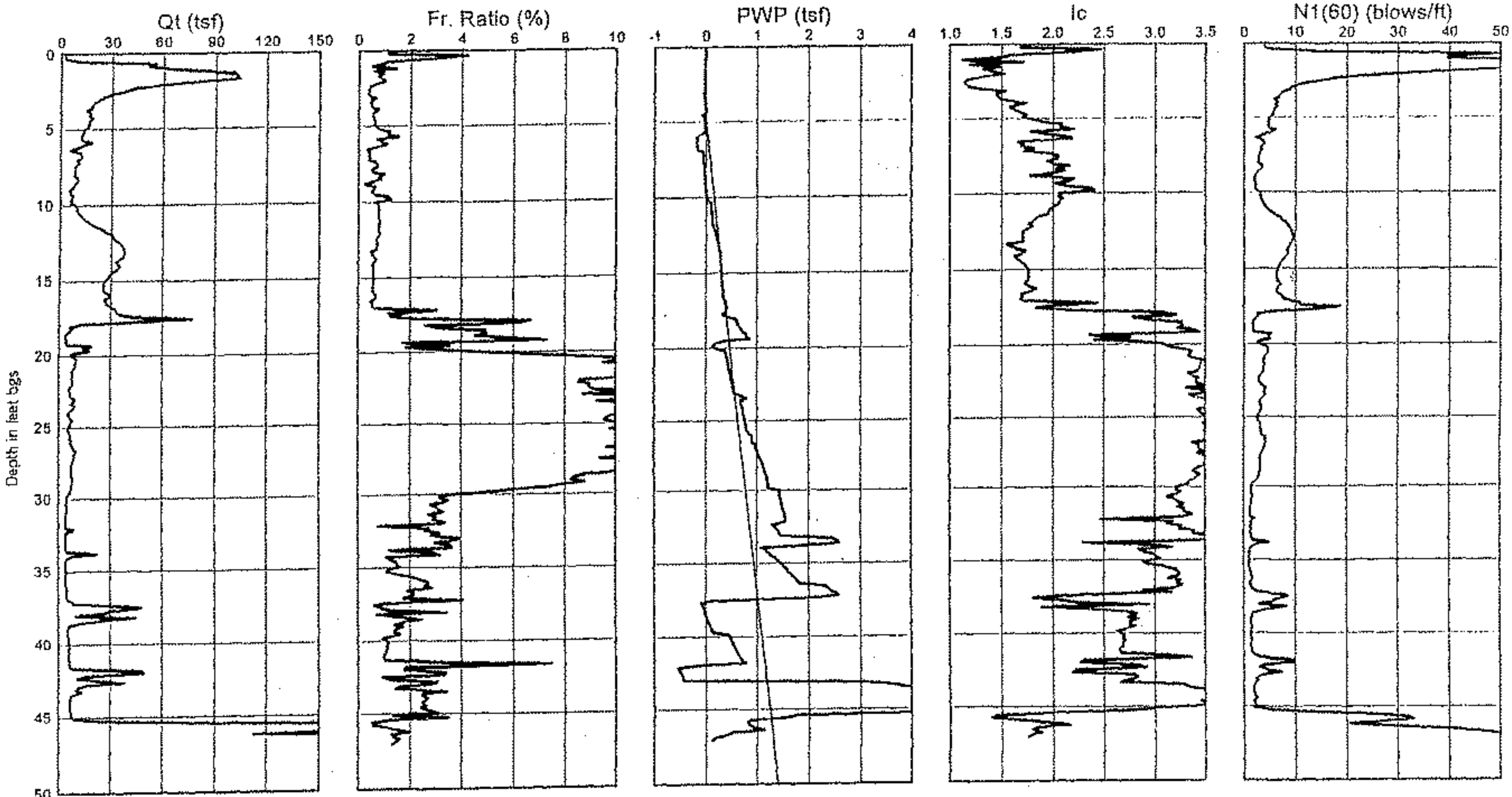
JECT NO. 00-007-300 DATE: July 25, 2000 DRAWN BY: Keith Brown PanGeo

Cone Penetration Test - CPT-S1B

Test Date : Jul 20, 2000
Location : Fisherman's Terminal

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 18
Water Table Depth : 5.00



Qt normalized for
unequal end area affects

Fr Ratio = 100*F/(Qt-Sigmav)
Gamma = 110.1 pcf

After Jefferies and Davies (1991)
Ic < 1.25 - Gravelly sands
1.25 <Ic < 1.90 - Clean to silty sand
1.90 <Ic < 2.54 - Silty sand to sandy silt
2.54 <Ic < 2.82 - Clayey silt to silty clay
2.82 <Ic < 3.22 - Clays

After Jefferies and Davies (1993)

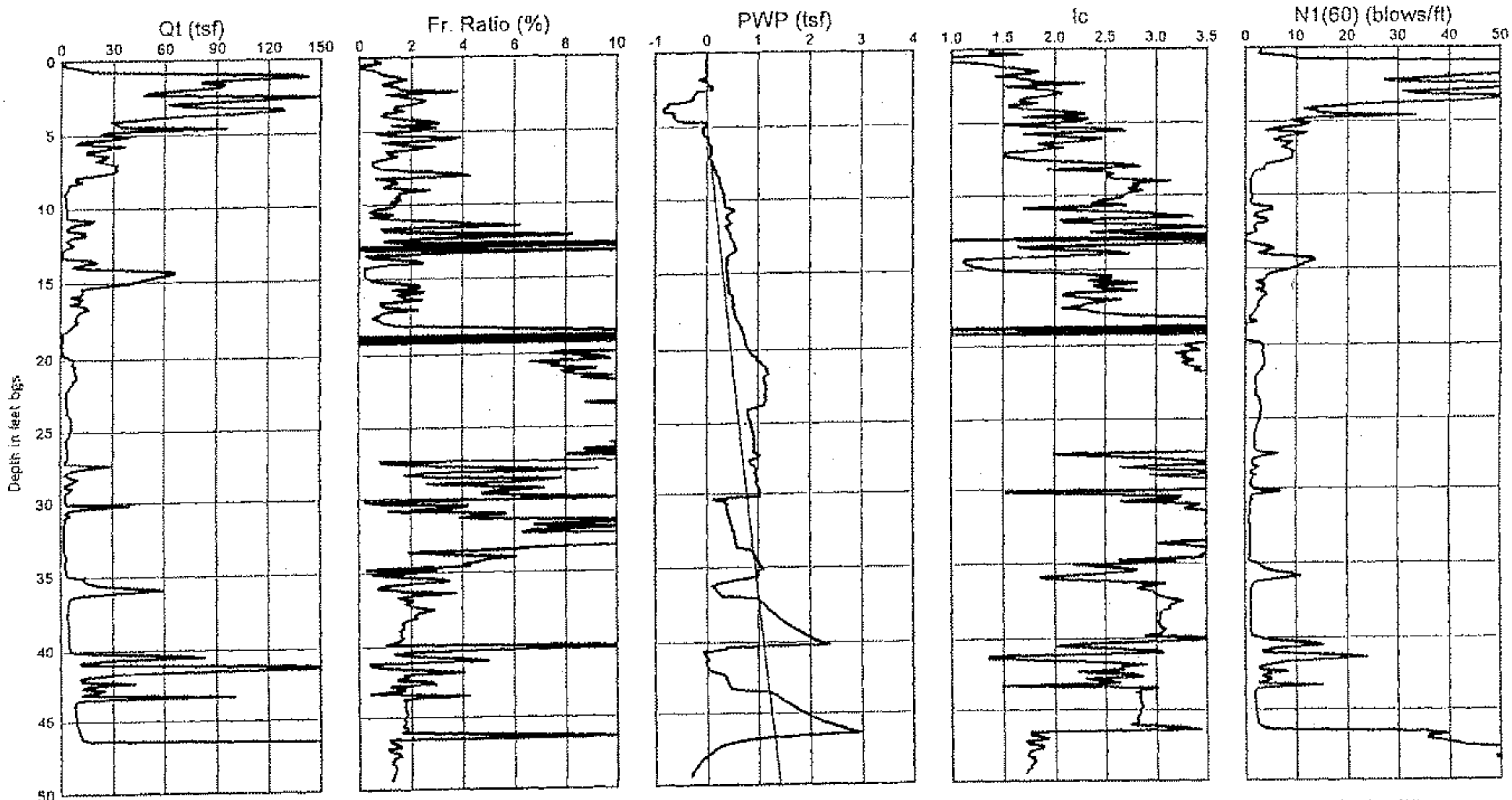
Figure A-6

Cone Penetration Test - CPT-S2

Test Date : Jul 20, 2000
Location : Fishermen's Terminal

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 18
Water Table Depth : 5.00



Qt normalized for unequal end area effects

Fr Ratio = 100*F/(Qt-Sigmav)
Gamma = 110.1 pcf

After Jefferies and Davies (1991)
Ic < 1.25 - Gravelly sands
1.25 <Ic < 1.90 - Clean to silty sand
1.90 <Ic < 2.54 - Silty sand to sandy silt
2.54 <Ic < 2.82 - Clayey silt to silty clay
2.82 <Ic < 3.22 - Clays

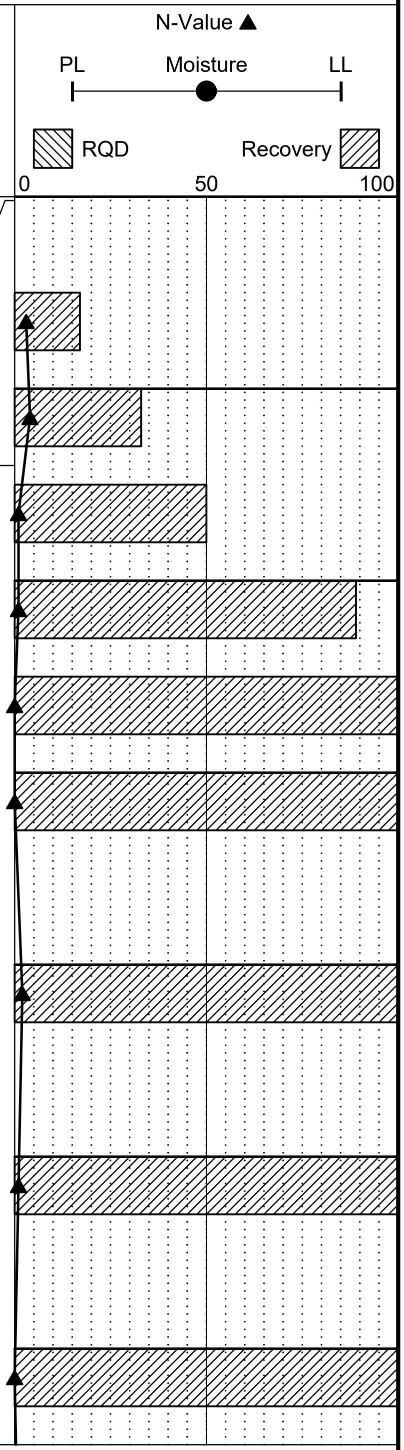
After Jefferies and Davies (1993)

Figure A-7

JECT NO. 00-007-300 DATE: July 25, 2000 DRAWN BY: Keith Brown PanGeo

Project:	Proposed Improvements	Surface Elevation:	
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Asphalt 2 inches.
						Loose, brown, silty, fine to coarse SAND: moist, some gravel and wood debris, non-plastic, mixed. (Fill).
	S-1		3 2 1			
5	S-2		2 3 1			Wood and metal debris, slight oily sheen.
	S-3		0 0 1			Very soft, green gray CLAY with silt: very moist, low to medium plastic, no dilatancy, some wood chunks and other debris at top, massive. (Lake Deposits).
10	S-4		0 0 1			Brown and green gray CLAY with silt, bedded, trace organic brown layers, minor sand and wood.
	S-5		0 0 0			Minor sand, massive.
15	S-6		0 0 0			Scattered wood fragments.
20	S-7		0 1 1			Low plastic, rapid dilatancy, trace fine sand, brown silt beds, wood and possible fine shell fragments.
25	S-8		0 0 1			Auger drilled to 25 feet, mud rotary 25 to 80 feet. Low to medium plastic, slow dilatancy, trace fine sane, laminated with brown silt laminae, minor shell fragments.
30	S-9		0 0 0			Low to medium plastic, no dilatancy, occasional sand and shell fragments, occasional brown laminae.



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/25/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water.

PanGEO INCORPORATED

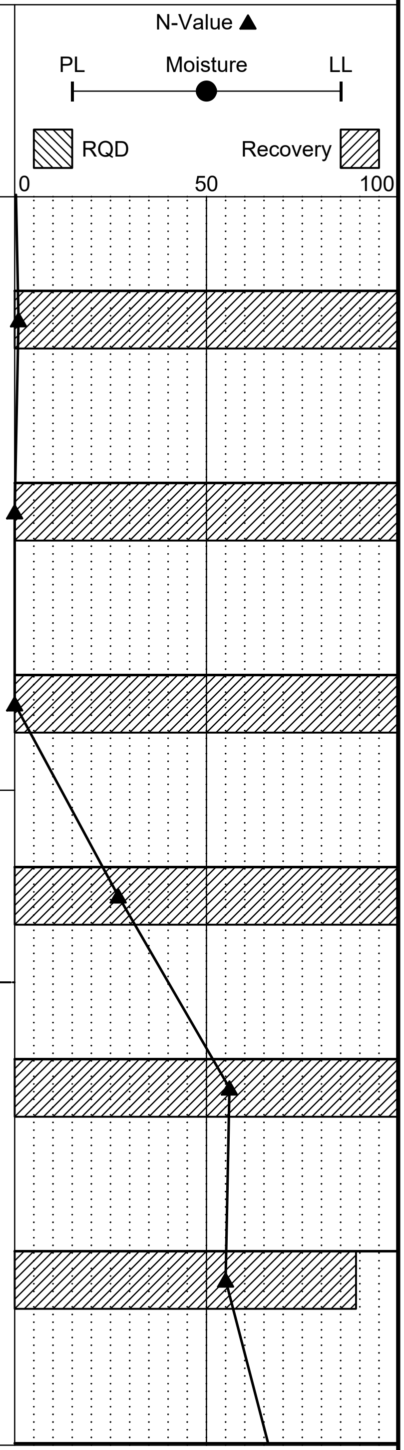
LOG OF TEST BORING PG-1-17

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Very soft, green gray CLAY with silt: very moist, low to medium plastic, no dilatancy, some wood chunks and other debris at top, massive. (Lake Deposits). *(Continued)*
35	S-10		0 0 1			Laminated, brown, peaty organics throughout woody fragments.
40	S-11		0 0 0			Occasional brown wood, silt interlaminae, laminated to massive.
45	S-12		0 0 0			Low to medium plastic, laminated.
						Medium dense and very stiff, green gray, interbedded, silty CLAY and fine SAND with silt: moist, low plastic and non-plastic, no dilatancy and rapid dilatancy, beds to 4 inches, laminated. (pre-Fraser Beds).
50	S-13		3 11 16			
						Very dense, green gray, interbedded fine to medium SAND and fine to coarse SAND: very moist to wet, trace non-plastic silt, homogeneous, laminated. (pre-Fraser Beds).
55	S-14		21 28 28			
						Gravelly bed.
60	S-15		15 23 32			Occasional silt interlaminae, laminated with moderately sharp contacts.
65						



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/25/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water.

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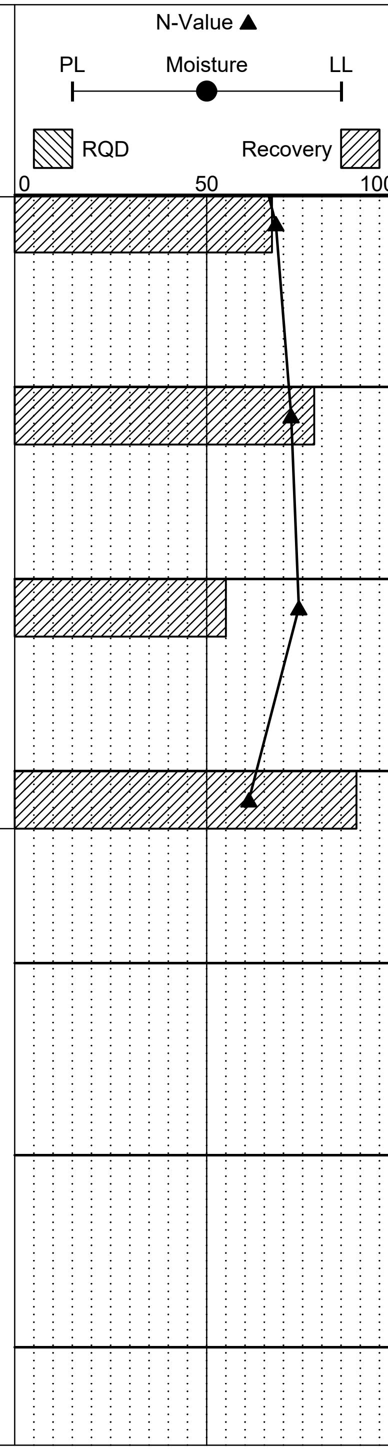
LOG OF TEST BORING PG-1-17

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
65	S-16		13 29 39			Very dense, green gray, interbedded fine to medium SAND and fine to coarse SAND: very moist to wet, trace non-plastic silt, homogeneous, laminated. (pre-Fraser Beds). *(Continued)* Fine SAND bed, trace to some silt, laminated.
70	S-17		15 32 40			Fine to coarse SAND, trace silt, homogeneous, indistinctly laminated.
75	S-18		7 26 48			Fine to medium SAND.
80	S-19		16 28 33			Fine to medium SAND, occasional gravel, trace silt.
						Bottom of Boring.
85						
90						
95						



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/25/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water.

PanGEO INCORPORATED

LOG OF TEST BORING PG-1-17

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX B

Site-Specific Ground Response Analysis (2nd Revision)

PanGEO INCORPORATED
Geotechnical & Earthquake Engineering Consultants

October 1, 2020
File No. 19-340

Ms. Elena Franks
Port of Seattle
PO Box 1209
Seattle WA 98111-1209

Subject: Site-Specific Seismic Ground Response Analysis (2nd Revision)
Fishermen's Terminal Redevelopment
Seattle, Washington

Dear Ms. Franks,

This revised report summarizes the results of our site-specific ground response analysis completed for the proposed Fishermen's Terminal Redevelopment project in Seattle, Washington.

We completed site-specific ground motion procedures based on American Society of Civil Engineers (ASCE) 7-16 Chapter 21 for the proposed Gateway BTS and MinC buildings located in the eastern portion of the site. The locations of the buildings are shown in Figure 1. The design earthquake level for the proposed buildings is based on a 2 percent probability of exceedance in 50 years (a return period of 2,475 years). Based on the information provided by your structural engineer, we understand the fundamental period of the proposed structures and their foundation systems ranges from about 0.162 to 1.5 seconds.

The site is underlain by up to about 40 feet of loose and soft soils that are prone to soil liquefaction. We calculated the ground surface response spectra for both liquefied and non-liquefied soil conditions.

The project site is located within the Seattle Basin. We incorporated the basin effects by multiplying the Risk-Targeted Maximum Considered Earthquake (MCE_R) response spectra by basin amplification factors, in accordance with the City of Seattle Director's Rule 20-2018,

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Subsurface Conditions – Based on a review of the existing nearby test borings, the site is generally underlain by fill and very soft lake bed deposits (silt and clay with peat) overlying competent glacially consolidated soils (silty fine sand). Specifically, our previous test borings PG-01-17 through PG-03-17 encountered fill soils (about 7 to 14 feet of loose to medium dense silty sand) over about 30 feet of very soft to soft silt and clay with peat (lake bed deposits). The lake bed deposits are underlain by glacially consolidated soils (medium dense to very dense silty fine sand). The test borings locations are shown in Figure 1. The borings logs are included in Attachment A.

Geophysical Survey – The soil conditions underlying the site were generalized based on the shear wave velocity measurements (Vs) obtained from two refraction microtremor (ReMi) surveys completed at the site on June 29, 2020. Each refraction survey consists of a profile of shear-wave velocity versus depth (see Attachment A). A site plan showing the locations of refraction survey is shown in Figure 1.

V_s30 (calculated from Ground Surface) – Based on the shear wave velocity measurements from the ReMi survey, the site-specific time-averaged shear wave velocity to 30 meters (Vs30) below the existing ground surface is about 631 feet per second (ft/s), or 192 meter/second (m/s). Based on

V_s30 (calculated from the Top of Glacially Consolidated Soils at about 40 feet deep) – Based on the information provided by your structural engineer, we understand the seismic design for the proposed foundation system may be governed by the seismic ground response at the top of the glacially consolidated soils below the bottom of the soft clay at about 40 feet below the existing grade. Based on the shear wave velocity measurements from the ReMi survey, the site-specific time-averaged shear wave velocity to 30 meters (Vs30) below the top of the glacially consolidated soils within the depth between about 40 and 140 feet deep is 1,054 feet per second (ft/s), or 321 meter/second (m/s).

PROBABILISTIC SEISMIC HAZARD ANALYSIS

We completed a site-specific Probabilistic Seismic Hazard Analysis (PSHA) corresponding to an MCE with a 2% probability of occurrence in 50 years using the Unified Hazard Tool (Conterminous U.S. 2014 v4.2.0) of National Seismic Hazard Mapping Project based on the 2014 United States Geological Survey (USGS) Seismic Source Characterization model. The

MCE uniform hazard spectrum (UHS) calculated for Vs_{30}=760 m/s ("rock" or "rock-like" conditions).

The Unified Hazard Tool utilized the ground motion prediction equations (GMPEs) presented in Table 1.

Table 1 – Earthquake Mechanism and Weighed Ground Motions Prediction Equations

Fault Type / Mechanism	Ground Motions Prediction Equations	Weight
Crustal	Abrahamson-et al (2014) NGA West 2	0.250
	Boore-et al (2014) NGA West 2	0.250
	Campbell-Bozorgnia (2014) NGA West 2	0.250
	Chiou-Youngs (2014) NGA West 2	0.250
Intraslab Subduction	BC Hydro (2012)	0.5
	Zhao et al (2006) USGS	0.5
Interface Subduction	BC Hydro (2012)	0.3334
	Zhao et al (2006) USGS	0.3333
	Atkinson-Macias (2009)	0.3333

Table 2 lists the MCE uniform hazard spectral accelerations at each period for Vs_{30}=760 m/s.

Maximum Component Adjustment Factors – The MCE UHS consists of geometric mean spectral accelerations. The geometric mean MCE spectral accelerations were converted into spectral ordinates corresponding to the direction of maximum horizontal response using the maximum component adjustment factors (Shahi and Baker, 2013), as shown in Table 2.

Risk Coefficient – The probabilistic spectral response accelerations shall be taken as the spectral response accelerations in the direction of maximum horizontal response that is expected to achieve a 1% probability of collapse within a 50-year period. We converted the probabilistic

MCE ground motions into the MCE_R ground motions by including the risk coefficients. The risk coefficients were calculated using the USGS Risk-Targeted Ground Motion Calculator web application based on the Method 2 included in Section 21.2.1.2 of ASCE 7-16. The calculated risk coefficients are shown in Table 2.

The MCE_R rock outcrop response spectra were computed by multiplying MCE spectra by the maximum component adjustment factors and risk coefficients, as shown in Table 2.

Table 2 – MCE and MCE_R UHS (Vs_{30}=760 m/s, Rock Outcrop)

Periods (sec)	MCE UHS (Vs_{30}=760 m/s (Rock Outcrop)	Maximum Component Adjustment Factor (Shahi and Baker, 2013)	Risk Coefficient (ASCE 7-16 Method 2)	MCE_R UHS (Vs_{30}=760 m/s (Rock Outcrop)
0	0.60	1.19	0.91	0.65
0.1	1.44	1.19	0.91	1.54
0.2	1.41	1.20	0.91	1.54
0.3	1.09	1.22	0.91	1.21
0.4	0.91	1.23	0.91	1.01
0.5	0.73	1.23	0.91	0.81
0.75	0.51	1.24	0.90	0.57
1	0.39	1.24	0.80	0.43
2	0.19	1.24	0.88	0.21
3	0.12	1.25	0.87	0.13
4	0.09	1.26	0.87	0.10
5	0.07	1.26	0.88	0.07

Basin Amplification – The site is located within the Seattle Basin, which generally consists of thick sedimentary and crystalline bedrock to about 7 to 8 kilometers deep, will result in ground

motion amplification. Based on the City of Seattle Director's Rule 20-2018, the amplification factors should be calculated for each type of earthquake source and weighted by percent contribution of the source for each period. We calculated the percent contribution of the source for each period based on the hazard deaggregation from our PSHA performed for the 2,475-year event and Vs30=760 m/s for rock outcrop condition, as shown in Table 3.

Table 3 – Seismic Hazard Deaggregation for Vs30=760m/s and 2475-year Event

Periods (sec)	Percent Contribution of Each Source		
	Shallow Crustal	Interslab Subduction	Interface Subduction
0	35	51	14
0.1	32	59	9
0.2	38	52	10
0.3	43	43	14
0.4	46	35	19
0.5	48	29	23
0.75	46	19	35
1	39	14	47
2	24	7	69
3	18	5	77
4	13	3	84
5	12	2	86

Crustal Sources – We calculated the basin amplification factors from crustal sources using Campbell and Bozorgnia (2014) GMM with Z2.5 (depth to Vs = 2,500 m/s) from the Stephenson et al. (2017) velocity model. The default Z2.5 input parameter for the selected GMM is 2.93 kilometers based on a Vs30 of 190 m/s. To include basin amplification effect in the selected GMM, we used a site-specific Z2.5 equal to about 6.35 km from the Stephenson et al. (2017) velocity model. The basin amplification factor is equal to the ratio of response spectra calculated

based on Z2.5 of 6.35 km and 2.93 km. The basin amplification factors from crustal sources are shown in Table 4.

Intraslab Subduction Sources – We calculated the intraslab basin amplification factors based on 11 sets of the observed basin amplification factors from local and regional earthquakes (i.e. M6.8 2001 Nisqually and the M6.4 2004 Vancouver Island earthquakes), as shown in Plate 1 below.

The calculated basin amplification factor at each period was taken as the average of 11 observed basin amplification factors. We used linear interpolation to calculate the basin amplification factors between the period of 0 to 0.5 seconds.

The basin amplification factors from intraslab subduction sources are shown in Table 4.

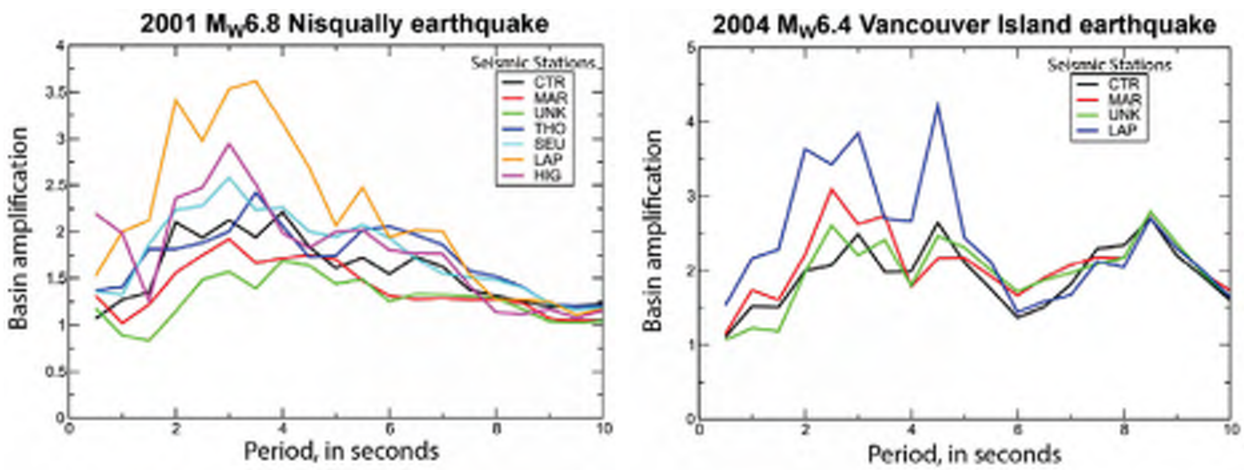

Plate 1. Observed Seattle basin amplification factors from M6.8 2001 Nisqually and the M6.4 2004 Vancouver Island earthquakes (Modified from USGS/SDCI Basin Amplification Workshop USGS Open-File Reports 2014-1196 and 2018-1149)

Interface Subduction Sources – We calculated the interface basin amplification factors based on results of M9 Project basin amplification factors with a reference site of Z2.5 approximately equal to 3 km. The calculated basin amplification factors linearly increase from 1.0 to 2.0 between periods of 0 to 2 seconds, and remains constant at 2.0 at periods greater than 2 seconds.

The calculated basin amplification factors from interface subduction sources are shown in Table 4.

Table 4 – Weighted-Average Basin Amplification Factors

Periods (sec)	Basin Amplification Factors (from each source)			Weighted-Average Basin Amplification Factors
	Shallow Crustal	Intraslab Subduction	Interface Subduction	
0	1.21	1.00	1.00	1.07
0.1	1.21	1.07	1.05	1.11
0.2	1.22	1.14	1.10	1.17
0.3	1.30	1.21	1.15	1.24
0.4	1.31	1.28	1.20	1.27
0.5	1.38	1.33	1.25	1.34
0.75	1.49	1.44	1.38	1.44
1	1.49	1.53	1.50	1.50
2	1.51	2.27	2	1.91
3	1.47	2.56	2	1.93
4	1.50	2.11	2	1.93
5	1.51	2.02	2	1.94

SITE-SPECIFIC GROUND RESPONSE ANALYSIS

We conducted one-dimensional nonlinear ground response analyses using computer program DEEPSOIL (Version 7.0, Build 7.0.26.0). Nonlinear total stress analyses were performed in the time domain for one-dimensional soil profile in which soils were modelled using General Quadratic/Hyperbolic (GQ/H) Model and Non-Masing Hysteretic Re/Un-loading rules. The Darendeli (2001) reference curves were used for modulus reduction and damping.

Nonlinear effective stress analysis was performed using the Vucetic and Dobry model for sand and silt and the Matasovic and Vucetic Model for clay and elastic silt to account for the generation and dissipation of pore water pressures and the consequent reductions of soil stiffness and strength for liquefied soil condition. The rock outcrop condition was modeled as elastic

halfspace. Figure 2 shows the selected soil models and parameters for modulus reduction and damping curves in the ground response analyses.

Epistemic Uncertainty in Shear Wave Velocity Measurements – The epistemic uncertainty in the shear wave velocity profile was incorporated into the analysis by considering the 16th (-1 sigma) and 84th (+1 sigma) percentile best estimate values based on the lognormal distribution of shear wave velocity measurements from the ReMi surveys. A standard deviation of the natural logarithm of Vs was assumed to be 0.31 (Toro, 1995). We developed three shear wave velocity profiles, lower bound (LB), best estimate (BE), and upper bound (UB) that are used in our ground response analyses. These profiles are shown in Figure 2.

Soil Profile and Rock Outcrop Depth – The ground response analyses were conducted for one-dimensional soil column that was developed based upon measured shear wave velocity from two ReMi surveys. These shear wave velocity measurements extend to as deep as about 200 feet without reaching Vs_{30}=760 m/s ("rock" or "rock-like" conditions). We assumed the depths of the rock outcrop to be 230 feet (UB), 260 feet (BE), and 330 feet (LB) below the ground surface in our analyses.

Selection of Input Ground Motions – The ground response analyses were conducted for each one of seven recorded horizontal ground motion acceleration time histories. The selected input ground motions consist of three crustal seismic sources and four subduction seismic sources, as shown in Table 5. These selected earthquake events generally have similar fault types, magnitudes, and fault distances that are consistent with those that control the target MCE_R response spectrum. The acceleration, velocity, and displacement time histories of the selected ground motions (with and without amplitude scaling) are included in Appendix B.

We understand that the fundamental period of vibration for the proposed structures and foundation ranges from about 0.162 to 1.5 seconds. Each of the selected ground motions time histories was adjusted to approximately match the equal hazard response spectrum in the period range of about 0.1 to 1.7 seconds. The records were adjusted for amplitude to match the target rock spectrum. Figures 3 and 4 show the MCE_R "rock" target response spectrum and the input ground motions (amplitude-adjusted) from the selected time histories.

Table 5 – Source Motions

Fault Type/ Mechanism	Event	Mw	Recording Station	Component	Scale Factor	Site to Source (km)
Crustal - Reverse	San Simeon, CA December 22, 2003	6.5	Templeton - 1 Story Hospital	090	1.35	5.1
Crustal - Reverse	Iwate (Japan) June 14, 2008	6.9	AKT023	AKT023-NS	1.45	11.7
Crustal – Reverse Oblique	Loma Prieta, CA October 17, 1989	6.9	San Jose - Santa Teresa Hills	SJTE225	1.85	14.2
Intraslab Subduction	Michoacán (Mexico) January 11, 1997	7.2	Caleta De Campos	S00E	1.9	17.6
Intraslab Subduction	El Salvador (Guatemala) January 13, 2001	7.6	Observatorio	090	1.7	91
Interface Subduction	Offshore near Biobio (Chile) Feb. 27, 2010	8.8	Curico	CUR-NS	1.2	170.5
Interface Subduction	Tohoku (Japan) March 11, 2011	9.0	Ujiie	TCGH12-EW2	1.2	277.6

PROBABLISITIC MCE$_R$ SPECTRUM

Ground Surface MCE$_R$ Response Spectra – We performed the seismic ground response analyses for BE, LB, and UB shear wave velocity profiles to calculate the MCE$_R$ ground surface response spectra for both non-liquefied and liquefied conditions. Figures 5 through 11 show the calculated MCE$_R$ ground surface response spectra as result of each selected input ground motion. The average and weighted average MCE$_R$ response spectra were calculated for non-liquefied and liquefied conditions, as shown in Figures 12 and 13, respectively.

For non-liquefied condition, the weighted average MCE_R response spectrum was calculated by assigning a 70 percent weights to the response spectra from the UB soil profile and 30 percent weight to the response spectra from the BE soil profile, as shown in Figure 12. For liquefied condition, the weighted average MCE_R response spectrum was calculated by assigning a 50 percent weight to the response spectra from the BE soil profile, 25 percent weights to the response spectra from the UB, and 25 percent weights to the response spectra from LB soil profile, as shown in Figure 13.

The weight averaged MCE_R response spectra for non-liquefied and liquefied conditions are shown in Figure 14. Figure 14 indicates the occurrence of liquefaction and the subsequent weakening of the soil resulted in lower spectral accelerations. Because the MCE_R response spectra within the period of interest (i.e. about 0.1 to 1.7 seconds) are governed by the MCE_R response spectra for non-liquefied condition, we incorporated the basin response into the MCE_R response spectra by multiplying the weighted-average MCE_R response spectra for non-liquefied condition by basin amplification factors (see basin amplification factors in Table 4). Figure 14 shows the ground surface MCE_R response spectra for non-liquefied condition with basin amplification.

Our recommended site-specific MCE_R ground surface response spectrum is shown in Figure 15. Our recommended MCE_R response spectrum was adjusted to be at least 80 percent code-based Site Class E for all spectral periods in accordance with ASCE 7-16 Section 21.3.

The recommended grounds surface MCE_R spectral response accelerations at each period are listed in Table 6 below:

Table 6 – Recommended Site-Specific MCE_R Response Spectrum

Periods (sec)	**Recommended MCE_R Ground Surface Spectral Accelerations**
0	0.45
0.1	0.66
0.2	0.89
0.3	1.08
0.4	1.08

Table 6 – Recommended Site-Specific MCE$_R$ Response Spectrum (continued)

Periods (sec)	Recommended MCE$_R$ Ground Surface Spectral Accelerations
0.5	1.08
0.75	1.08
1	1.08
1.5	1.00
2	0.75
3	0.50
4	0.37
5	0.30

MCE$_R$ Response Spectra at the Top of Glacially Consolidated Soils – Based on the information provided by your structural engineer, we understand the seismic design for the proposed foundation system may be governed by the seismic ground response at the top of the glacially consolidated soils below the bottom of the soft clay at about 40 feet below the existing grade.

We performed the seismic ground response analyses for BE, LB, and UB shear wave velocity profiles to calculate the MCE$_R$ response spectra at the top of the glacially consolidated soils below the bottom of the soft clay. Because soil liquefaction is not anticipated within the glacially consolidated soils, we calculated the MCE$_R$ response spectra for non-liquefied condition only. Figures 16 through 22 show the calculated MCE$_R$ response spectra at the top of the glacially consolidated soils as result of each selected input ground motion. The average and weighted-average response spectra are shown in Figure 23. The weighted average response spectrum was calculated by assigning a 50 percent weight to the response spectra from the BE soil profile, 25 percent weight to the response spectra from the UB, and 25 percent weight to the response spectra from LB soil profile.

Figure 24 shows MCE_R response spectra at the top of the glacially consolidated soils with basin amplification. The basin response was incorporated into the MCE_R response spectra by multiplying the weighted-average MCE_R response spectra by basin amplification factors (see basin amplification factors in Table 4).

Our recommended site-specific MCE_R response spectrum at the top of the glacially consolidated soils below the bottom of the soft clay is shown in Figure 25. Our recommended MCE_R response spectrum was adjusted to be at least 80 percent code-based Site Class D for all spectral periods in accordance with ASCE 7-16 Section 21.3.

The recommended MCE_R spectral accelerations at each period are listed in Table 7 below:

Table 7 – Recommended Site-Specific MCE_R Response Spectrum at the Top of the Glacially Consolidated Soils

Periods (sec)	Recommended MCE_R Spectral Accelerations Top of the Glacially Consolidated Soils
0	0.50
0.1	0.80
0.2	1.33
0.3	1.66
0.4	1.66
0.5	1.56
0.75	1.42
1	1.22
1.5	0.73
2	0.47
3	0.31
4	0.23
5	0.19

We trust that the information outlined in this letter meets your need at this time. Please call if there are any questions.

Sincerely,

W. Paul Grant

Yi-Hsun William Chao, P.E.
Senior Geotechnical Engineer

W. Paul Grant, P.E.
Principal Geotechnical Engineer

LIST OF ATTACHMENTS

Figures:

Figure 1 – Site and Exploration Plan

Figure 2 – Shear Wave Velocity Data and Profile

Figure 3 – MCE "Rock" Spectra, Individual Input Ground Motions

Figure 4 – MCE "Rock" Spectra, Average Input Ground Motion

Figure 5 – MCE_R Ground Surface Response Spectra, Iwate (Japan), 2008
Component: AKT023-NS

Figure 6 – MCE_R Ground Surface Response Spectra, Loma Prieta, CA (USA), 1989
Component: SJTE225

Figure 7 – MCE_R Ground Surface Response Spectra, San Simeon, CA (USA), 2003
Component: 90

Figure 8 – MCE_R Ground Surface Response Spectra, Michoacán (Mexico), 1997
Component: S00E

Figure 9 – MCE_R Ground Surface Response Spectra, El Salvador (Guatemala), 2001
Component: 090

Figure 10 – MCE_R Ground Surface Response Spectra, Tonoku (Japan), 2011
Component: TCGH12-EW2

Attachments:

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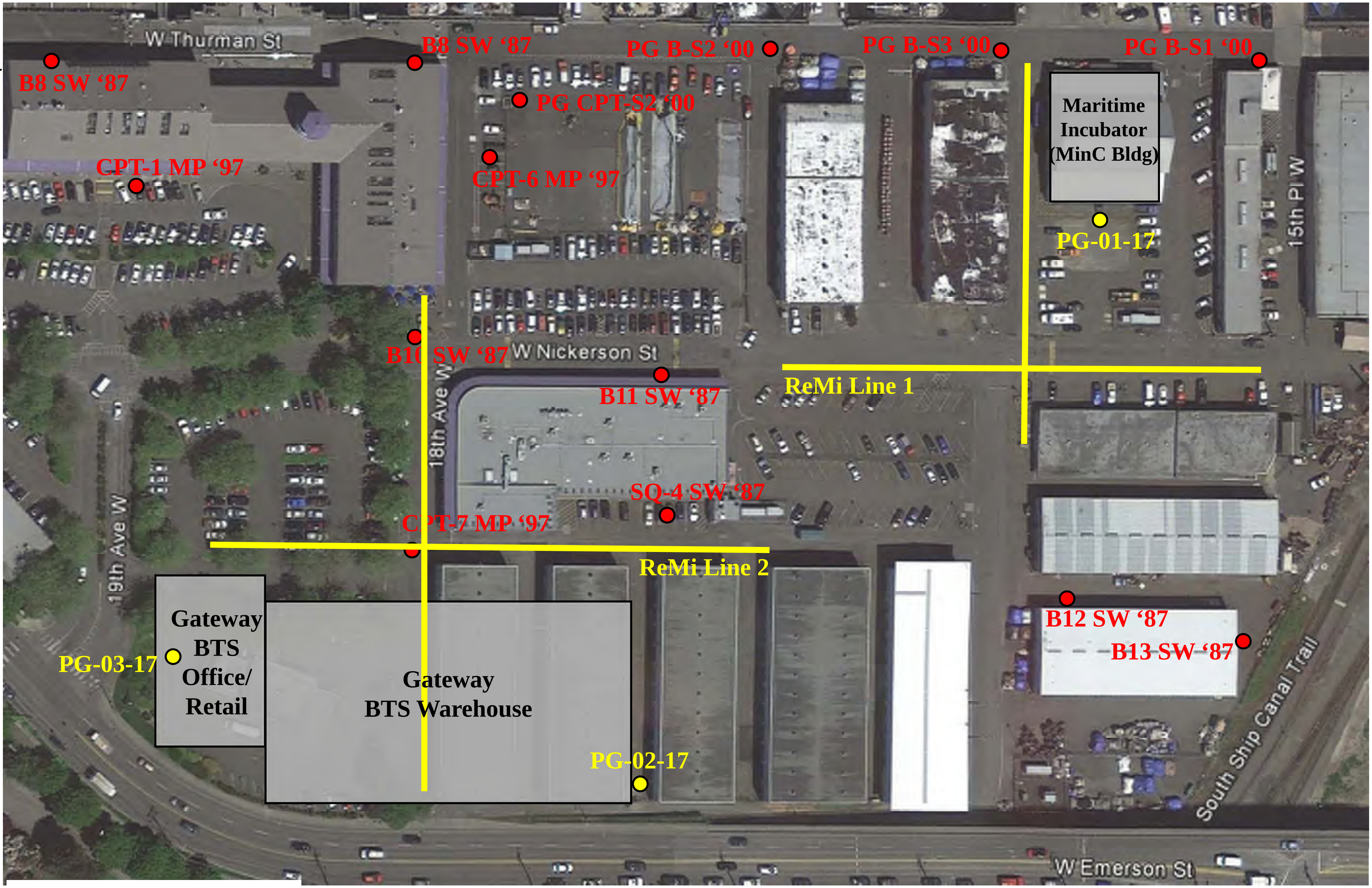


LEGEND:
- ReMi Survey
- PanGEO Boring 2017
- Previous Boring

Approx. Scale: 1":120'

PanGEO INCORPORATED

Site-Specific Seismic Ground Response Analysis
Fishermen's Terminal Redevelopment
Seattle, WA

SITE AND EXPLORATION MAP

Project No.	Figure No.
19-340	1

Generalized Soil Profile and Soil Model

Loose to m. dense SM/SP-SM (Fill) Darendeli (2001), Ko=0.5, PI=0

V. soft, MH/CH, Darendeli (2001) OCR=1, Ko=0.5, PI=34

V. soft, PT/CH, Darendeli (2001) OCR=1, Ko=0.5, PI=45

V. soft, CL/CH, Darendeli (2001) OCR=1, Ko=0.5, PI=25

Med. dense SM (Glacially Consolidated Soils)

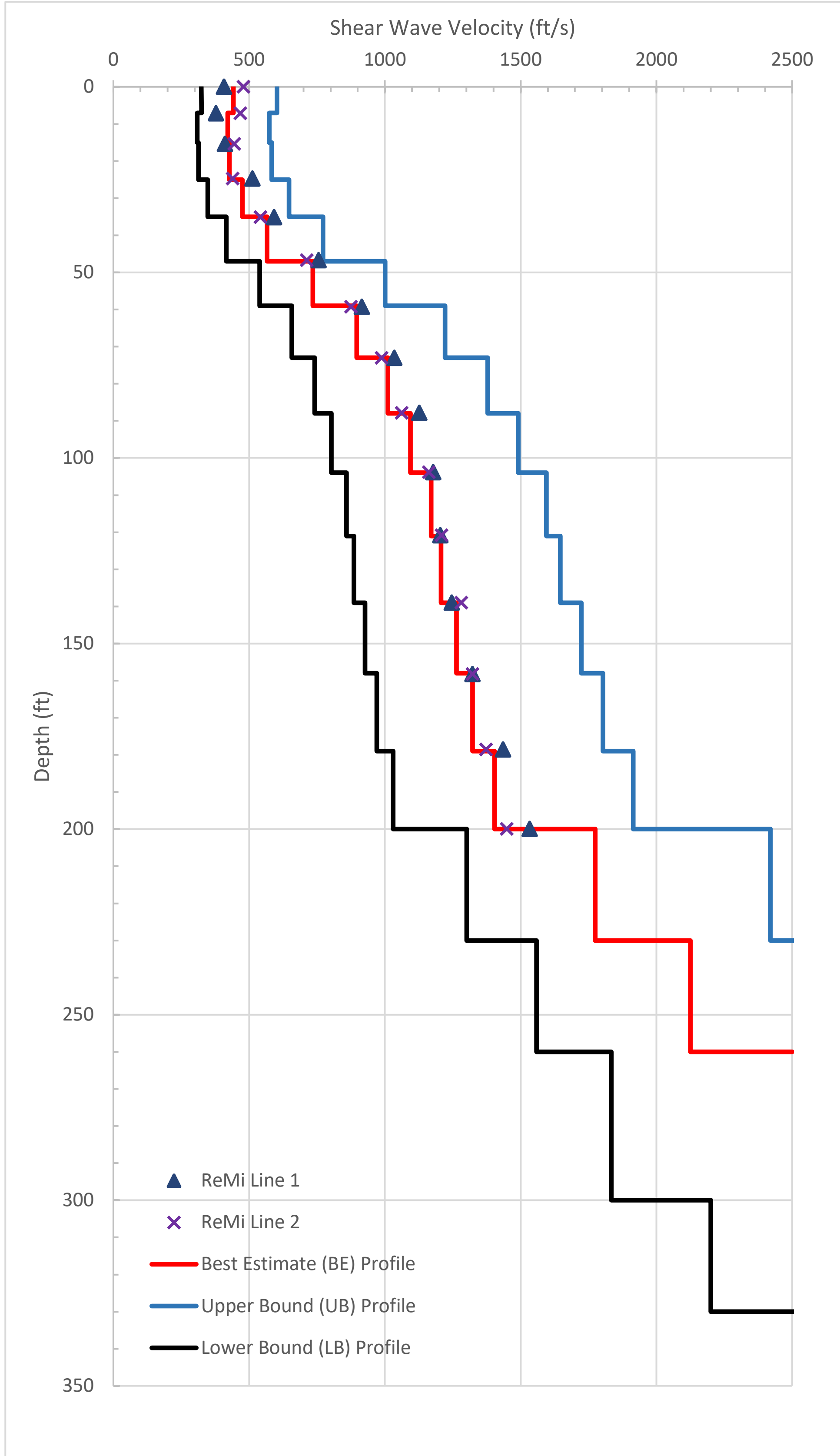
Dense to very dense, SM/SM-ML (Pre-Fraser Beds) Darendeli (2001), OCR=16, Ko=2.0, PI=0 (Glacially Consolidated Soils)

Very dense, Pre-Fraser Beds Darendeli (2001), OCR=16, Ko=2.0, PI=0 (Glacially Consolidated Soils)

Bedrock @230' (Upper Bound Profile) (Elastic Halfspace)

Bedrock @260' (Best Estimate Profile) (Elastic Halfspace)

Bedrock @330' (Lower Bound Profile) (Elastic Halfspace)

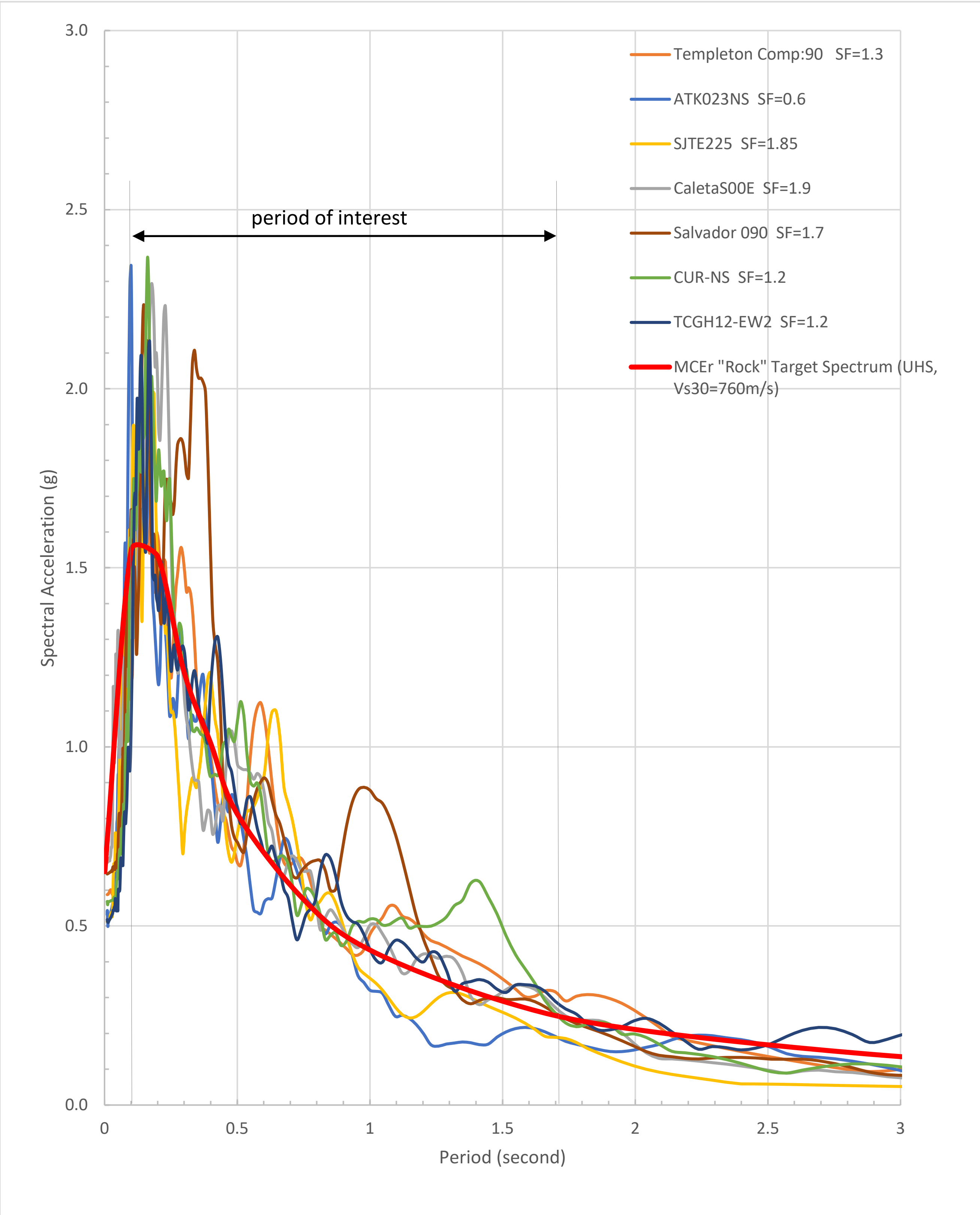


PanGEO INCORPORATED

Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA

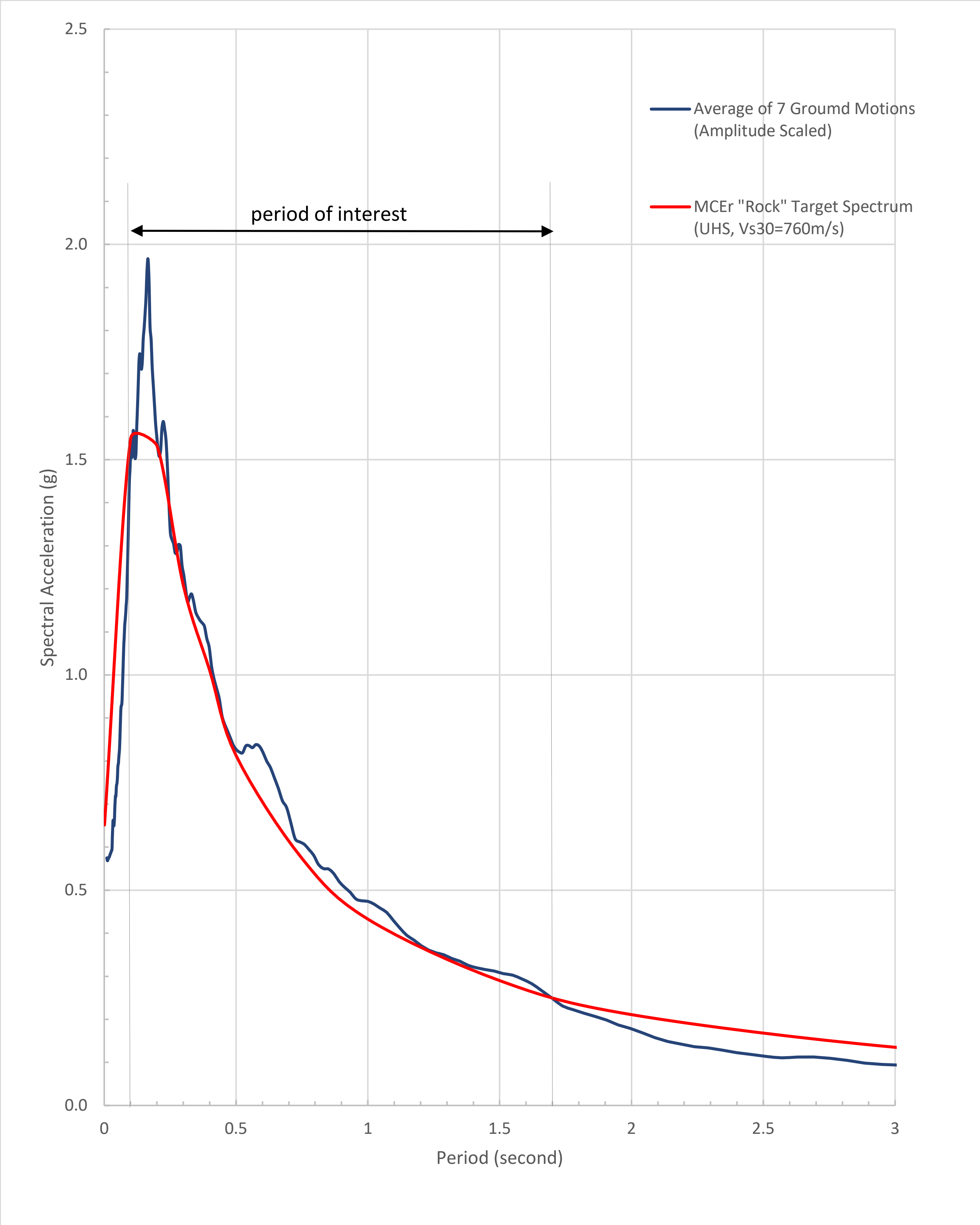
Shear Wave Velocity Data and Profile

Project No.	Figure No.
19-340	2



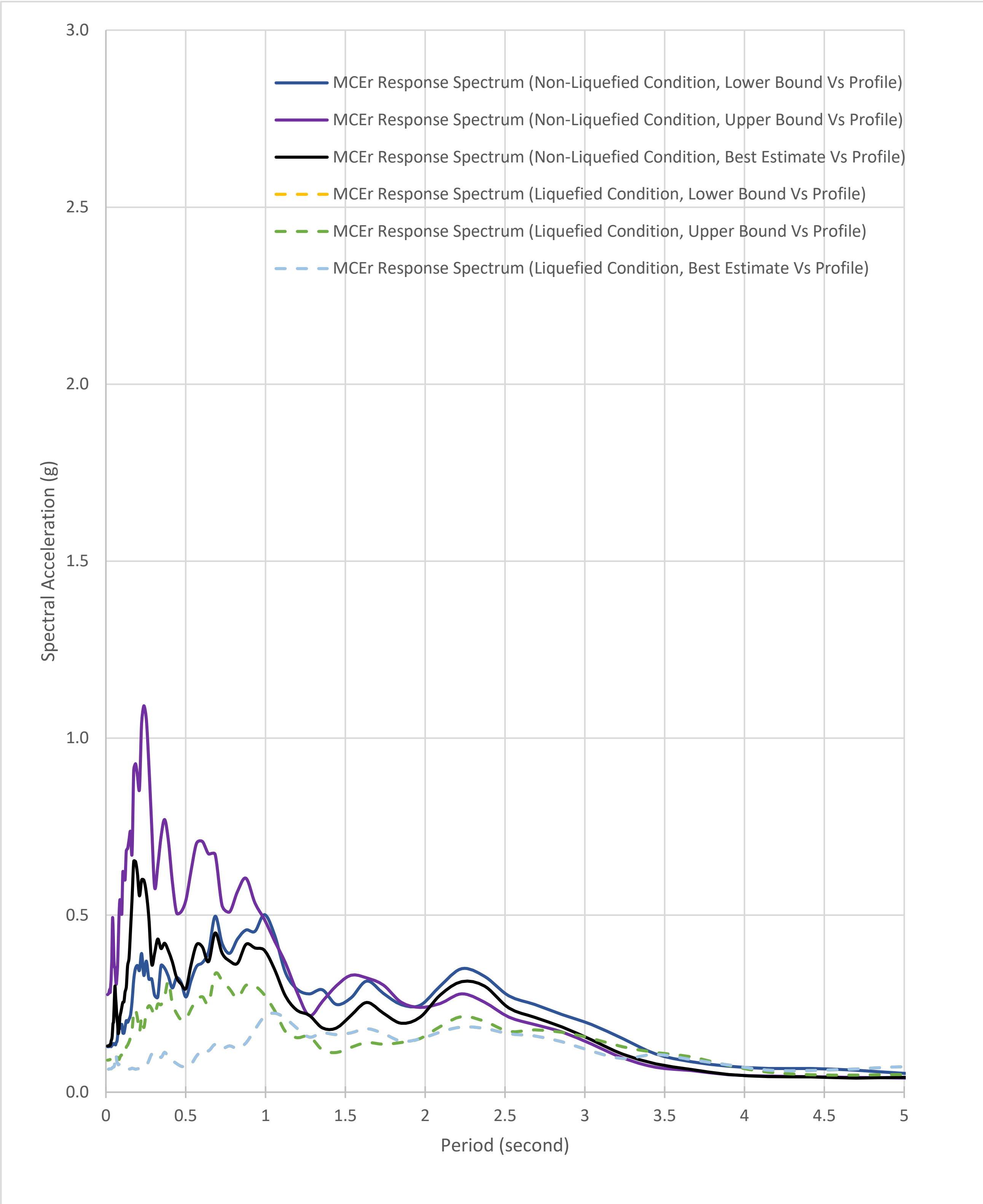
1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Ph 1 Redevelopment Seattle, WA	**MCE$_R$ "Rock" Target Spectra Individual Input Ground Motions**	
		Project No. 19-340	Figure No. **3**

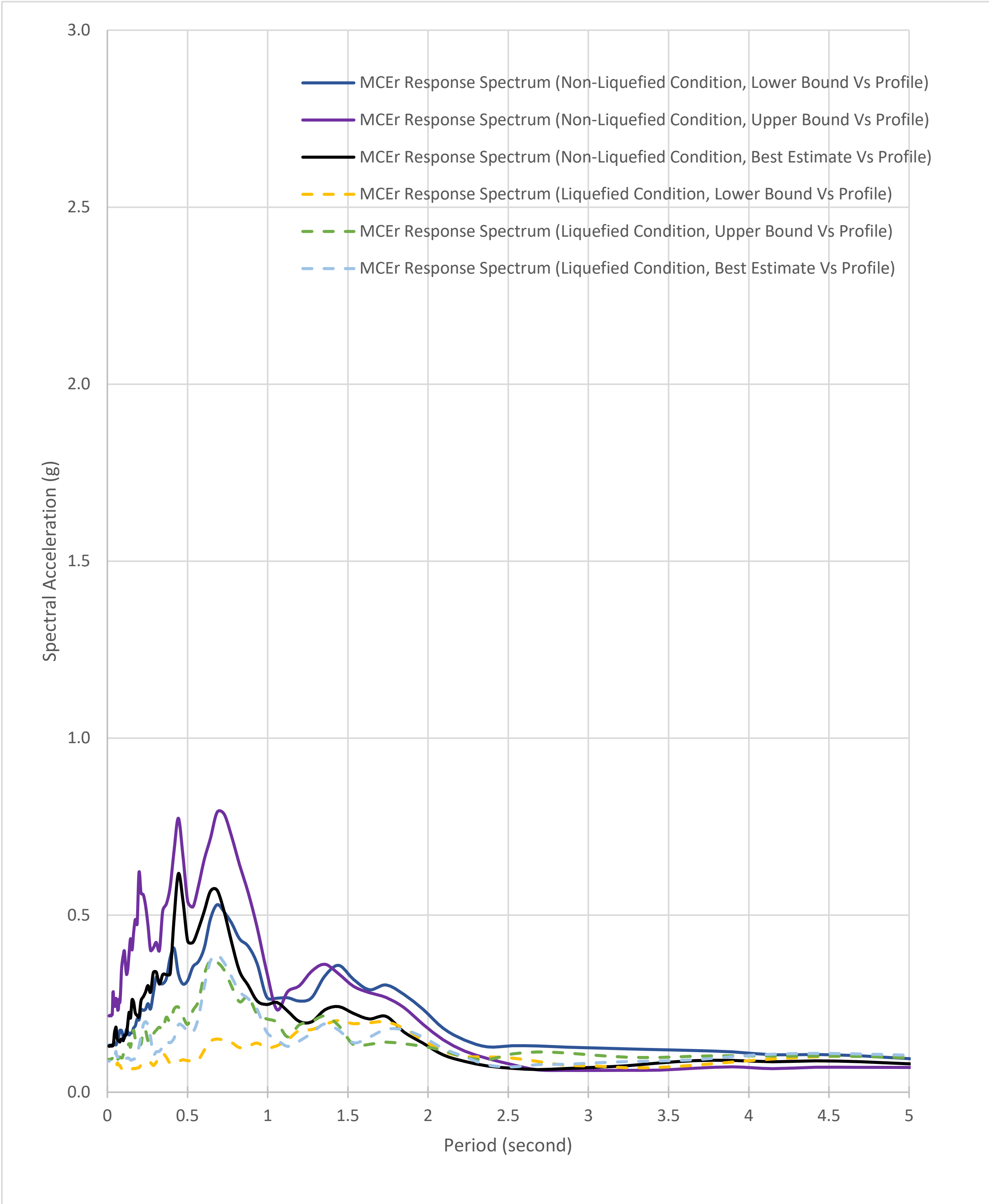


1. Spectra correspond to free field motions at the ground surface for 5% damping

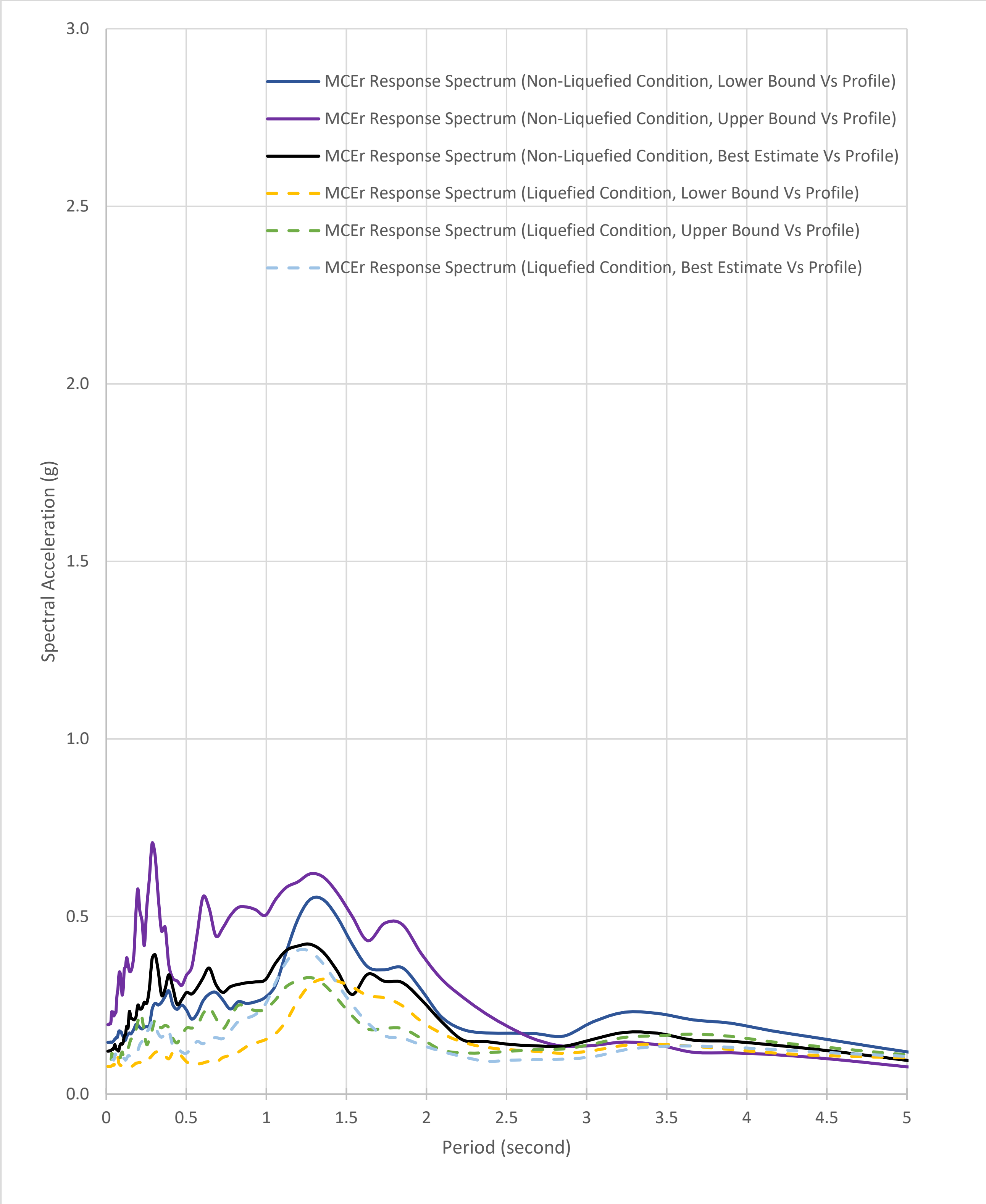
PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	MCE$_R$ "Rock" Target Spectrum Average Input Ground Motions	
		Project No. 19-340	Figure No. 4



PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	**MCER Ground Surface Response Spectrum** **Iwate (Japan), 2008** **Component: AKT023-NS**	
		Project No. 19-340	Figure No. **5**



PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Ground Surface Response Spectrum Loma Prieta, CA (USA), 1989 Component: SJTE225**	
		Project No. 19-340	Figure No. **6**



PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Ground Surface Response Spectrum San Simeon, CA (USA), 2003 Component: 90**	
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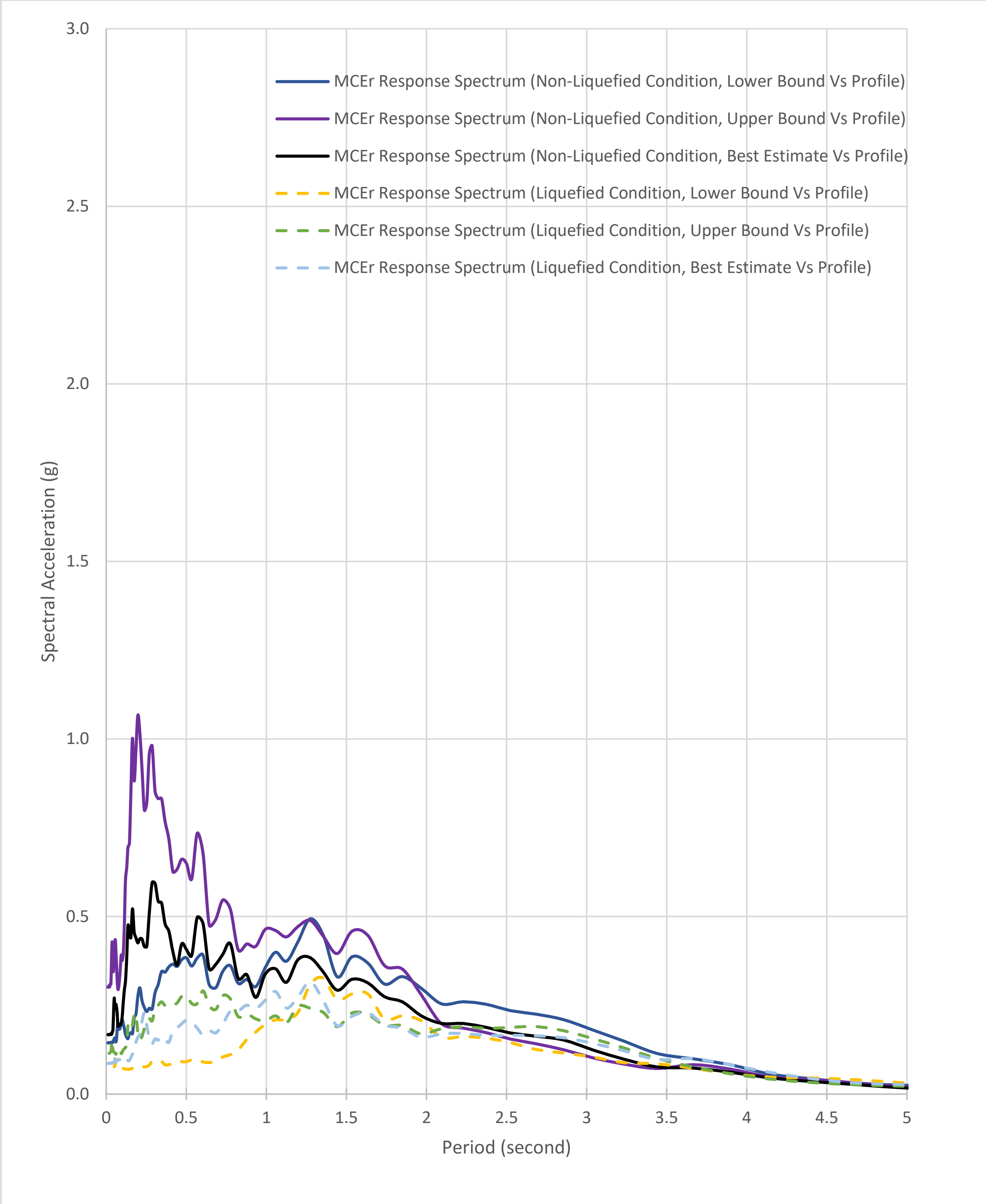

PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Ground Surface Response Spectrum Michoacán (Mexico), 1997 Component: S00E**	
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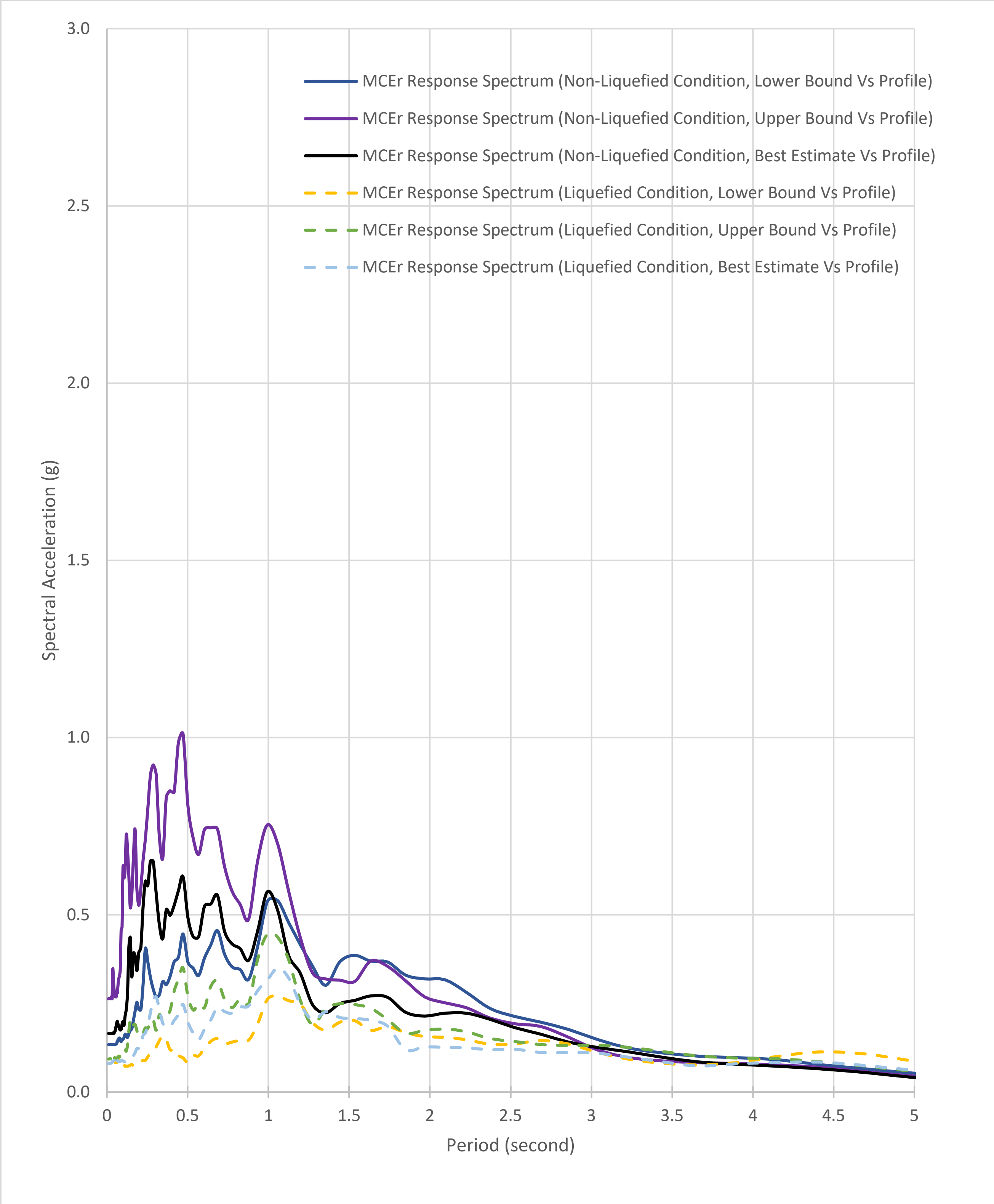
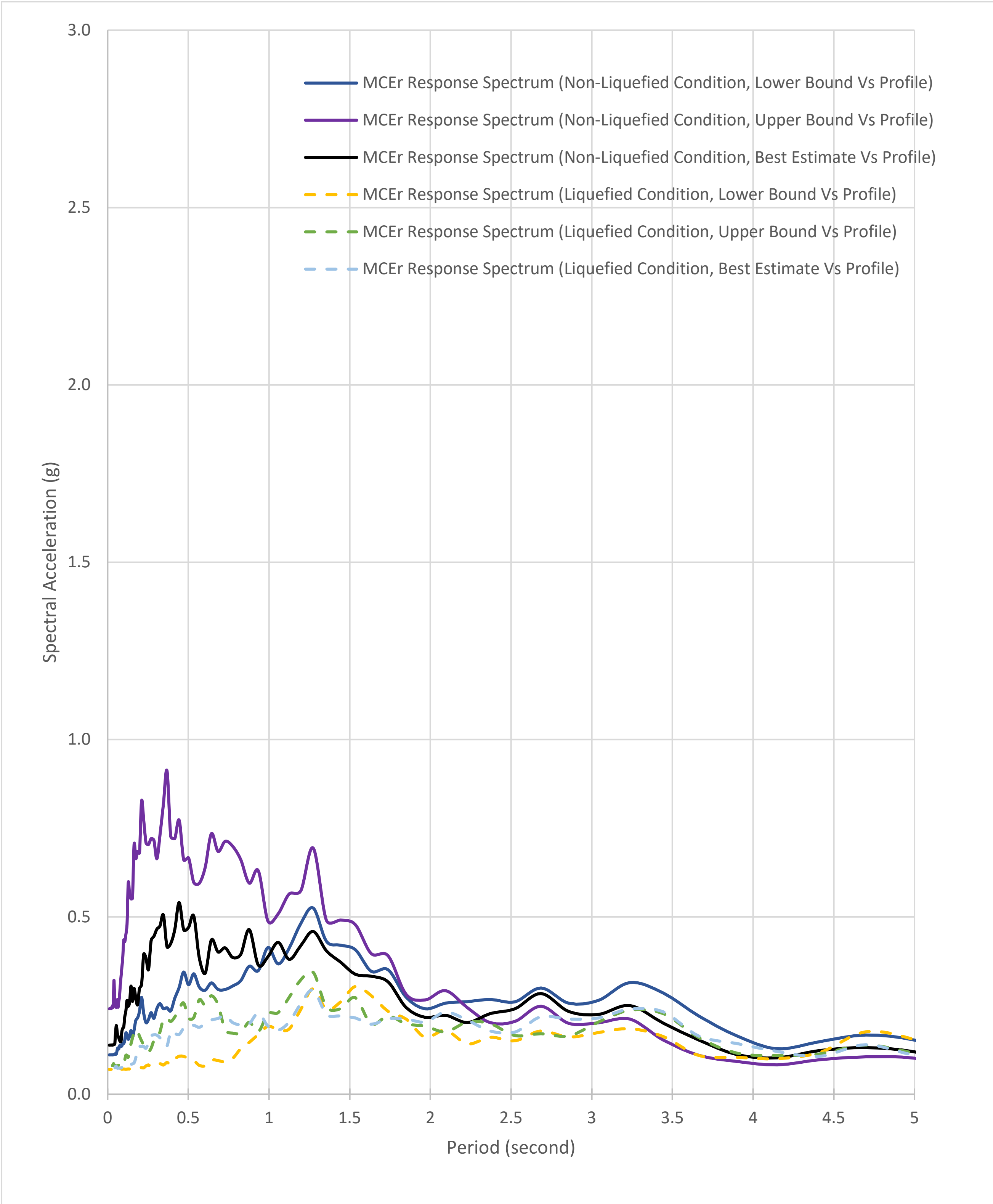


PanGEO INCORPORATED

Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA

MCER Ground Surface Response Spectrum El Salvador (Guatemala), 2001 Component: 090

Project No.	Figure No.
19-340	**9**



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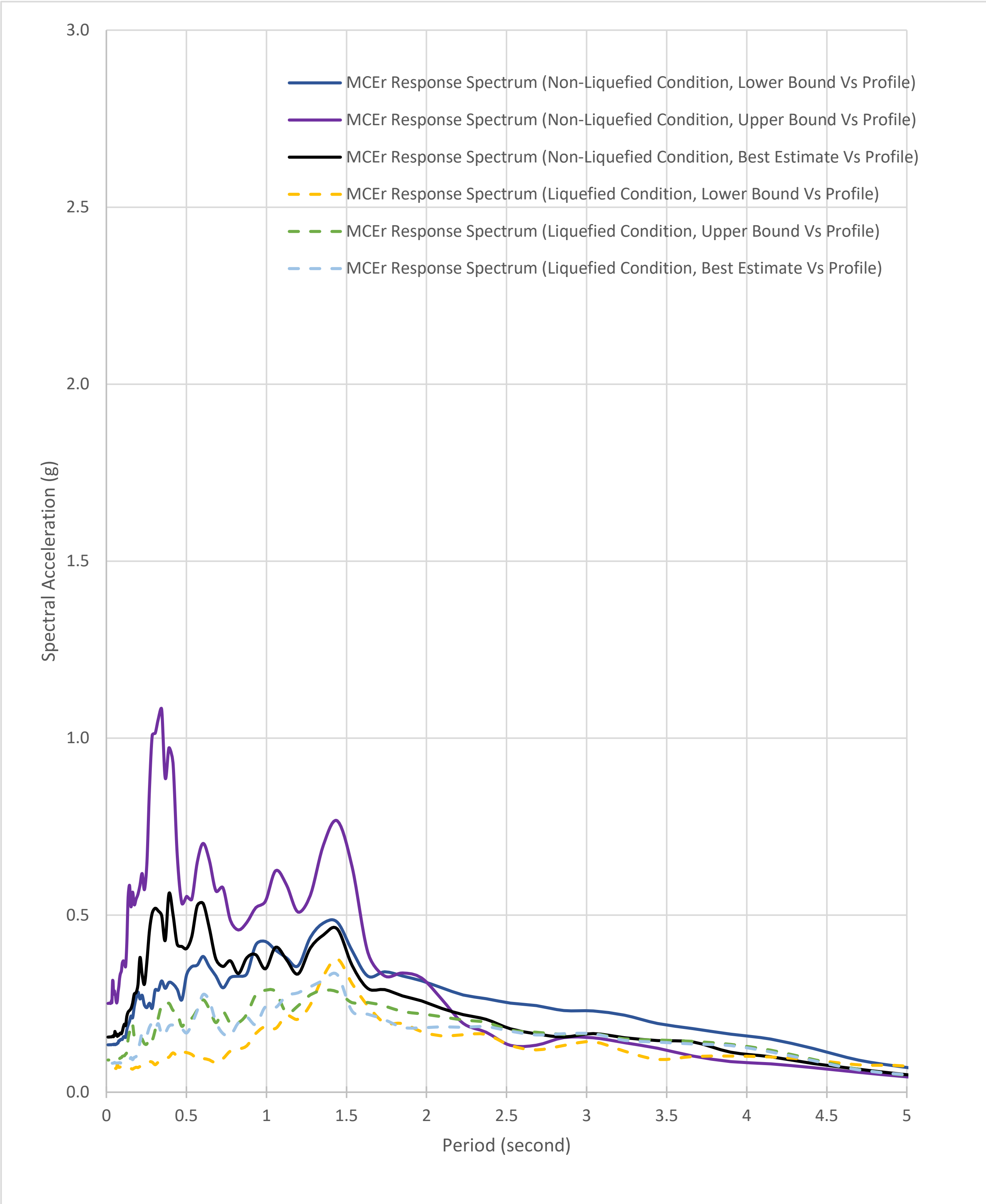
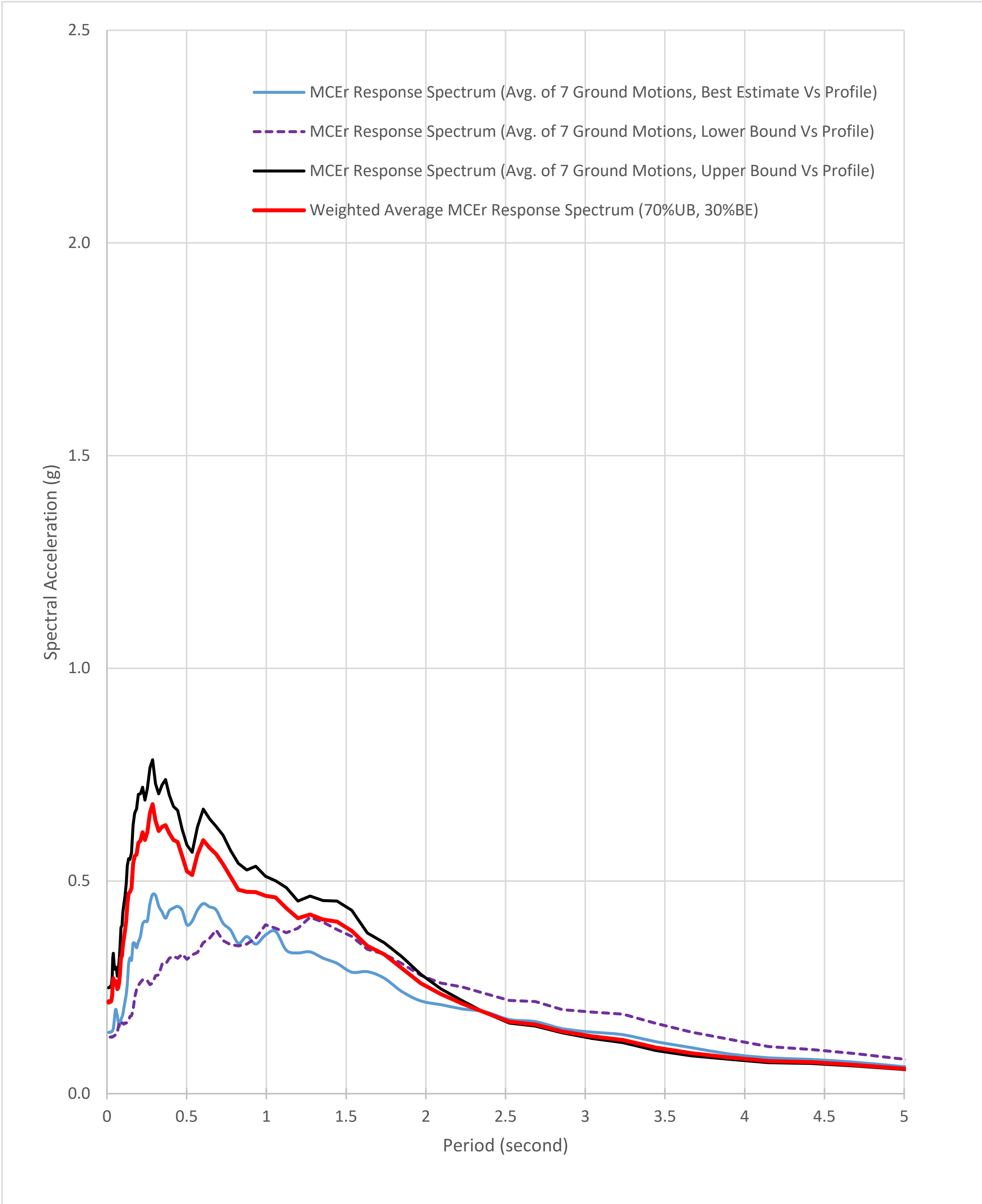
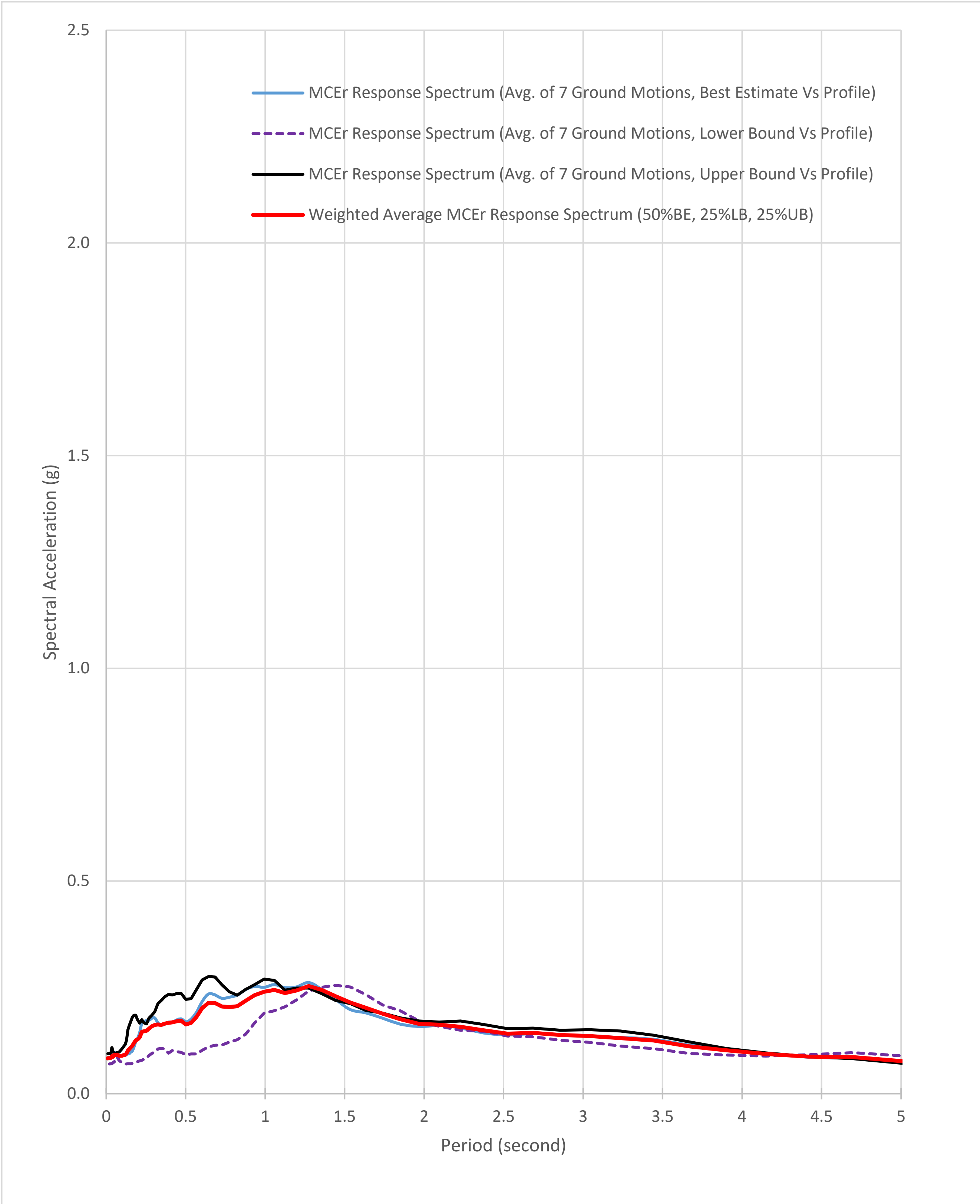


PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Ground Surface Response Spectrum Chile 2010 (Offshore near Biobio) Component: CUR-NS**	
		Project No. 19-340	Figure No. **11**



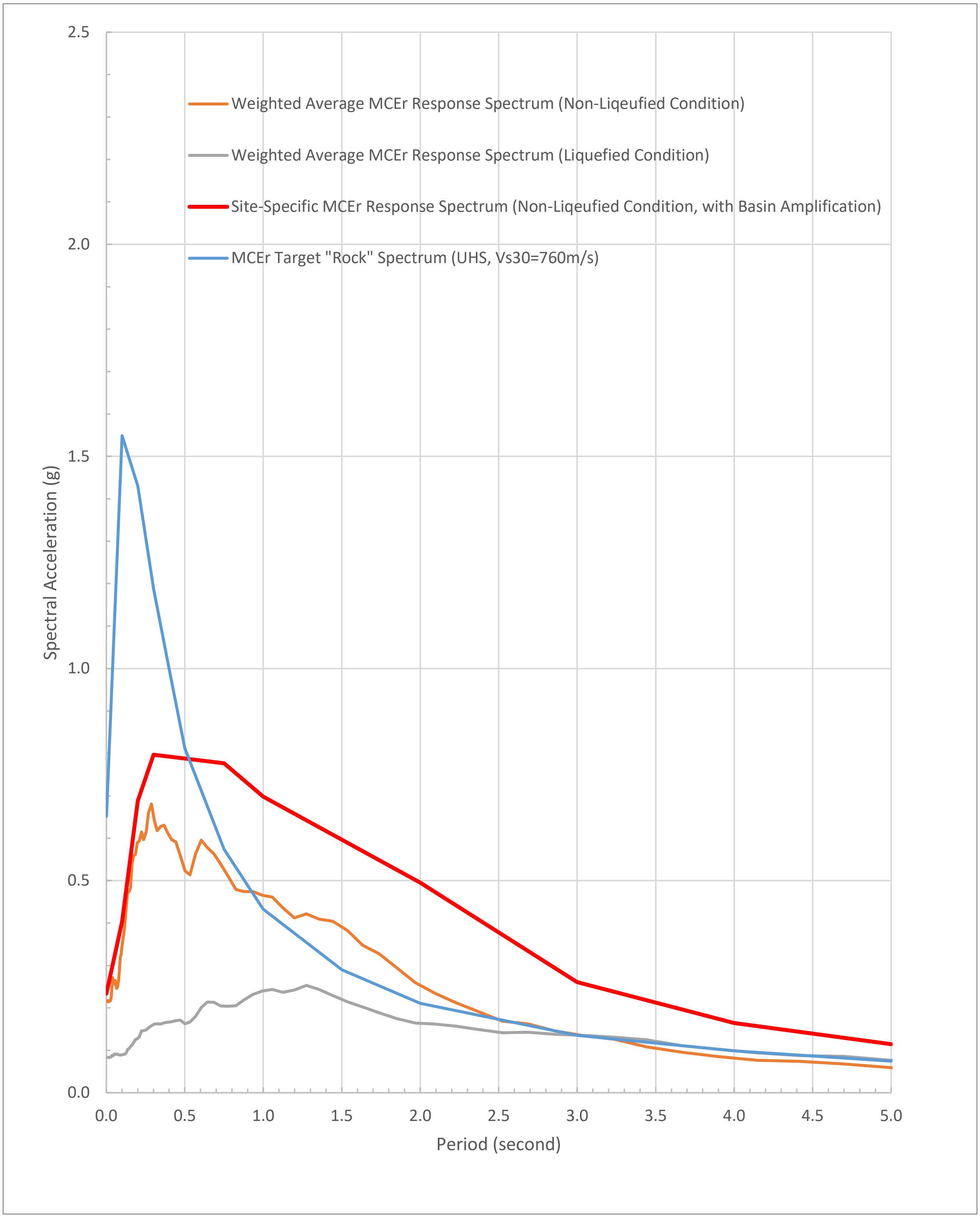
1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Ground Surface Response Spectrum Non-Liquefied Condition**	
		Project No. 19-340	Figure No. **12**



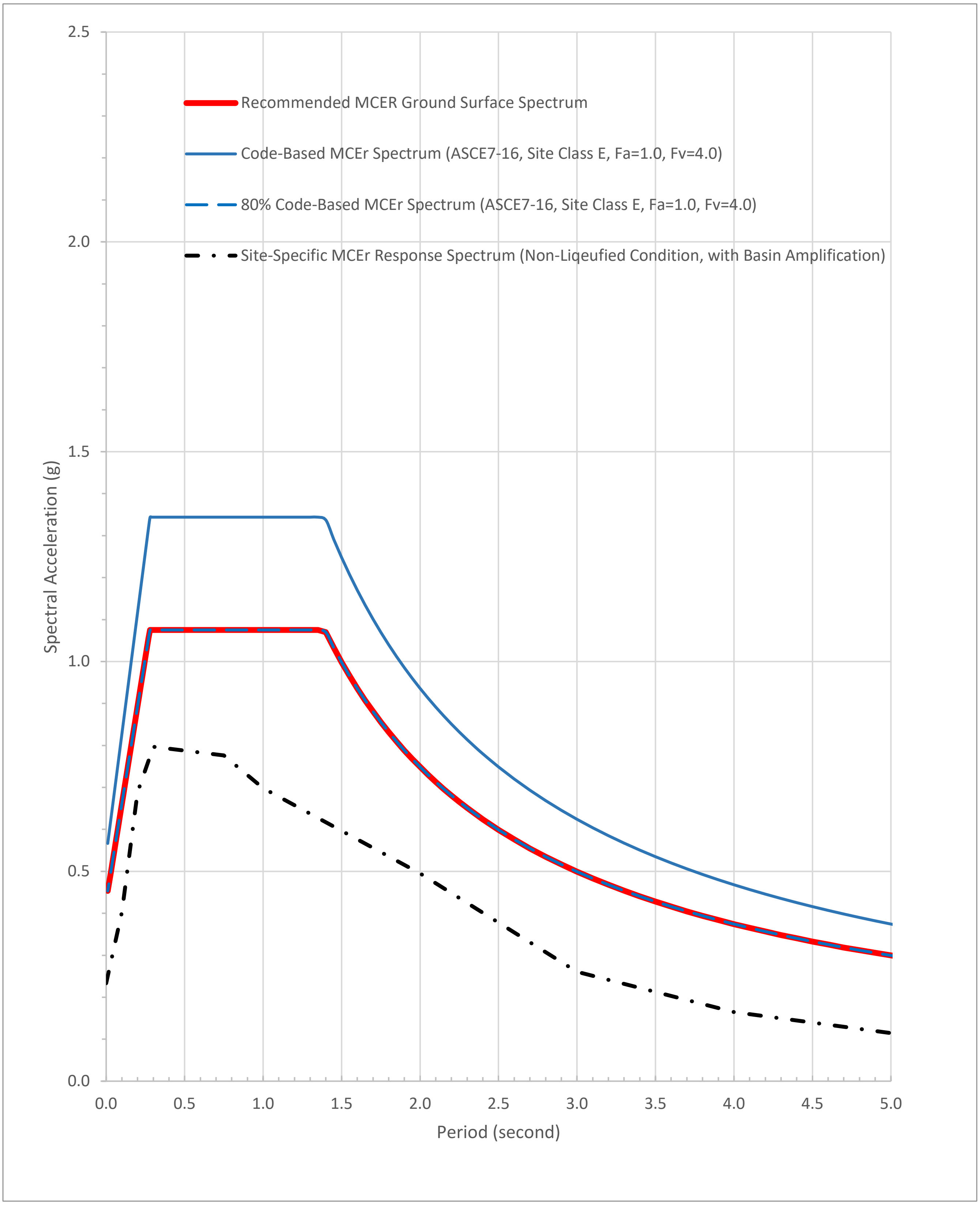
1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	MCER Ground Surface Response Spectrum Liquefied Condition	
		Project No. 19-340	Figure No. 13



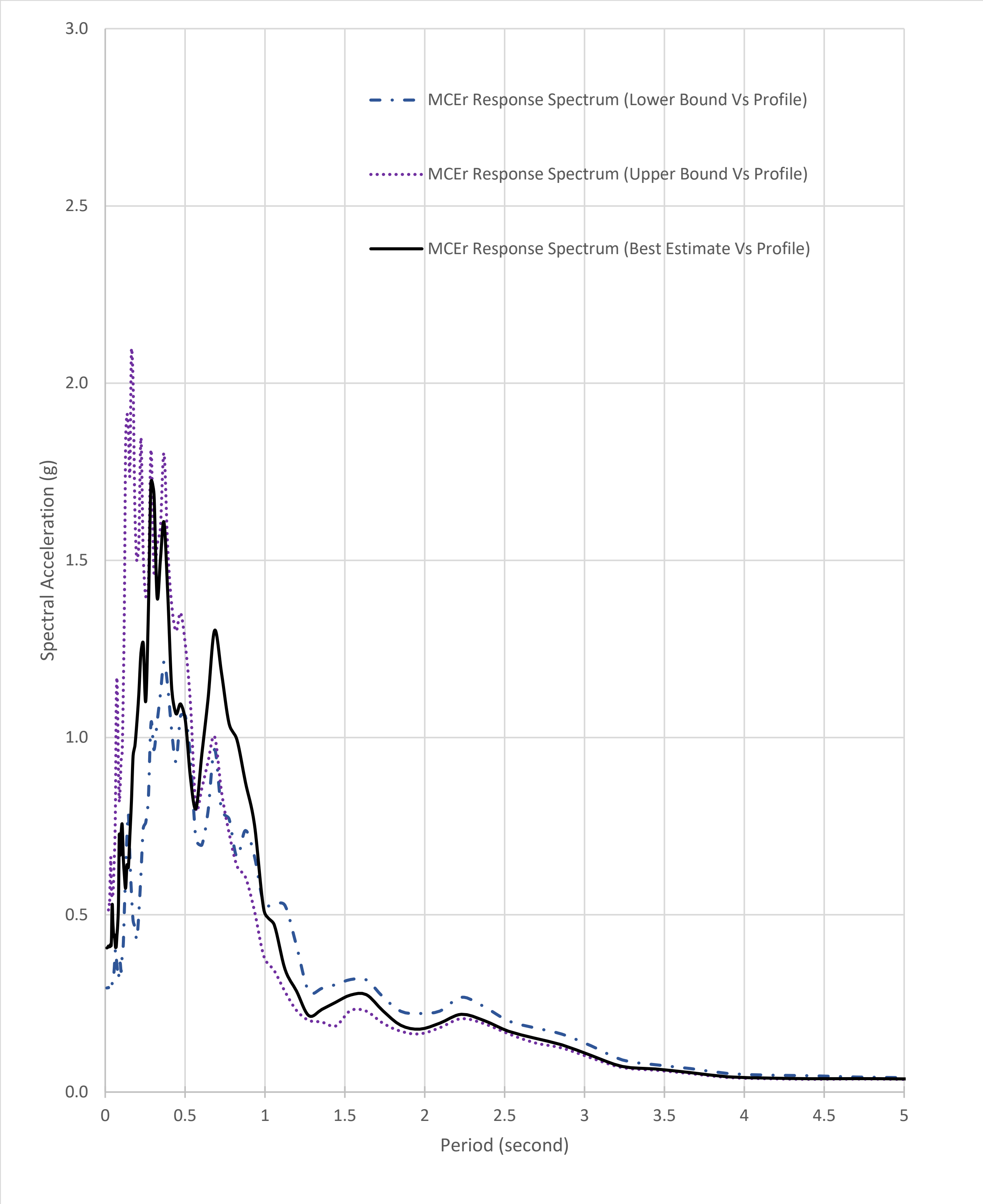
1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Ground Surface Response Spectrum Liquefied and Non-Liquefied Conditions**
		Project No. 19-340 — Figure No. **14**

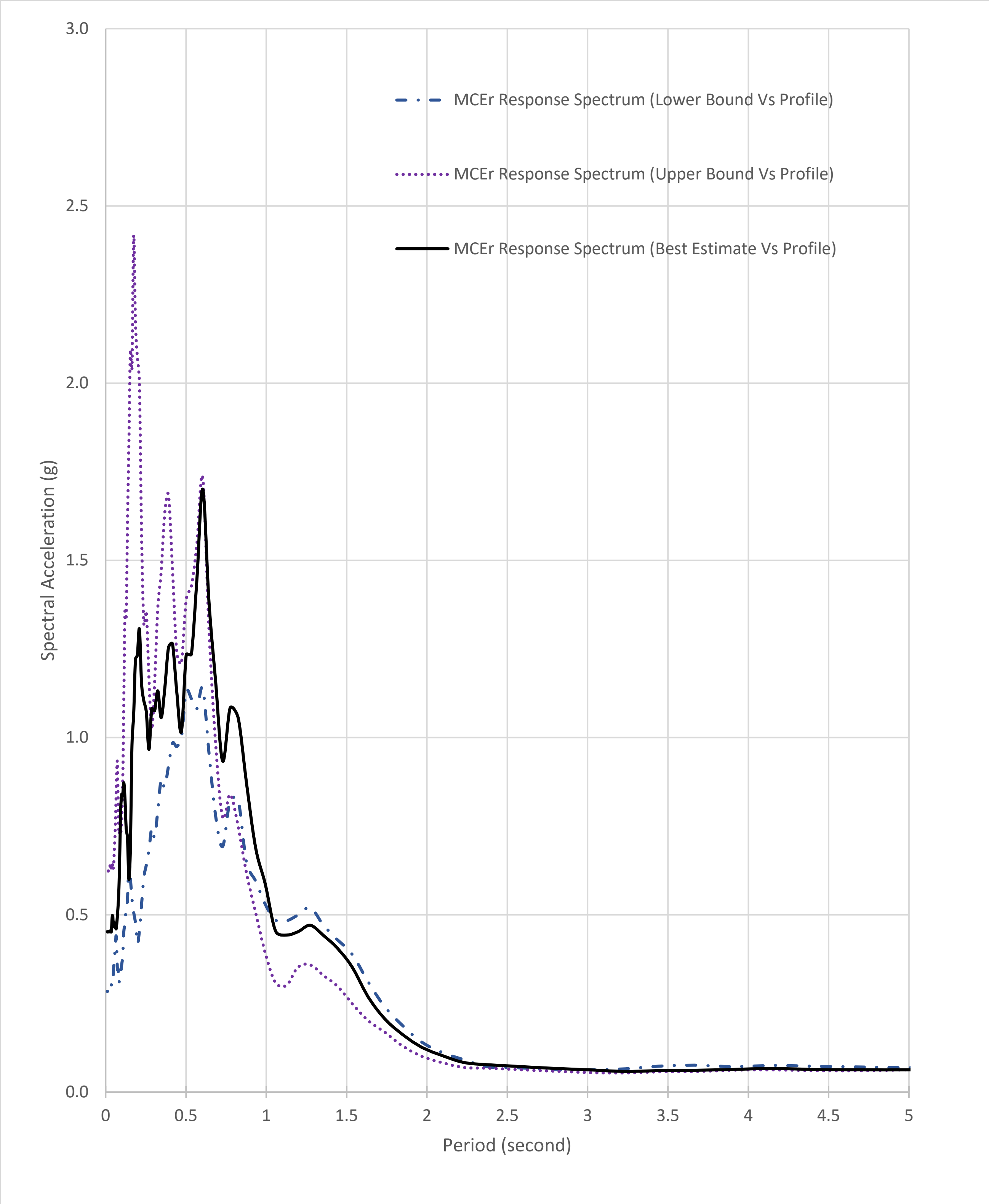


1. Spectra correspond to free field motions at the ground surface for 5% damping

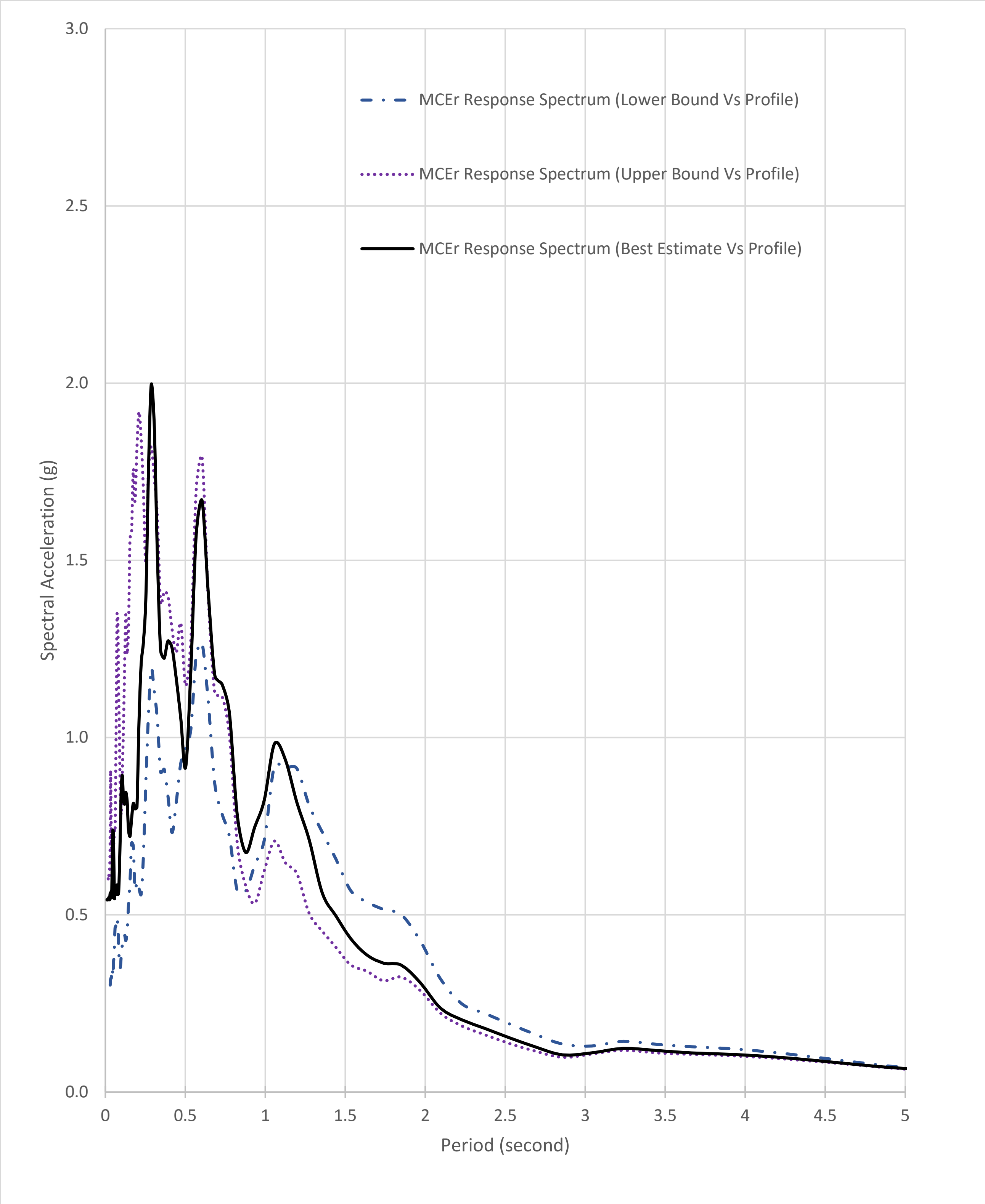
PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**Recommended Site-Specific MCE$_R$ Ground Surface Response Spectra**	
		Project No. 19-340	Figure No. **15**



PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	MCER Response Spectrum Top of Glacially Consolidated Soils Iwate (Japan), 2008, Component: AKT023-NS	
		Project No. 19-340	Figure No. 16



PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCE$_R$ Response Spectrum Top of Glacially Consolidated Soils Loma Prieta, CA (USA), 1989, Component: SJTE225**	
		Project No. 19-340	Figure No. **17**



PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Response Spectrum Top of Glacially Consolidated Soils San Simeon, CA (USA), 2003, Component: 90**	
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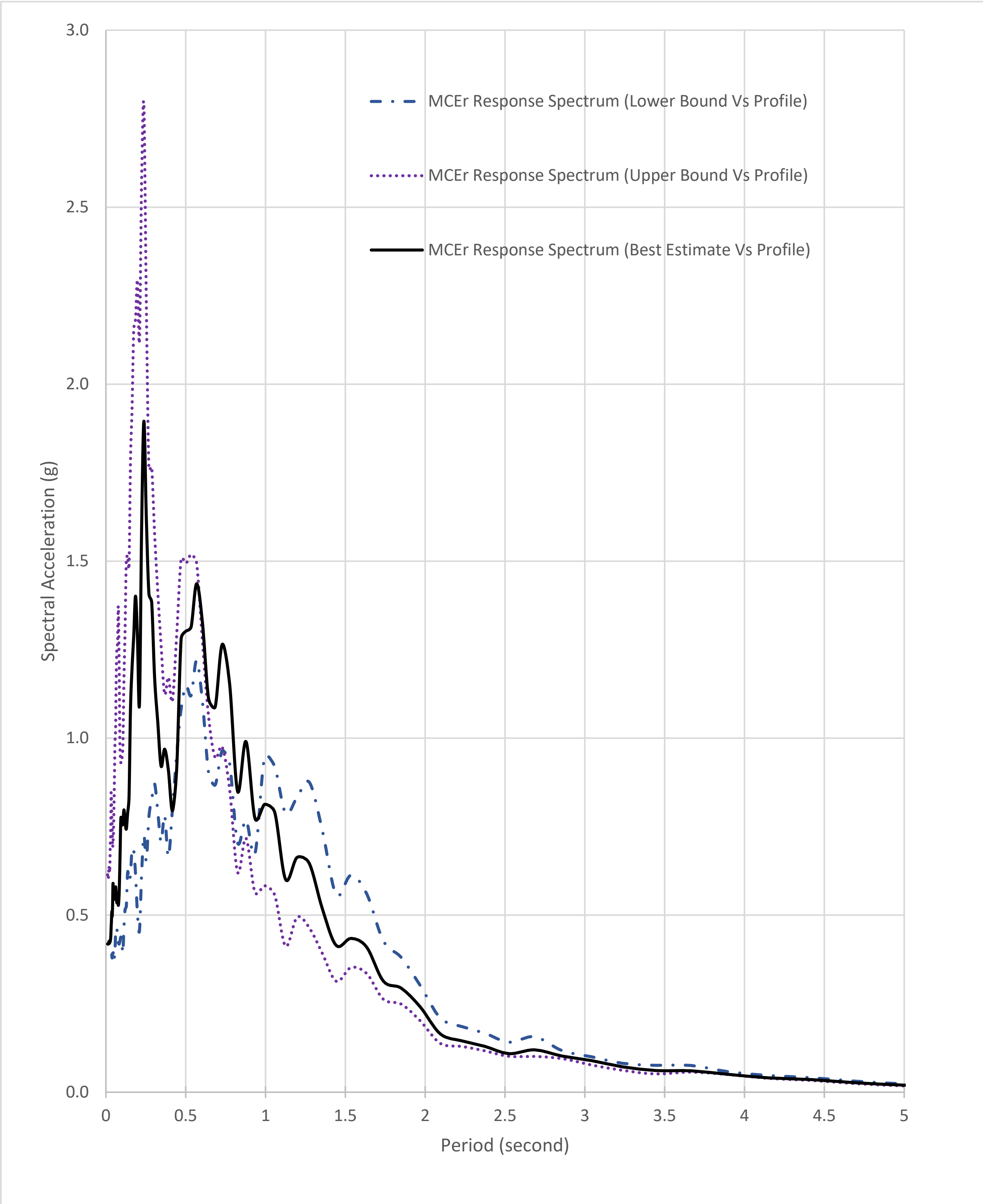

PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	MCER Response Spectrum Top of Glacially Consolidated Soils Michoacán (Mexico), 1997, Component: S00E	
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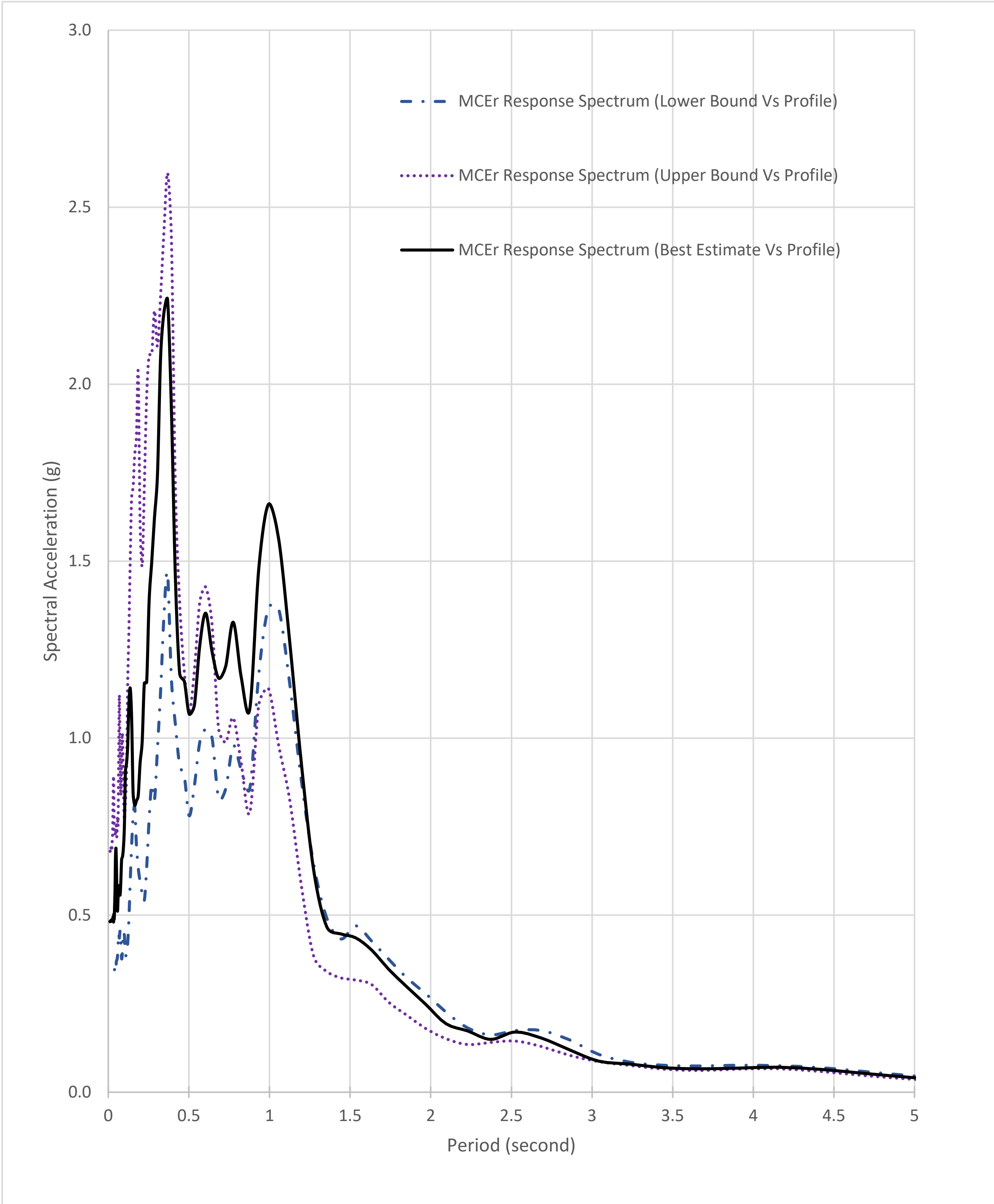

PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCE$_R$ Response Spectrum Top of Glacially Consolidated Soils El Salvador (Guatemala), 2001, Component: 090**	
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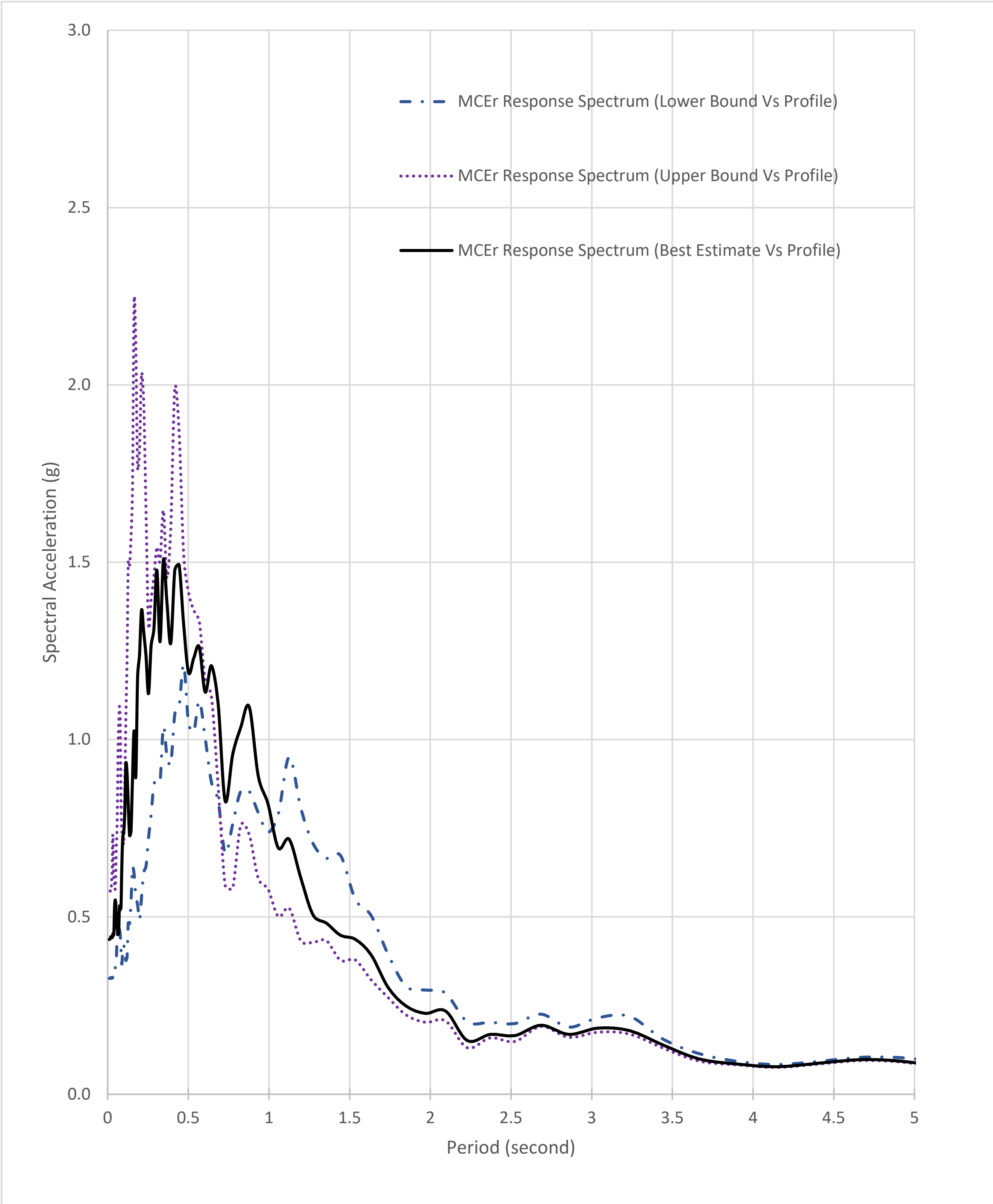

PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	MCER Response Spectrum Top of Glacially Consolidated Soils Tonoku (Japan), 2011, Component: TCGH12-EW2	
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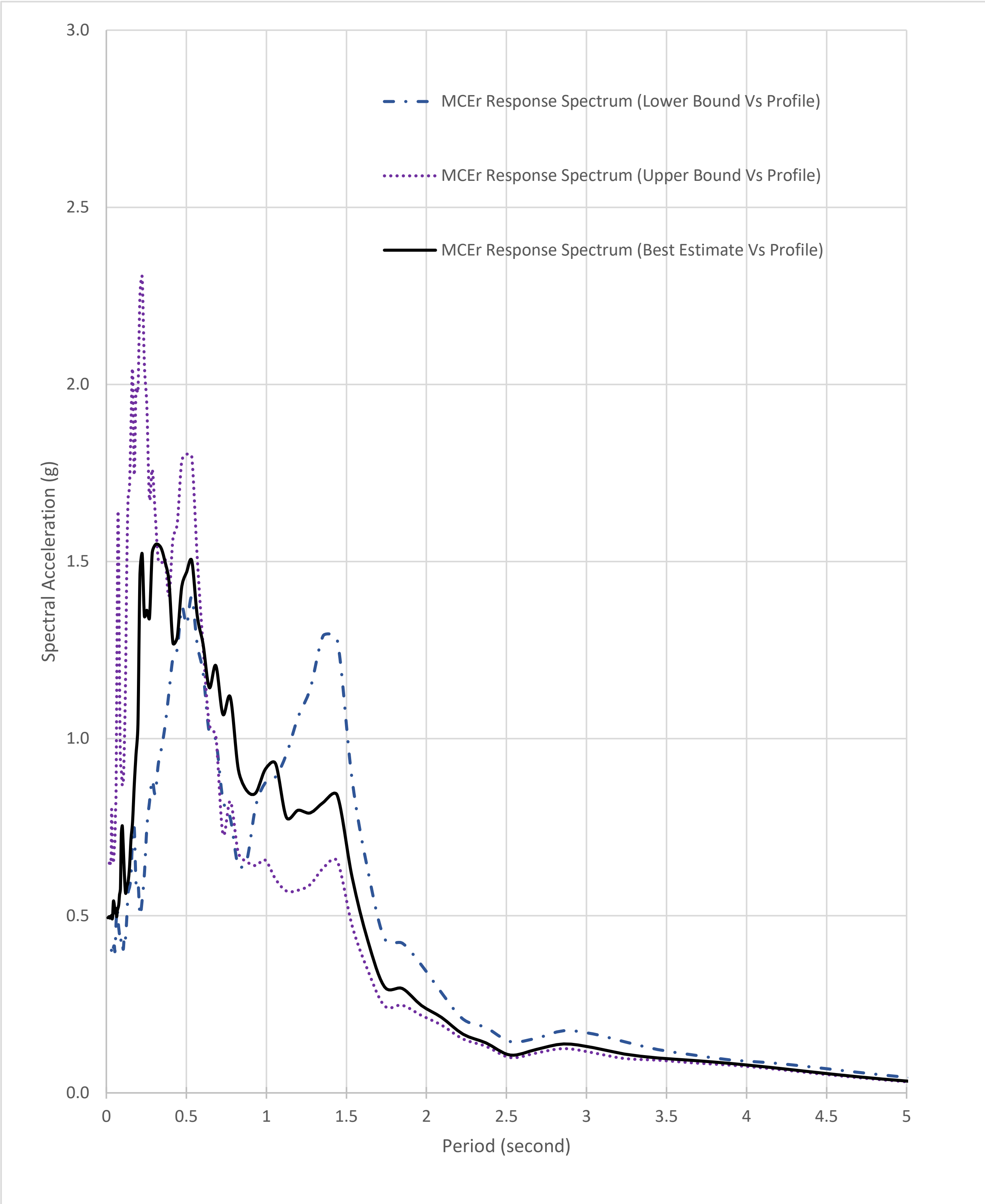
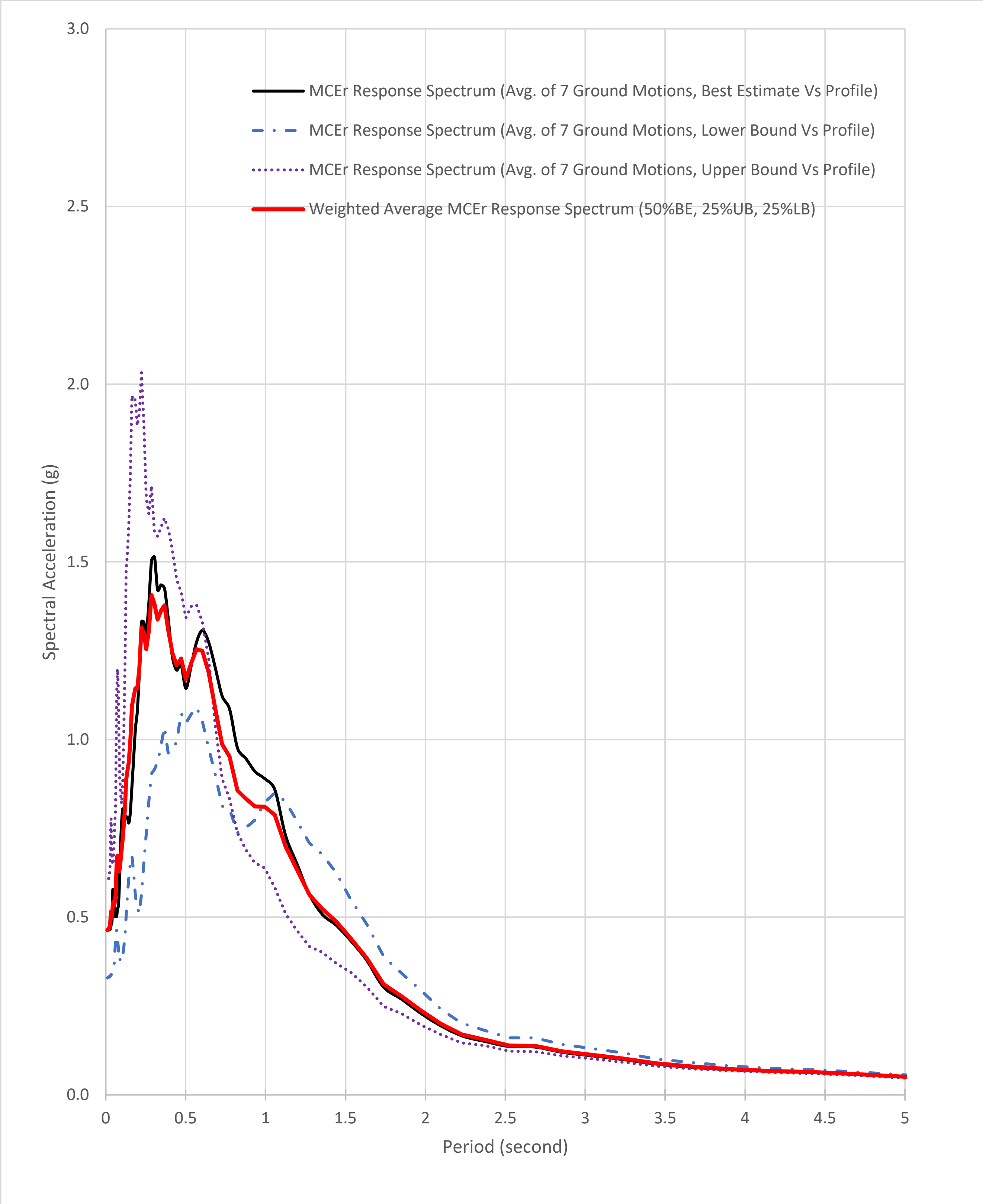
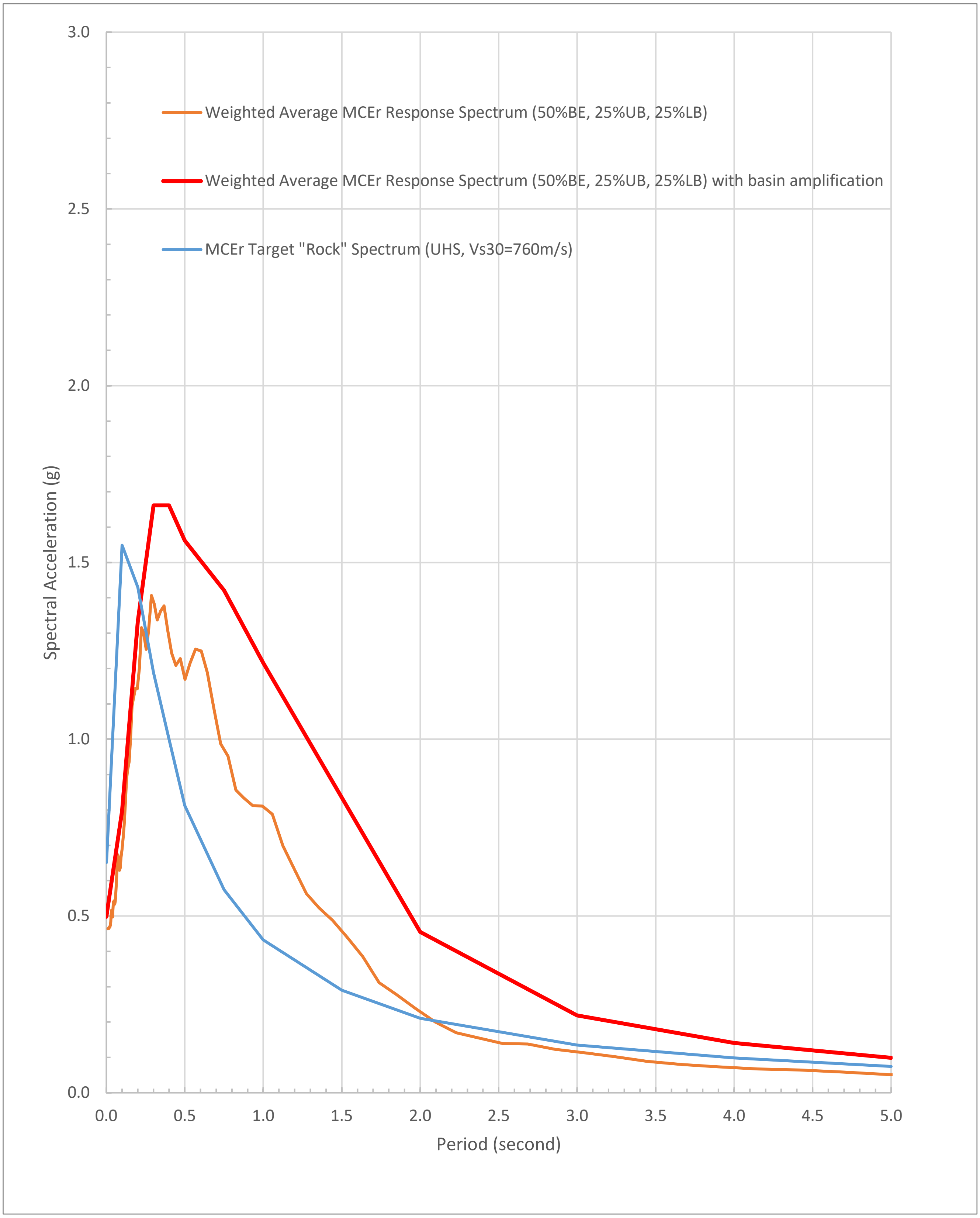


PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**MCER Response Spectrum Top of Glacially Consolidated Soils Chile 2010 (Offshore near Biobio), Component: CUR-NS**
		Project No. 19-340
		Figure No. **22**



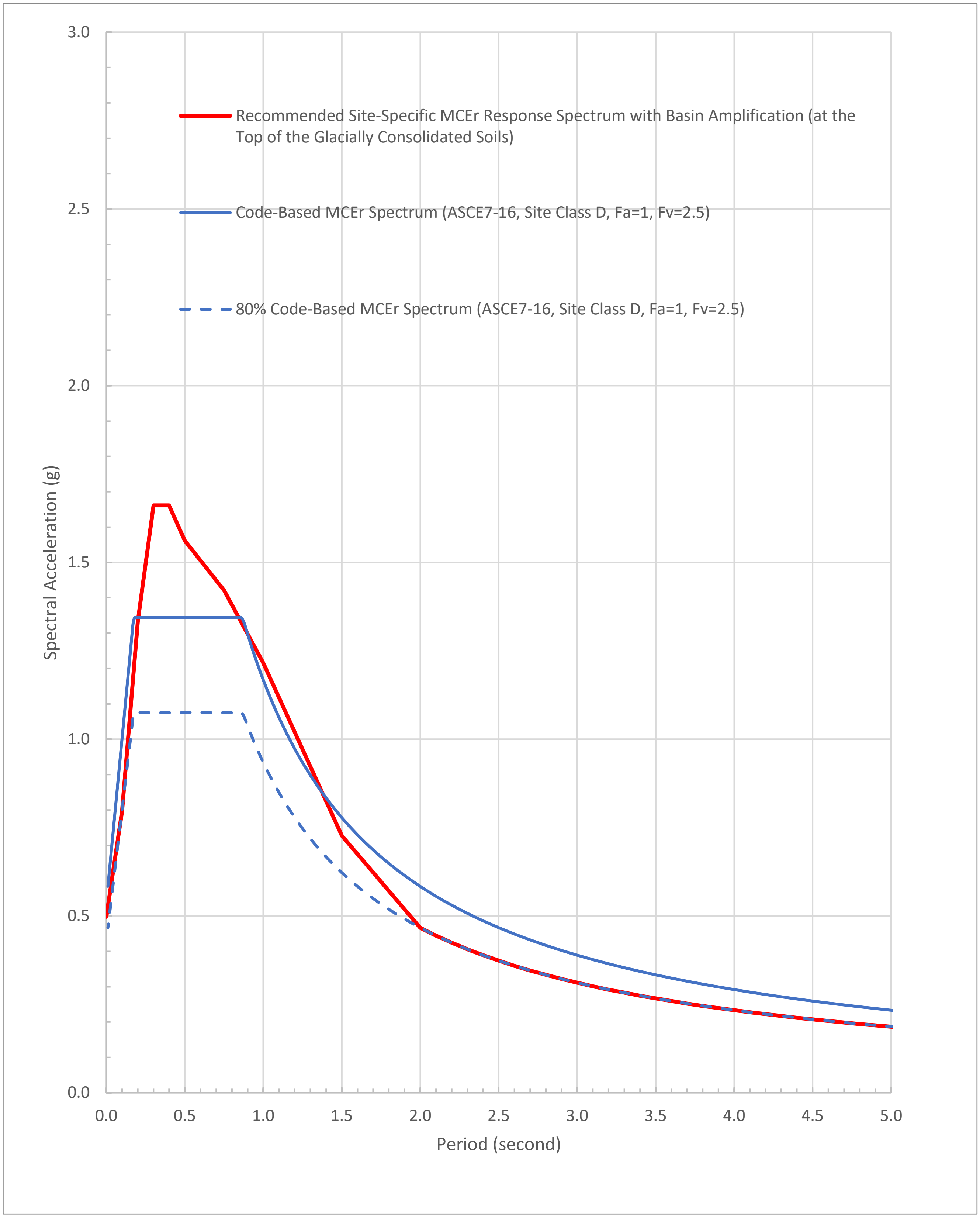
1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**Weighted Average MCER Response Spectrum Top of Glacially Consolidated Soils**	
		Project No. 19-340	Figure No. **23**



1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	Weighted Average MCER Response Spectrum with Basin Amplification Top of Glacially Consolidated Soils	
		Project No. 19-340	Figure No. 24



1. Spectra correspond to free field motions at the ground surface for 5% damping

PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	**Recommended Site Specific MCER Response Spectrum Top of Glacially Consolidated Soils**	
		Project No. 19-340	Figure No. **25**

ATTACHMENT A

SHEAR WAVE VELOCITY MEASUREMENTS

AND BORING LOGS (PG-01-17 to PG-03-17)

Global Geophysics

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Redmond, WA, 98073-2229
Tel: 425-890-4321
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Report on MAM Surveys
At Fishermen's Terminal

Global Geophysics Project No. 110-0626

Prepared for
PanGeo, Inc
3213 Eastlake Ave East, Suite B
Seattle, WA 98102

Prepared by
Global Geophysics LLC
P.O. Box 2229, Redmond, WA 98073-2229

July 1, 2020

CONTENTS

1. OBJECTIVE

Global Geophysics LLC conducted two MAM surveys around Fisherman's Terminal in Seattle, WA. The proposed objective of this investigation is to estimate S-Wave velocities to a depth of 100ft. This report provides the methods, instrumentation, data collection and processing procedures, results, and analysis of this investigation.

2. INTRODUCTION

Surface waves are a special type of seismic wave whose propagation is confined to near the near surface medium. The depth of subsurface penetration of a surface wave is directly proportional to wavelength. In a non-homogeneous medium, surface waves are dispersive, i.e. each wavelength has a characteristic velocity stemming from subsurface heterogeneities. The velocity that the surface waves' wavelengths propagate through the subsurface is related to the shear wave (S-Wave) velocity of the subsurface. If the S-Wave velocity varies with depth, so will the surface wave's wavelength velocity. Analysis of how the wavelength varies, or dispersion, allows us to estimate the S-Wave velocity as it passes through the subsurface. The S-Wave velocity of the subsurface can then be used to infer useful characteristics such as the rock/soil type, stratigraphy, and soil conditions.

Average S-Wave velocities to a depth of 100ft (30m) are known as V_{S100} (V_{S30}) and are sorted into classes by the International Building Code (IBC) to provide valuable earthquake engineering design information. These classes are shown here:

Class Name	Ground Description	V_{S100}	V_{S30}
A	Hard Rock	>5000ft/s	>1500m/s
B	Rock	5000ft/s to 2500ft/s	1500m/s to 760m/s
C	Dense Soil or Soft Rock	2500ft/s to 1200ft/s	760m/s to 360m/s
D	Stiff Soil	1200ft/s to 600ft/s	360m/s to 180m/s
E	Soft Soil	<600ft/s	<360m/s
F	Needs site specific evaluation	NA	NA

Surface waves can be utilized in both active and passive deployments. Multichannel Analysis of Surface Waves (MASW) comprises most active deployments while Microtremor Array Measurements (MAM) are the primary method to collect passive data. MASW arrays are typically linear while MAM arrays can be linear but generally perform better when deployed in 2D orientations (triangular, circular, T-shaped, or L-shaped arrays).

For this project, MAM surveys were deployed at the locations shown on Figure 1.

Figure 1. Site Map

3. METHODOLOGY AND INSTRUMENTATION

3.1 Microtremor Array Measurements (MAM) Method

A detailed description of the MAM method can be found in Okada, 2003. MAM arrays generally have a greater degree of flexibility with their design and in addition to linear arrays, can be deployed in 2D arrays such as the circular, triangular, T and L arrays. Depending on the layout of an MAM array, fewer than 24 geophones are needed. Since this is a passive survey, the ambient vibrations of the surroundings are utilized rather than deliberately generated. These passive sources can come from all directions and include traffic, ocean waves, cultural noise, and construction. MAM arrays should utilize an array size equal to the depth of investigation (Geometrics, 2009) and record the ambient vibrations for a minimum of 30 seconds and collect a minimum of 10 minutes of data.

Wireless geophones, such as the SmartSolo IGU-16 or the Geometrics Atom enable passive arrays to be deployed to sizes much larger than wired arrays. Wireless MAM arrays can span several hundred, or even several thousand feet; enabling much deeper investigations into the subsurface.

3.2 Surface Wave Dispersion Curve Modeling

Dispersion curves are useful for determining S-Wave velocities of the subsurface and are generated with the help of specialized software. Data files are added to the software and their traces displayed by location versus time, showing the seismic waves that arrive at each geophone over the course of the record.

For MASW data, a fast Fourier transform is performed to transform the data from the time domain to the frequency domain (Taipodia & Babu, 2013). At each frequency, a phase velocity can be calculated, and the fundamental mode and higher modes can be differentiated from each other and preferentially picked.

In the MAM case, the data is transformed with a fast Fourier transform to the frequency domain. Then the coherence (or similarity between traces or waveforms) is calculated. If the coherences are averaged over a long period of time or over many data blocks, the data is considered to be Spatially Auto-Correlated (SPAC) ((Aki, 1957). From here, the phase velocity can be calculated from each frequency and fundamental and higher modes can be picked. From the fundamental mode, the dispersion curve can be created and edited (Roesset, 1991). The dispersion curve is used to create an inversion model that displays the S-Wave velocities at the desired range of depths (Xia, Miller, & Park, 1999). Theoretical dispersion curves are generated via a matrix method (Saito & Kabasawa, 1993) and compared against the observed dispersion curve. The model is updated until the observed and theoretical dispersion curves converge. The resulting model is the delivered S-Wave velocity model for the array.

4. INSTRUMENTS AND EQUIPMENT

4.1 MAM

For this investigation, Global Geophysics used 24 SmartSolo IGU-16, 5Hz, Z component, wireless geophones deployed in four different T-Arrays. Data were downloaded from the geophones via a SmartSolo 4 Slot All-in-One box. The SmartSolo Lite software package was used to execute quality control and export individual datasets. Data processing was accomplished with Geometrics SeisImager/SW software package.

Figure 2. A SmartSolo IGU-16

Figure 3. SmartSolo All-In-One Box

5. PROCEDURES

5.1 Field Deployment

MAM Cross-Array

Line 1 had an array size of 300 feet for the N/S limb and 400 feet for the N/S limb of the Cross-Array. Geophone deployment can be seen in Fig #. Data were recorded for a total of 1 hour.

Line 2 had an array size of 396 feet for the N/S limb and 470 feet for the E/W limb of the Cross-Array. Geophone deployment can be seen in Fig. #. Data were recorded for a total of 1 hour.

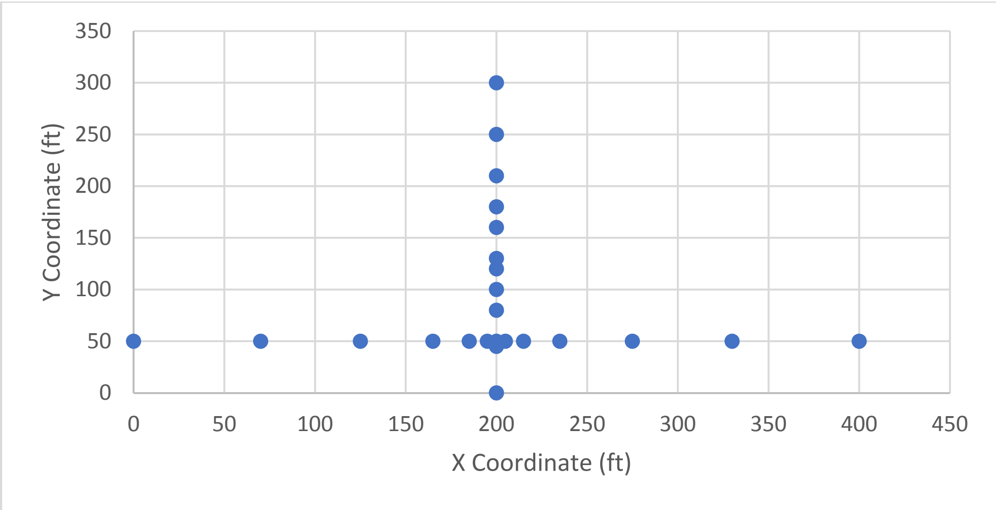

Figure 4. Line 1 Geophone Layout

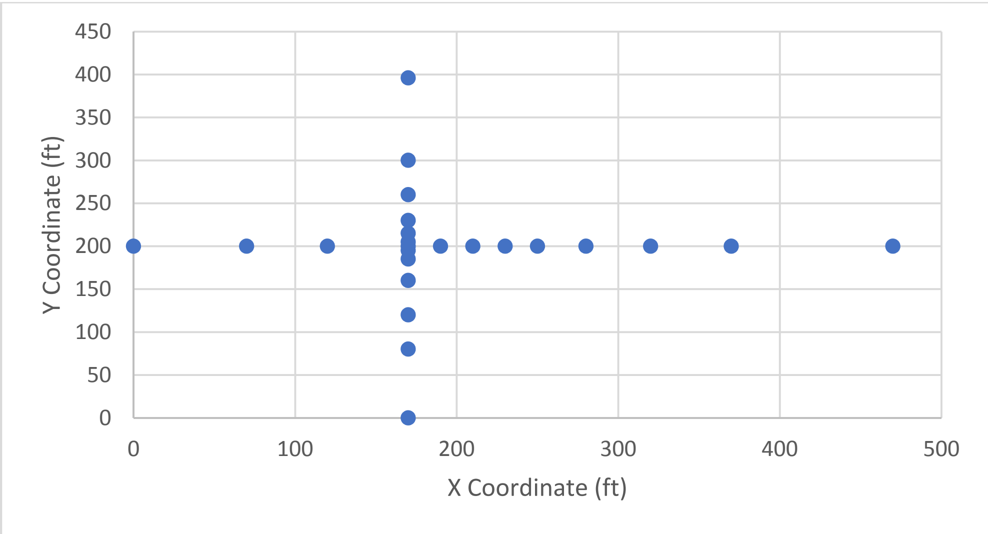

Figure 5. Line 2 Geophone Layout

5.2 Quality Control and Data Processing

5.2.1 Quality Control

Wireless MAM Arrays

Approximately 1 hour of data is collected to increase amount of high-quality data. Major disturbances and issues are noted in terms of severity and time of occurrence so they can be deleted from the data or avoided during processing. The exact start and end times are also noted. When data is downloaded from SmartSolo IGUs, built in quality control software in SmartSolo Lite detects problems and displays self-test data so problematic units can be addressed if necessary.

5.2.2 Data Processing

In SmartSolo Lite, the data are exported in SEG2 format based on the start and end times for each survey. The data are truncated 2 minutes after the start time and 2 minutes before the end time to avoid the possibility of using data on geophones that are not yet in sync. Each data file represents a trace that is at most 1,800,000 samples long (1 hour of data sampled at 2ms).

This data is opened in the SPAC+ program within SeisImager/SW and Spatial Auto Correlation analysis is performed using the specific geophone geometry for each array. The program determines the level of coherence and is considered satisfactory where coherence approaches 1.0. The dispersion curve is then calculated. The fundamental mode is picked with the assistance of the software and any uncertain data at high and low frequencies are clipped.

From this dispersion curve, an initial inversion model is generated with a target depth of 100ft and 15 calculated layers. The model shows the shear wave velocity of the top 100 feet for the site and the fit between the observed and calculated dispersion curves is calculated using the least square method (LSM).

6. RESULTS

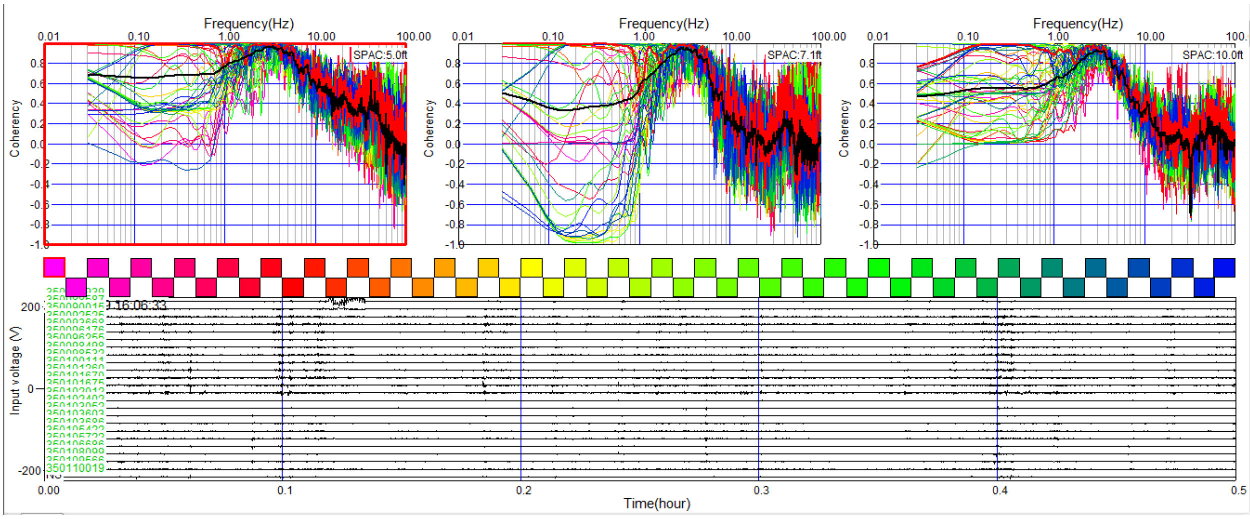

Figure 6. Line 1 Coherency

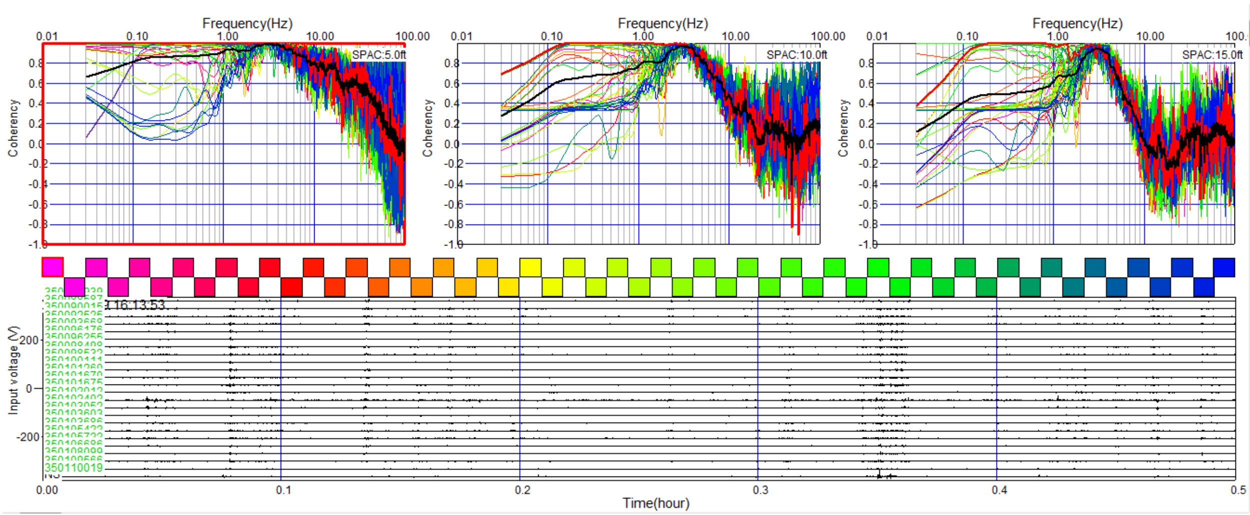

Figure 7. Line 2 Coherency

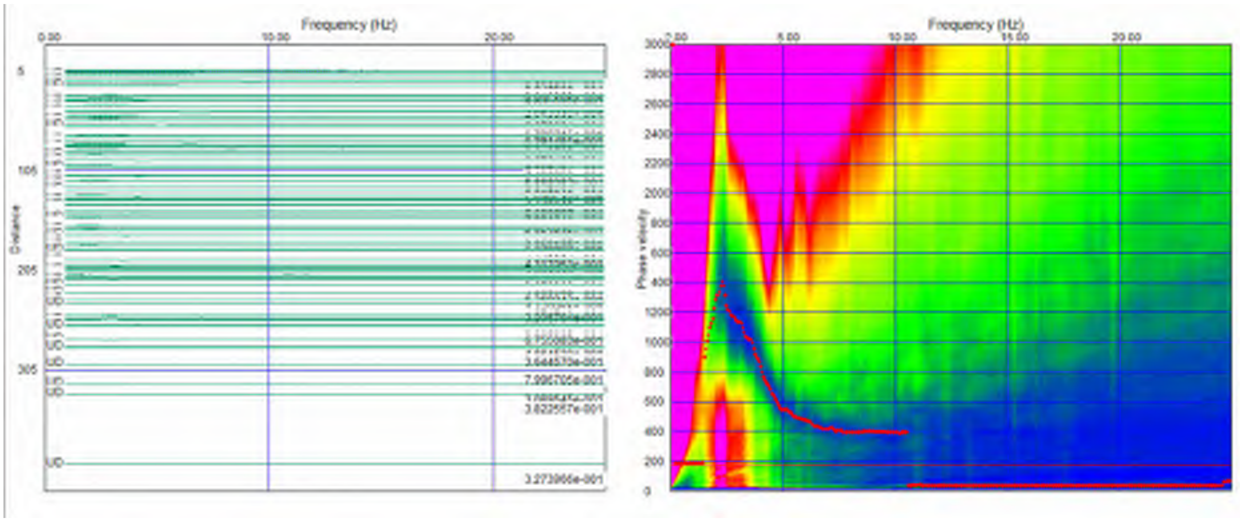

Figure 8. Line 1 SPAC and Dispersion Curve

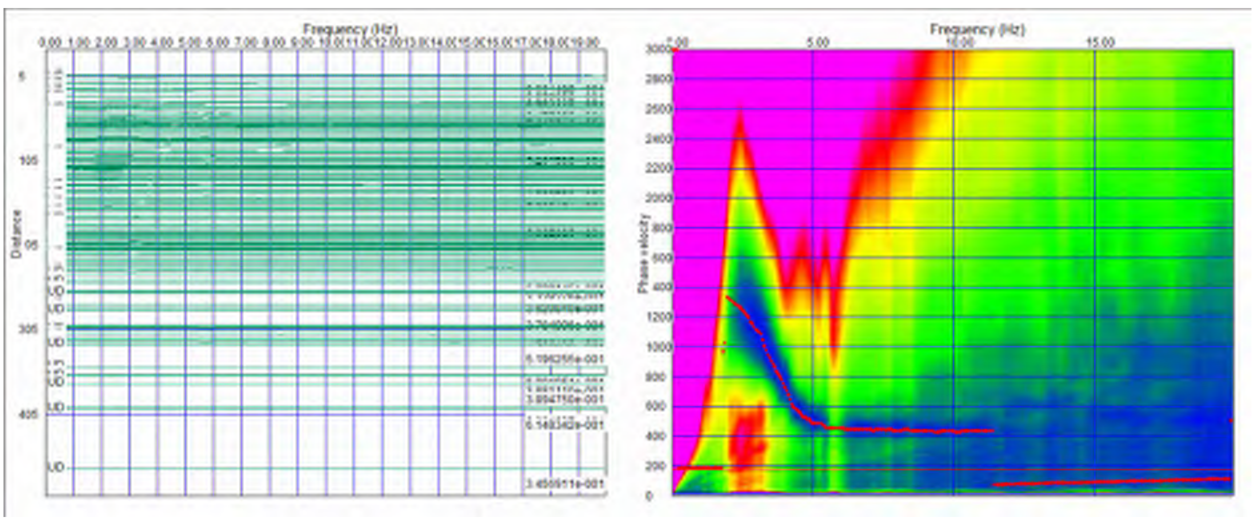

Figure 9. Line 2 SPAC and Dispersion Curve

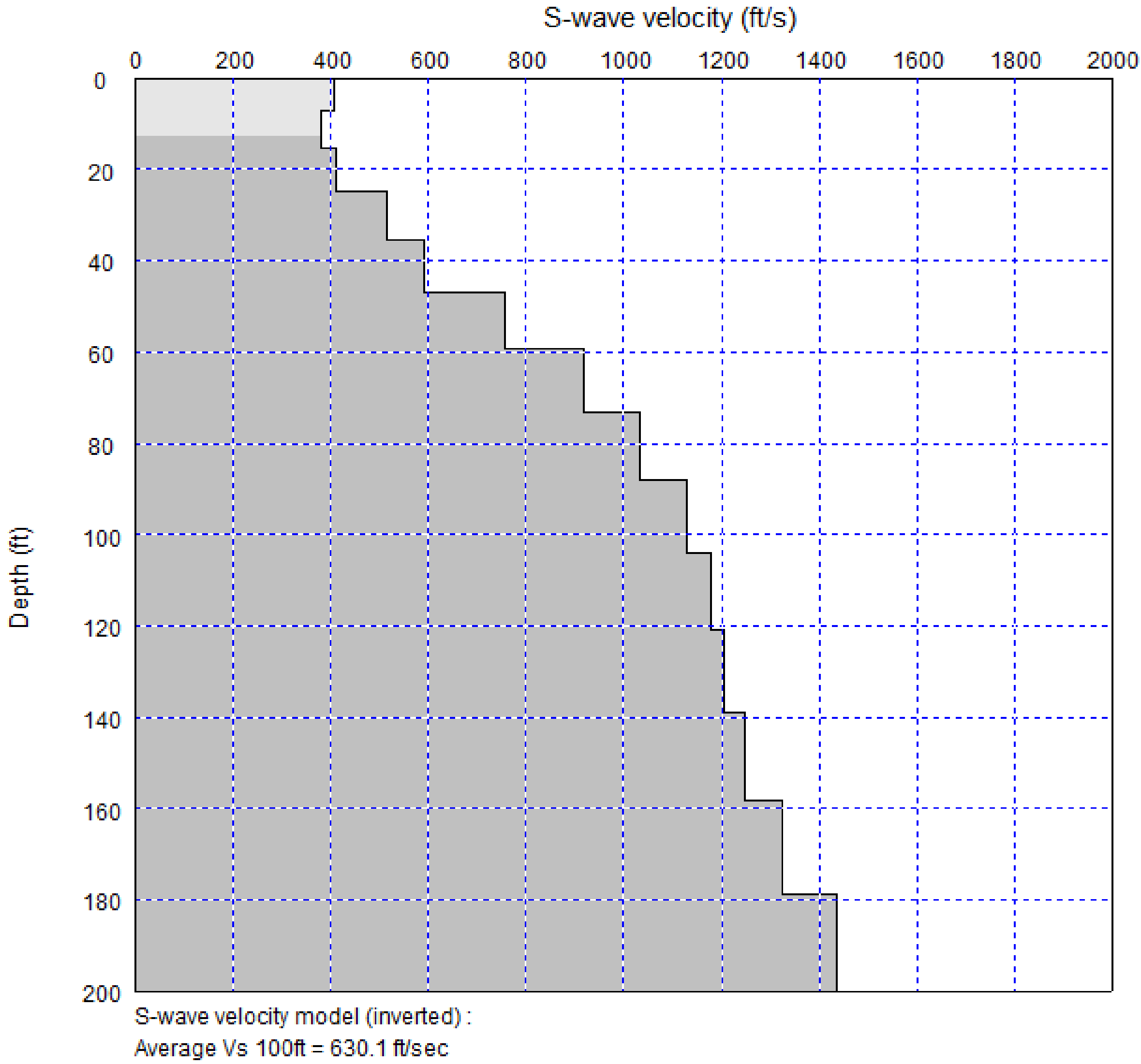

Figure 10. Line 1 S-Wave Model

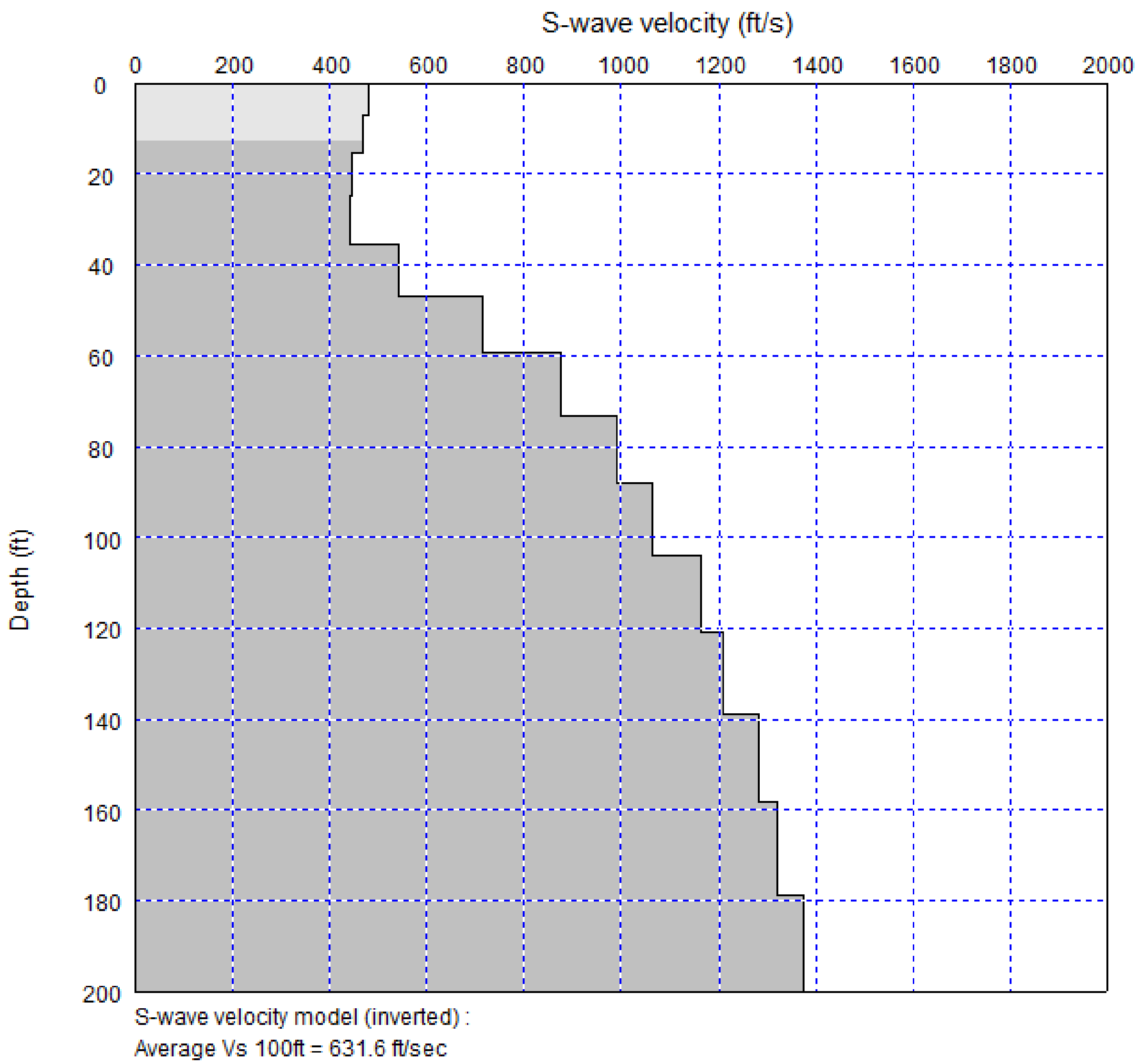

Figure 11. Line 2 S-Wave Model

7. ANALYSIS

The Vs_{100} values from the 2 soundings are in the range of 631.6 – 630.1ft/s.

8. LIMITATIONS OF THE GEOPHYSICAL METHOD

Global Geophysics' services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions and are subject to the time limits, financial and physical constraints applicable to the services. MAM is a remote sensing geophysical method that may not detect all subsurface conditions due to the limitations of the methods, soil conditions, size of the features, and their depths.

Sincerely,

Global Geophysics, LLC.

Alex Kover

Staff Geophysicist

John Liu, Ph.D., R.G.
Principal Geophysicist

9. APPENDIX

9.1 REFERENCES

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RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes:
1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered:	Units of material distinguished by color and/or composition from material units above and below	Fissured:	Breaks along defined planes
Laminated:	Layers of soil typically 0.05 to 1mm thick, max. 1 cm	Slickensided:	Fracture planes that are polished or glossy
Lens:	Layer of soil that pinches out laterally	Blocky:	Angular soil lumps that resist breakdown
Interlayered:	Alternating layers of differing soil material	Disrupted:	Soil that is broken and mixed
Pocket:	Erratic, discontinuous deposit of limited extent	Scattered:	Less than one per foot
Homogeneous:	Soil with uniform color and composition throughout	Numerous:	More than one per foot
		BCN:	Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

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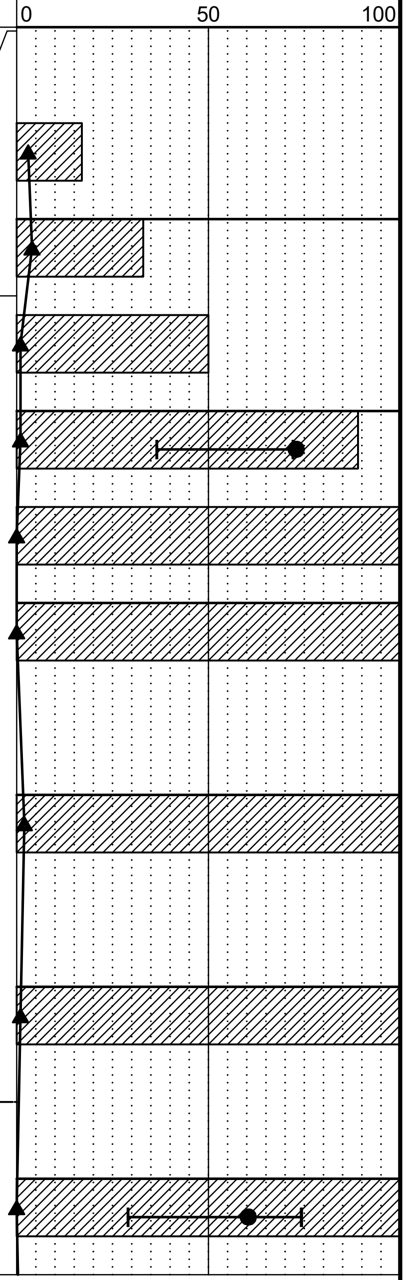
Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	Proposed Improvements	Surface Elevation:	22.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Asphalt 2 inches.
						Loose, brown, silty, fine to coarse SAND: moist, some gravel and wood debris, non-plastic, mixed. (Fill).
	S-1		3 2 1			
5	S-2		2 3 1			Wood and metal debris, slight oily sheen.
	S-3		0 0 1			Very soft, green gray elastic SILT (MH): very moist, low to medium plastic, no dilatancy, some wood chunks and other debris at top, massive. (Lake Deposits).
10	S-4		0 0 1			Trace organic brown layers, minor sand and wood.
	S-5		0 0 0			Minor sand, massive.
15	S-6		0 0 0			Scattered wood fragments.
20	S-7		0 1 1			Low plastic, rapid dilatancy, trace fine sand, brown silt beds, wood and possible fine shell fragments.
25	S-8		0 0 1			Auger drilled to 25 feet, mud rotary 25 to 80 feet. Low to medium plastic, slow dilatancy, trace fine sane, laminated with brown silt laminae, minor shell fragments.
						Very soft, green gray, fat CLAY (CH) with silt: very moist, medium plastic, no dilatancy, occasional sand and shell fragments, occasional brown laminae. (Lake Deposits).
30	S-9		0 0 0			

N-Value ▲
PL Moisture LL
RQD Recovery



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/25/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

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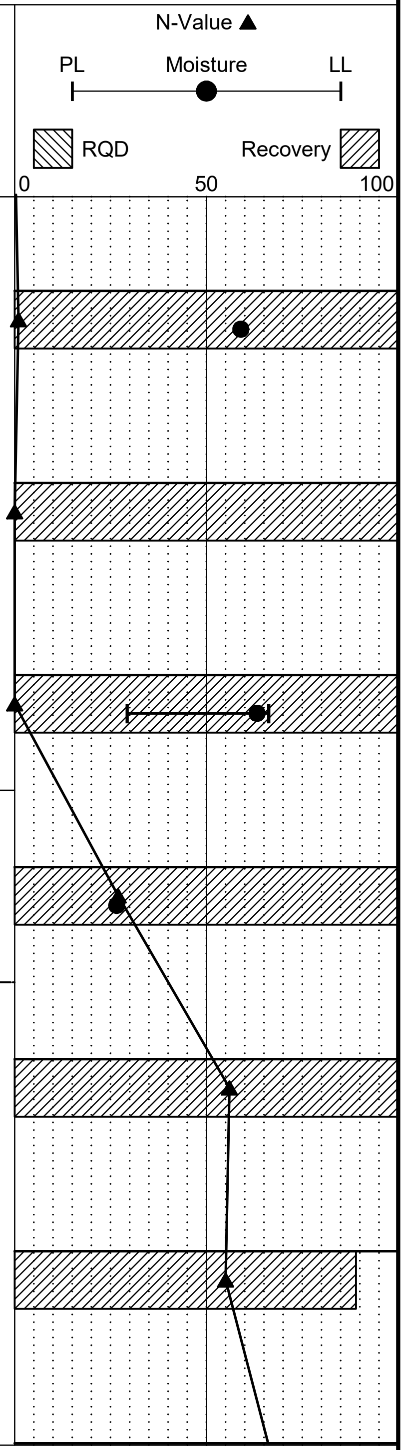
LOG OF TEST BORING PG-01-17

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	22.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Very soft, green gray, fat CLAY (CH) with silt: very moist, medium plastic, no dilatancy, occasional sand and shell fragments, occasional brown laminae. (Lake Deposits). *(Continued)*
35	S-10		0 0 1			Laminated, brown, peaty organics throughout woody fragments.
40	S-11		0 0 0			Occasional brown wood, silt interlaminae, laminated to massive.
45	S-12		0 0 0			Low to medium plastic, laminated, fat CLAY (CH).
						Medium dense, green gray, silty, fine SAND (SM): moist, non-plastic, rapid dilatancy, occasional interbeds of low plastic, silty clay, beds to 4 inches, laminated. (pre-Fraser Beds).
50	S-13		3 11 16	GS		
						Very dense, green gray, silty, fine SAND (SM): very moist to wet, trace non-plastic silt, homogeneous, laminated, with occasional interbeds of fine to coarse sand. (pre-Fraser Beds).
55	S-14		21 28 28			
						Gravelly bed.
60	S-15		15 23 32			Occasional silt interlaminae, laminated with moderately sharp contacts.
65						



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/25/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

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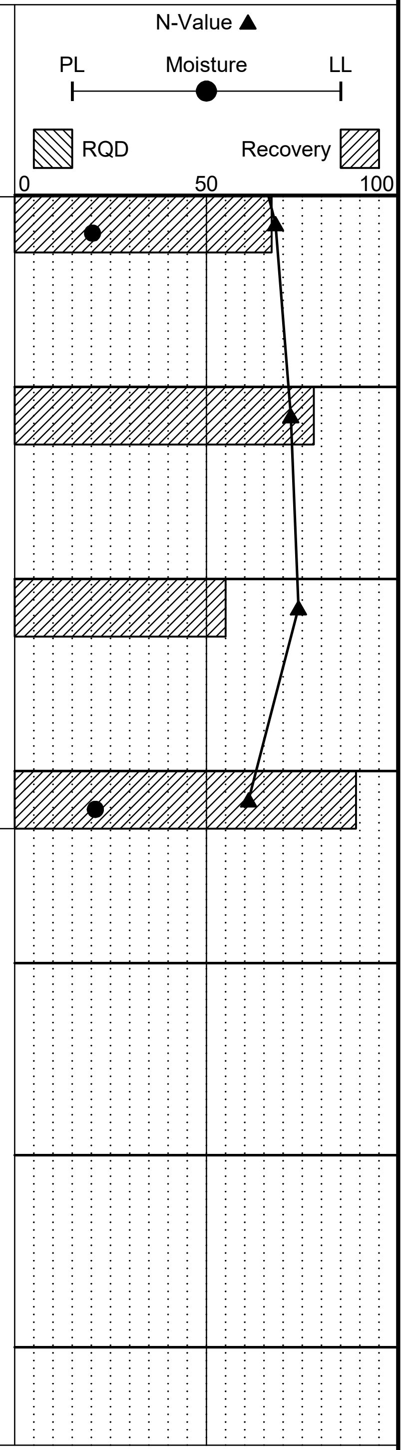
LOG OF TEST BORING PG-01-17

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	22.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
65	S-16		13 29 39	GS		Very dense, green gray, silty, fine SAND (SM): very moist to wet, trace non-plastic silt, homogeneous, laminated, with occasional interbeds of fine to coarse sand. (pre-Fraser Beds). *(Continued)* Fine SAND bed, trace to some silt, laminated.
70	S-17		15 32 40			Fine to coarse SAND, trace silt, homogeneous, indistinctly laminated.
75	S-18		7 26 48			Fine to medium SAND.
80	S-19		16 28 33	GS		Silty, fine SAND (SM), occasional gravel, trace silt.
						Bottom of Boring.
85						
90						
95						



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/25/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

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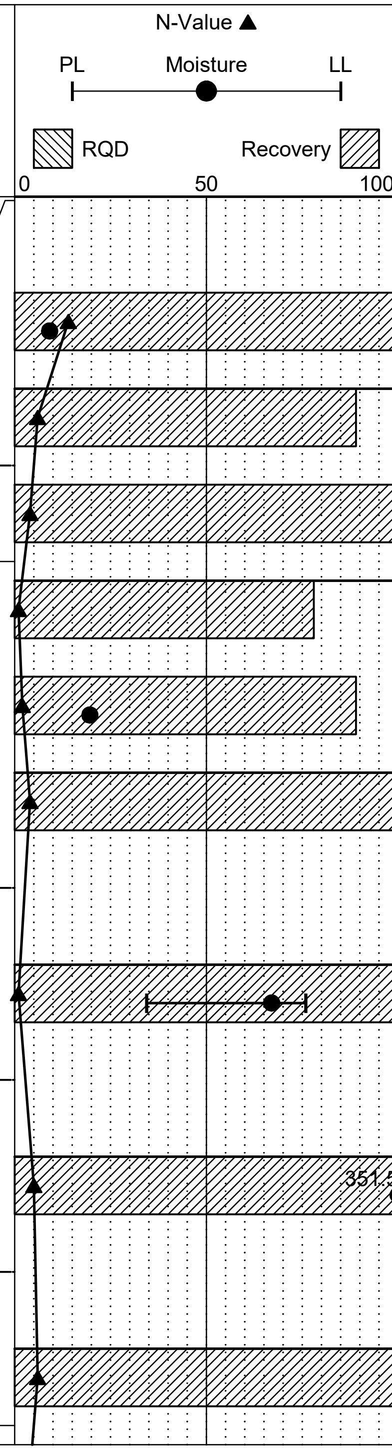
LOG OF TEST BORING PG-01-17

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	24.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Asphalt 2 inches.
						Medium dense to loose, green gray, silty, fine SAND with gravel (SM): moist, slightly plastic fines, lumps of hard, brown laminated silt with rusty fractures. (Fill).
	S-1		4 7 7	GS		
5	S-2		2 2 4			Becoming loose, fine to medium SAND with silty beds, non-plastic, brick fragments, discolored pockets.
	S-3		1 1 3			Loose, green gray, silty, fine SAND: wet, occasional gravel, non-plastic, rapid dilatancy, mixed lumps of silty clay. (Fill).
10	S-4		1 1 0			Loose, green gray, silty, fine SAND (SM): wet, non-plastic with rapid dilatancy, medium stiff, low plastic clayey silt at top, homogeneous, some wood fibers, brown pocket, massive. (Lake Deposits).
	S-5		0 1 1	GS		Occasional organic pockets, silt beds.
15	S-6		1 2 2			Silty, fine SAND grading to fine sandy SILT, non-plastic with rapid dilatancy, 3 inch medium stiff silty clay interbed with sharp,rusty contacts.
						Soft, green gray, fat CLAY with silt: very moist, medium plastic, no dilatancy, homogeneous, fine, angular, brown peaty organic clasts throughout, laminated. (Lake Deposits).
20	S-7		0 0 1			
						Soft, brown, fibrous PEAT: wet, with woody fragments, laminated. (Lake Deposits).
25	S-8		1 2 3			
						Loose and soft, green gray, interbedded CLAY with silt and silty, fine SAND: wet, low to medium plastic and non-plastic, no dilatancy and rapid dilatancy, laminated and fine bedded, 4 inch beds. (Lake Deposits).
30	S-9		0 3 3			



Completion Depth:	81.5ft	Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.
Date Borehole Started:	9/25/17	
Date Borehole Completed:	9/26/17	
Logged By:	S. Evans	
Drilling Company:	Holocene Drilling	

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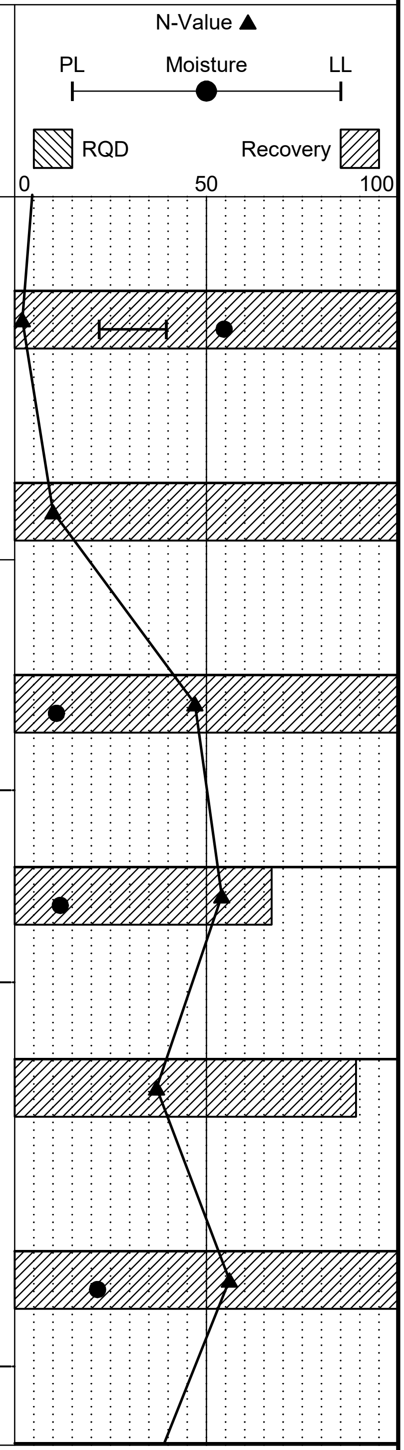
LOG OF TEST BORING PG-02-17

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	24.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Soft, green gray, lean CLAY (CL) with silt: wet, low to medium plastic, no dilatancy, some fine sand, laminated. (Lake Deposits). *(Continued)*
35	S-10		0 1 1			
40	S-11		3 2 8			Grading to CLAY with fine sand, medium dense, laminated to massive.
						Dense, green gray, silty, fine SAND: very moist, non-plastic fines, homogeneous, layer of hard, till-like clay at top, occasional gravel, massive. (pre-Fraser Beds).
45	S-12		3 20 27	GS		
						Very dense, green gray, silty, fine to coarse SAND (SM) with gravel: very moist, non-plastic fines with rapid dilatancy, fine bedded (4 inch beds) with finer / coarser beds, one organic lens, indistinctly laminated. (pre-Fraser Beds).
50	S-13		24 30 24	GS		
						Dene to very dense, green gray, silty, fine SAND (SM): wet, non-plastic fines with rapid dilatancy, occasional organics, massive to indistinctly laminated. (pre-Fraser Beds).
55	S-14		17 19 18			
60	S-15		17 24 32	GS		
						Dense, green gray, fine to medium SAND with silt: wet, trace coarse sand, occasional gravel, non-plastic fines with rapid dilatancy, indistinctly laminated. (pre-Fraser Beds).
65						



Completion Depth:	81.5ft
Date Borehole Started:	9/25/17
Date Borehole Completed:	9/26/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

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LOG OF TEST BORING PG-02-17

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	24.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION	N-Value ▲ (0–50–100); PL — Moisture ● — LL; RQD / Recovery
65	S-16	X	16 17 19			Dense, green gray, fine to medium SAND with silt: wet, trace coarse sand, occasional gravel, non-plastic fines with rapid dilatancy, indistinctly laminated. (pre-Fraser Beds). *(Continued)*	
						Very dense, green gray, silty, fine SAND: wet, non-plastic with rapid dilatancy, occasional gravel, homogeneous, massive to indistinctly laminated. (pre-Fraser Beds).	
70	S-17	X	18 26 32				
75	S-18	X	20 26 30			Some beds grading to sandy SILT.	
						Very dense, green gray, fine sandy SILT grading to silty, fine to medium SAND: wet, non-plastic, rapid dilatancy, homogeneous, massive. (pre-Fraser Beds).	
80	S-19	X	21 29 33				
						Bottom of Boring.	
85							
90							
95							

Completion Depth: 81.5ft
Date Borehole Started: 9/25/17
Date Borehole Completed: 9/26/17
Logged By: S. Evans
Drilling Company: Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

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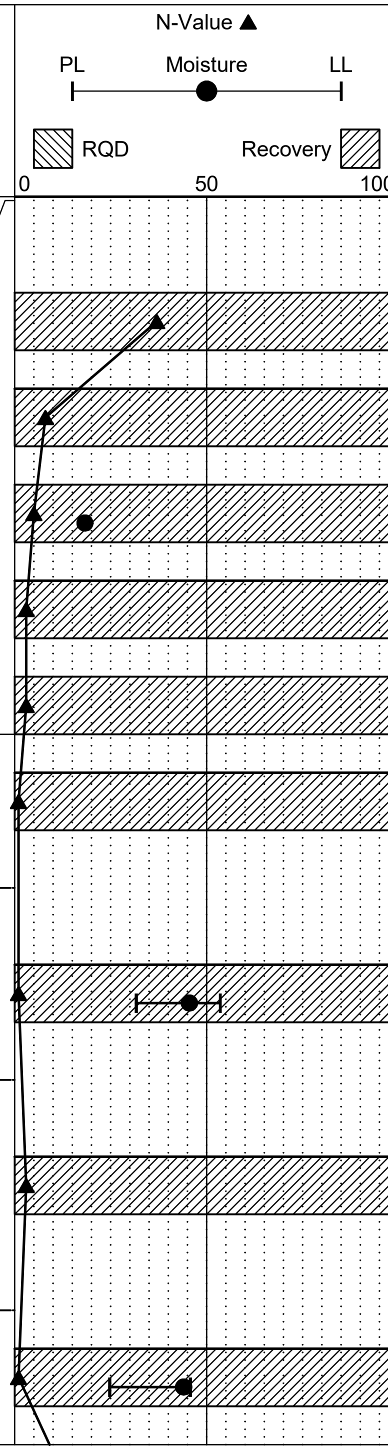
LOG OF TEST BORING PG-02-17

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	25.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Asphalt, 2 inches.
						Dense to loose, brown to gray, fine to coarse SAND with silt (SP-SM): moist, poorly graded, layered, non-plastic fines, trace gravel, homogeneous, massive. (Fill).
	S-1		17 18 19			
5	S-2		5 4 4			Grading to fine to medium SAND with silt.
	S-3		3 3 2	GS		Grading to wet, fine to coarse SAND with silt (SP-SM).
10	S-4		1 1 2			Homogeneous, massive to indistinctly laminated.
	S-5		1 1 2			Trace fine gravel, massive.
						Very loose, green gray, fine to medium SAND with silt: wet, clayey silt interbeds with fine organics, fine bedded and laminated. (Lake Deposits).
15	S-6		1 0 1			
						Very soft, green gray, elastic SILT (MH): very moist, low plastic, no dilatancy, fine organic lenses and wood fibers, laminated. (Lake Deposits).
20	S-7		0 1 0			
						Soft, brown, fibrous PEAT: wet, homogeneous, laminated woody fibers throughout. (Lake Deposits).
25	S-8		1 1 2			
						Very soft, green gray, lean CLAY (CL) with slit: wet, low to medium plastic, no dilatancy, occasional organics, occasional silt or fine sand laminae, laminated. (Lake Deposits).
30	S-9		1 0 1			



Completion Depth:	80.7ft
Date Borehole Started:	9/26/17
Date Borehole Completed:	9/26/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

PanGEO INCORPORATED

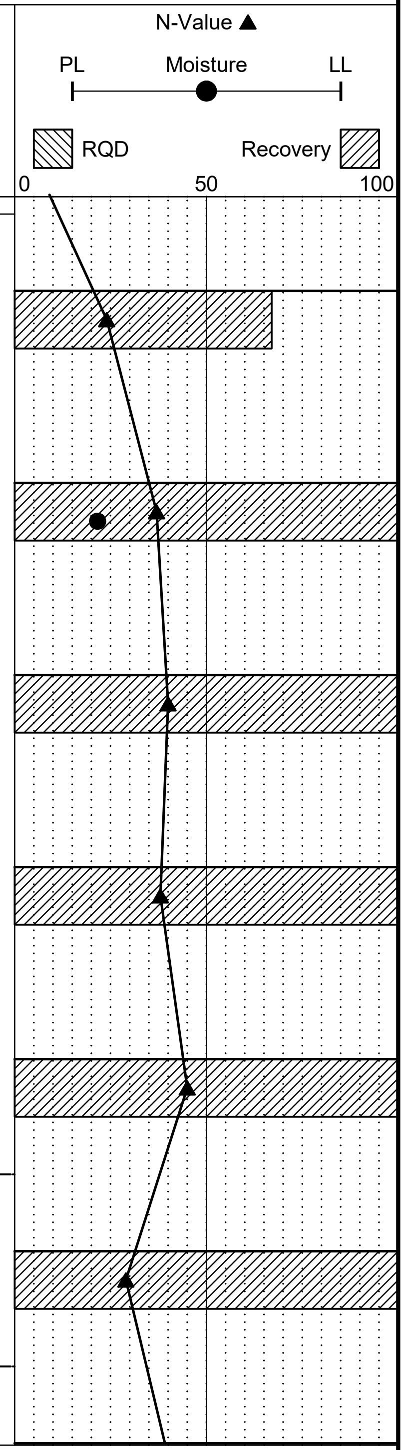
LOG OF TEST BORING PG-03-17

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	25.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
						Medium dense to dense, green gray, silty, fine SAND: wet, non-plastic with rapid dilatancy, homogeneous, massive to indistinctly laminated. (pre-Fraser Beds).
35	S-10		5 11 13			
40	S-11		14 18 19	GS		Grading to dense, fine SAND with silt (SP-SM), poorly graded, massive.
45	S-12		10 18 22			Grading to silt, fine SAND.
50	S-13		12 17 21			Silty, fine SAND, massive.
55	S-14		17 20 25			
						Medium dense and very stiff, green gray, interbedded, silty, fine SAND and silty CLAY: wet, non-plastic and low to medium plastic, rapid dilatancy and no dilatancy, fine bedded and laminated, beds 1 to 2 inches, sharp contacts. (pre-Fraser Beds).
60	S-15		14 11 18			
						Dense, green gray, silty, fine SAND (SM): wet, non-plastic fines with rapid dilatancy, homogeneous, massive to indistinctly laminated. (pre-Fraser Beds).
65						



Completion Depth:	80.7ft
Date Borehole Started:	9/26/17
Date Borehole Completed:	9/26/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

PanGEO INCORPORATED

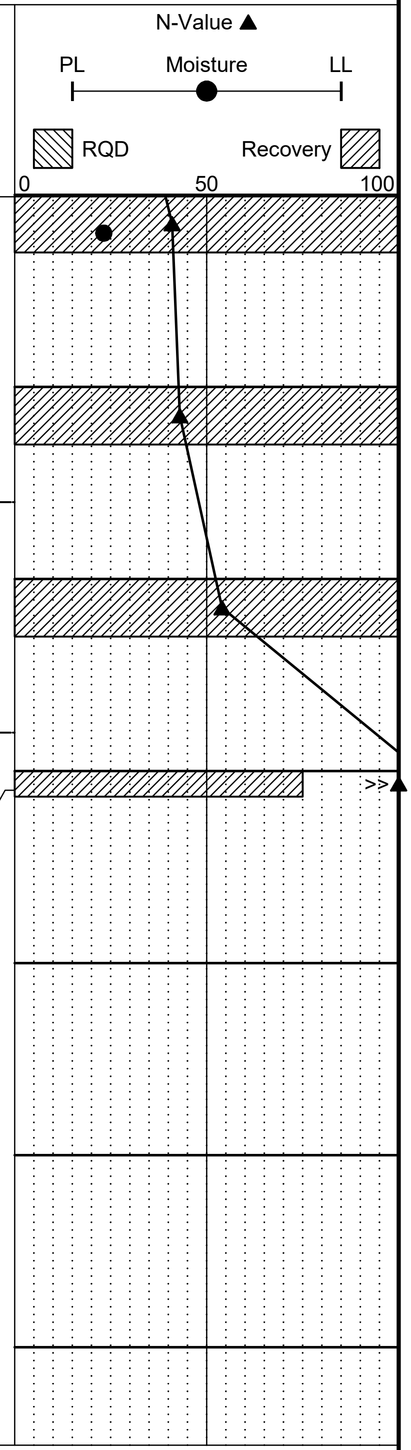
LOG OF TEST BORING PG-03-17

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Improvements	Surface Elevation:	25.0ft
Job Number:	14-105.180	Top of Casing Elev.:	
Location:	Fisherman's Terminal, 1700 W. Emerson, Seattle, WA	Drilling Method:	HSA/Mud
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
65	S-16		18 22 19	GS		Dense, green gray, silty, fine SAND (SM): wet, non-plastic fines with rapid dilatancy, homogeneous, massive to indistinctly laminated. (pre-Fraser Beds). *(Continued)*
70	S-17		16 22 21			Grading to very silty, fine SAND to sandy SILT, rare organic bits in tip, occasional gravel. (pre-Fraser Beds).
						Very dense, green gray, fine to medium sandy SILT: wet, non-plastic to slightly plastic, rapid and slow dilatancy beds, one wood chip, occasional gravel, massive. (pre-Fraser Beds).
75	S-18		8 20 34			
						Very dense, green gray, sandy, fine to coarse GRAVEL: wet, minor silt clay matrix, sub-rounded and blacky basaltic gravel, massive. (pre-Fraser Beds).
80	S-19		50 50/2			Bottom of Boring.
85						
90						
95						



Completion Depth:	80.7ft
Date Borehole Started:	9/26/17
Date Borehole Completed:	9/26/17
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Groundwater estimated from sample moisture and observed free water. Elevation interpreted from City of Seattle GIS contours.

PanGEO INCORPORATED

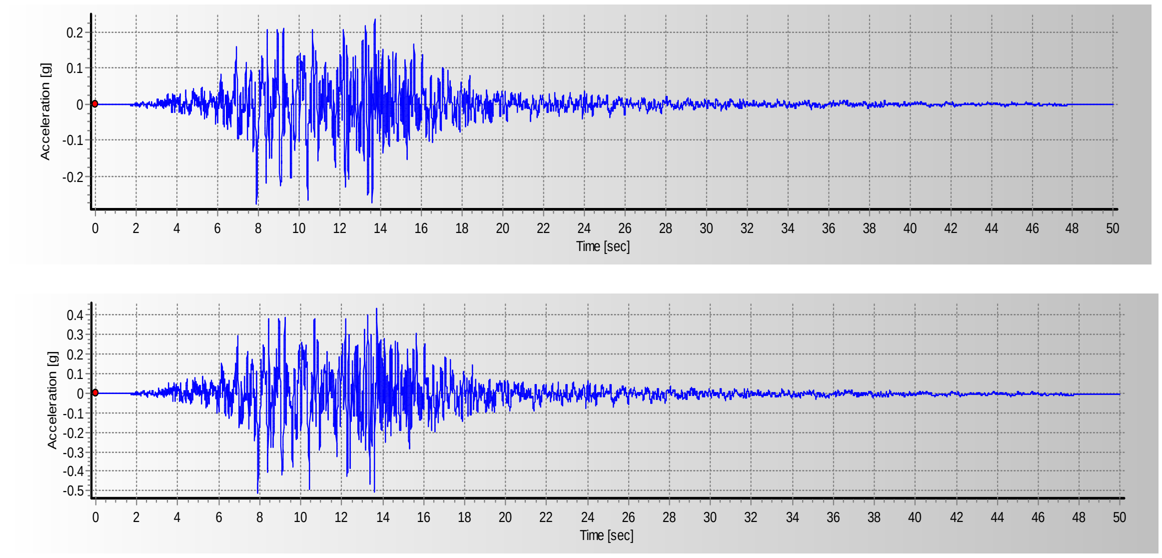
LOG OF TEST BORING PG-03-17

Figure A-4

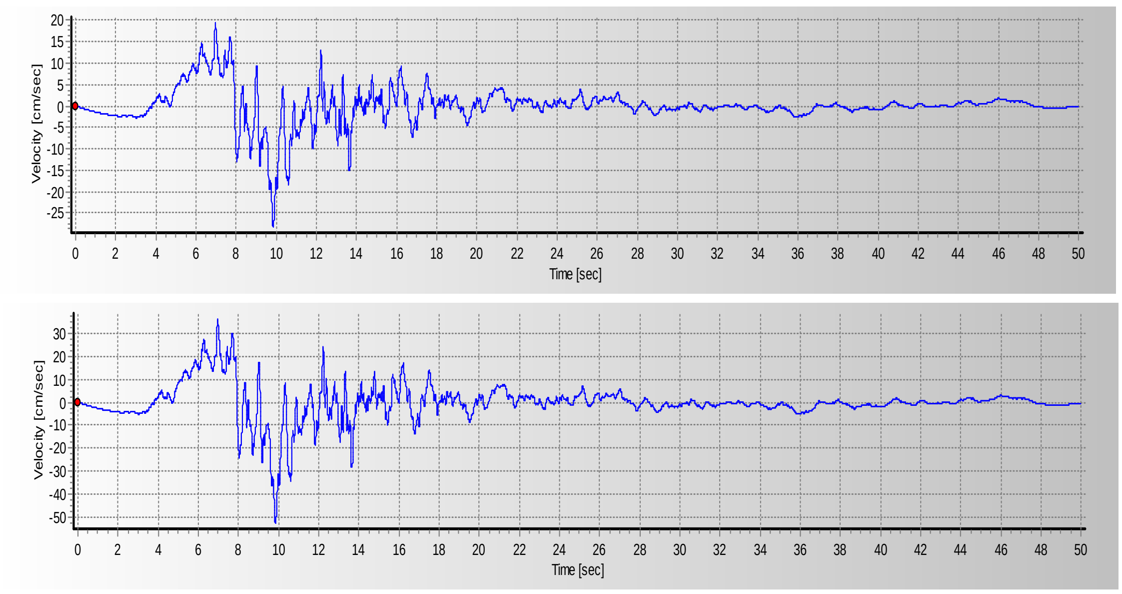
The stratification lines represent approximate boundaries. The transition may be gradual.

ATTACHMENT B

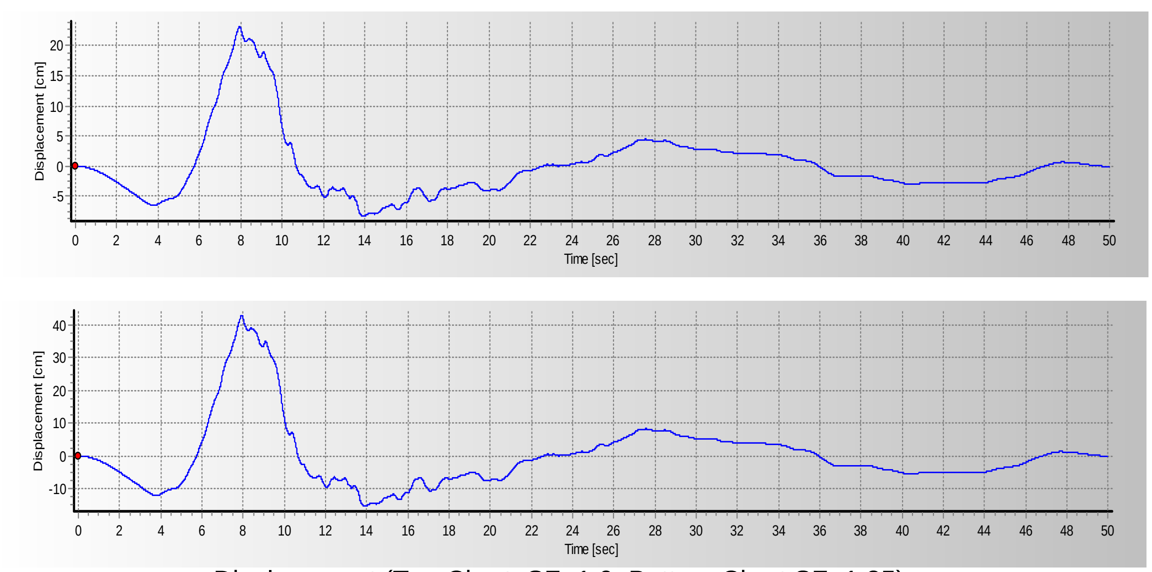
ACCELERATION, VELOCITY, AND DISPLACEMENT TIME SERIES



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.85)

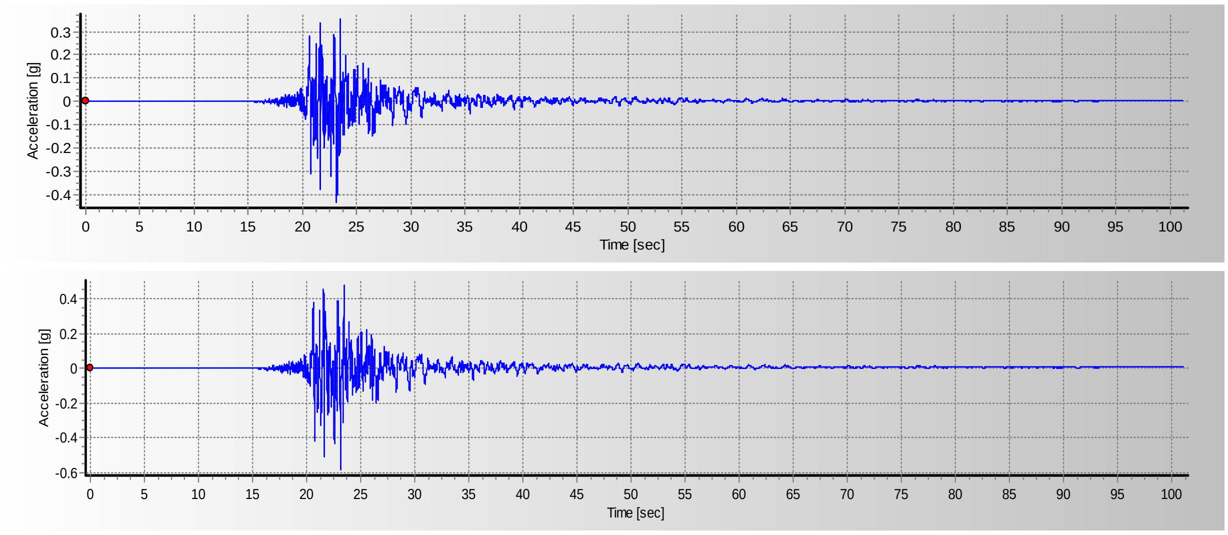


Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.85)

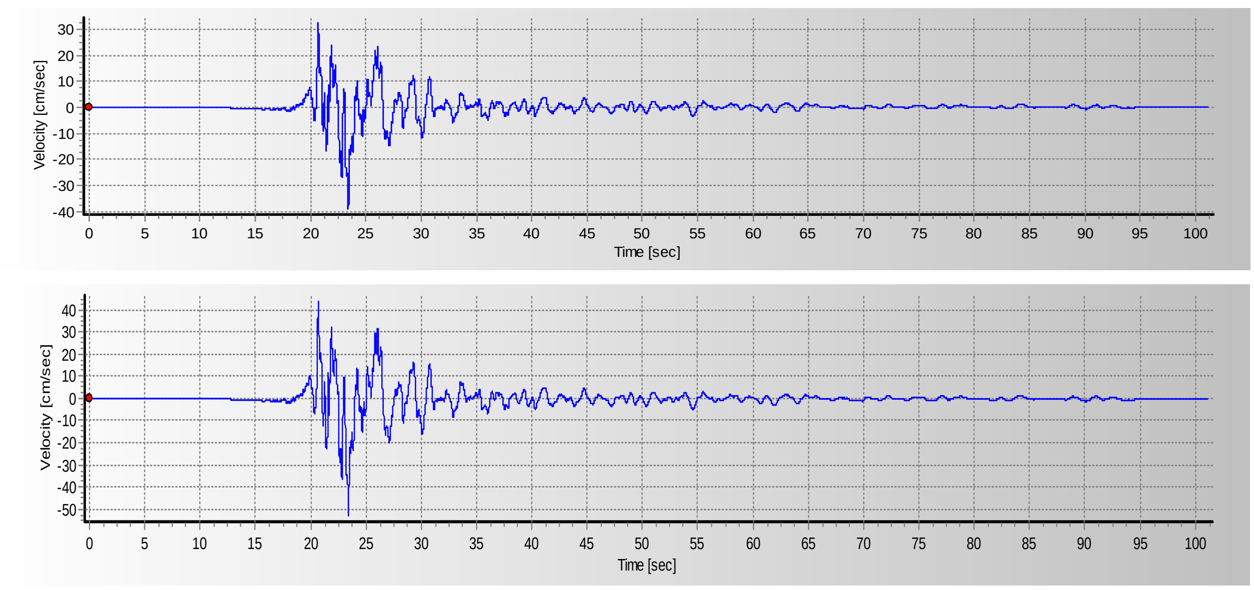


Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.85)

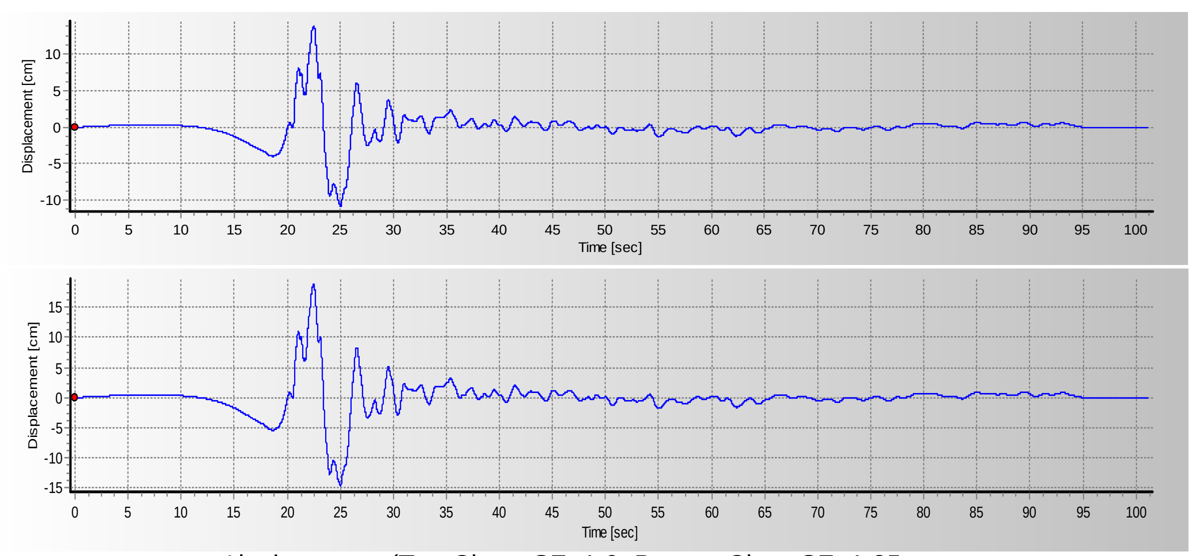
PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**Acceleration, Velocity, and Displacement Time Series Loma Prieta, CA, USA, 1989 (Sta: Santa Teresa Hills) Component: SJTE225**	
		Project No. 19-340	Figure No. **B-1**



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.35)

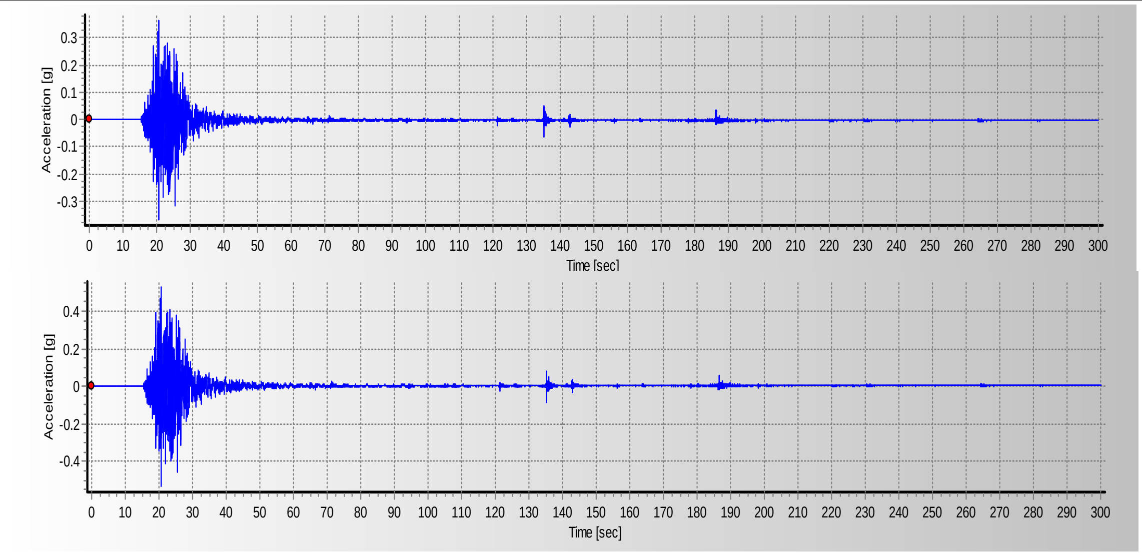


Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.35)

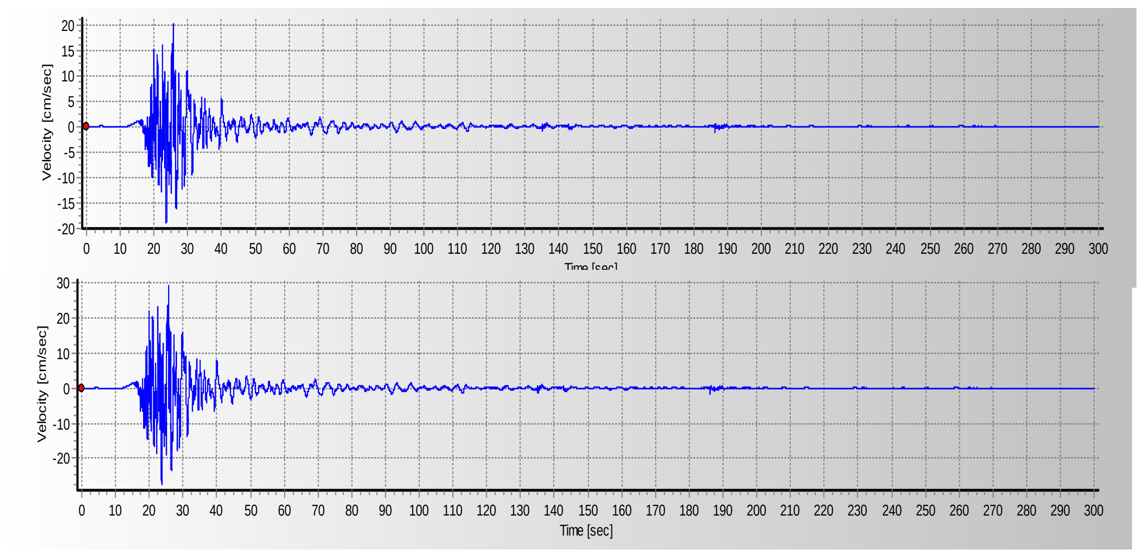


Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.35

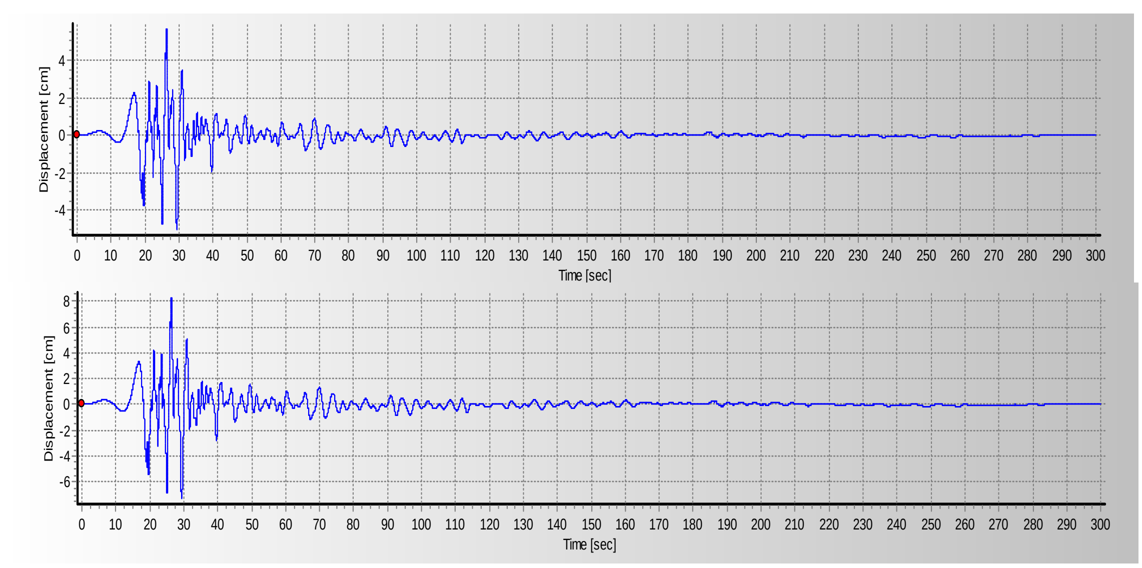
PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**Acceleration, Velocity, and Displacement Time Series San Simeon, CA, USA 2003 (Sta: Templeton Hospital) Component: 90**	
		Project No. 19-340	Figure No. **B-2**



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.45)

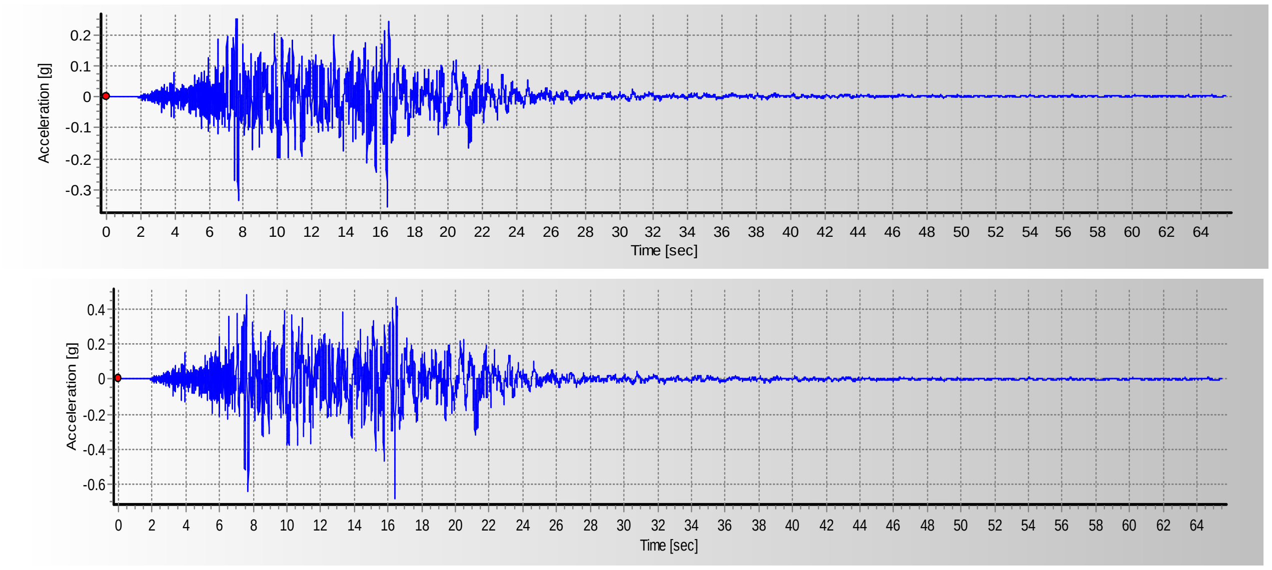


Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.45)

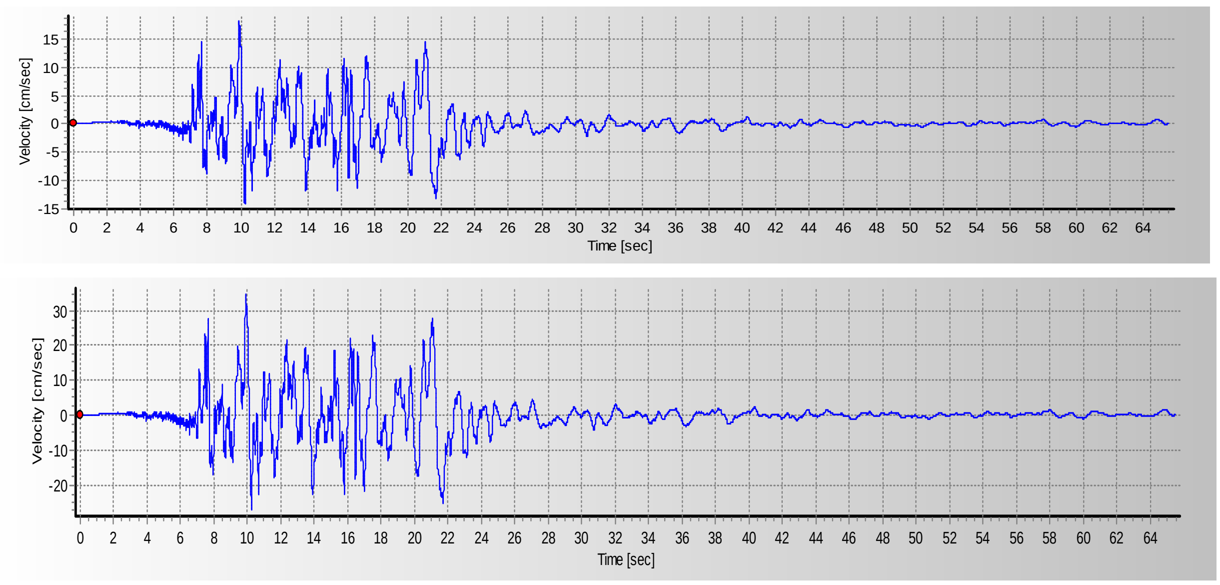


Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.45)

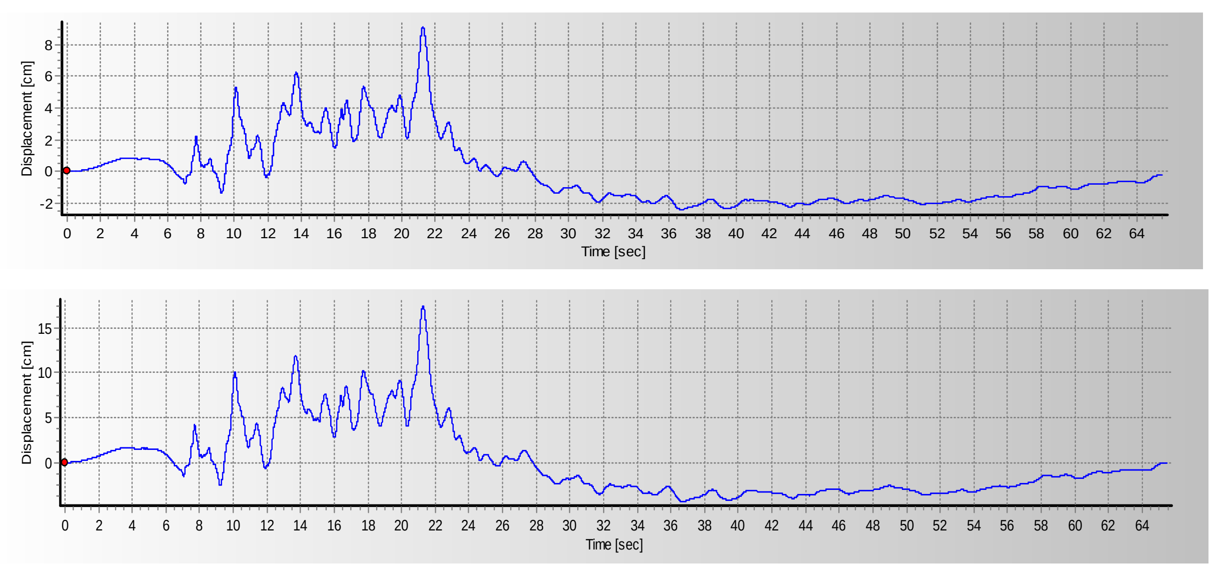
PanGEO INCORPORATED	Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA	**Acceleration, Velocity, and Displacement Time Series Iwate, Japan, 2008 (Sta: ATK023) Component: AKT023-NS**	
		Project No. 19-340	Figure No. **B-3**



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.9)

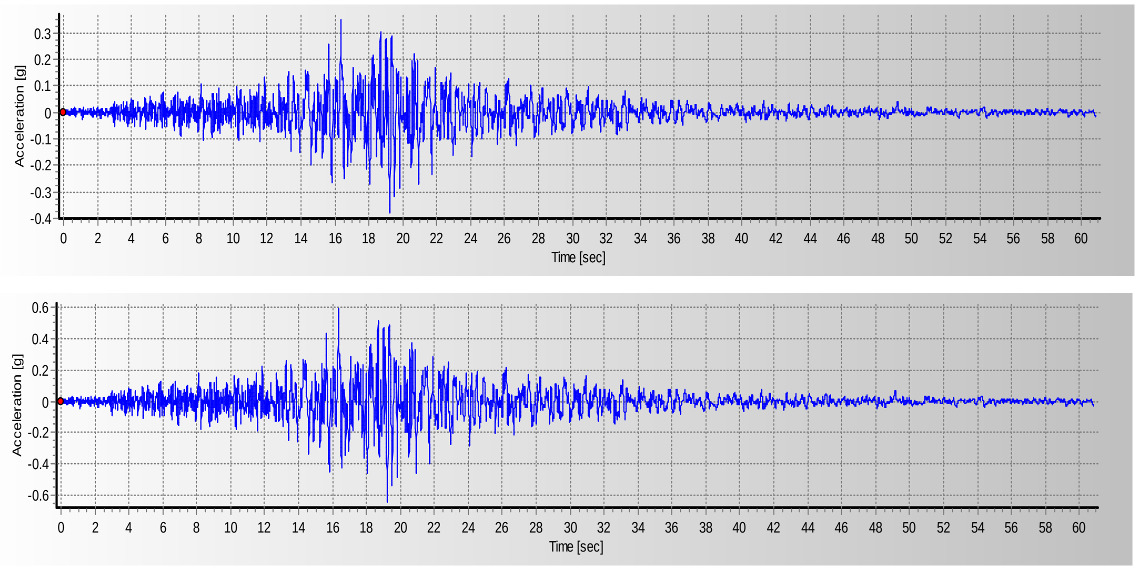


Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.9)

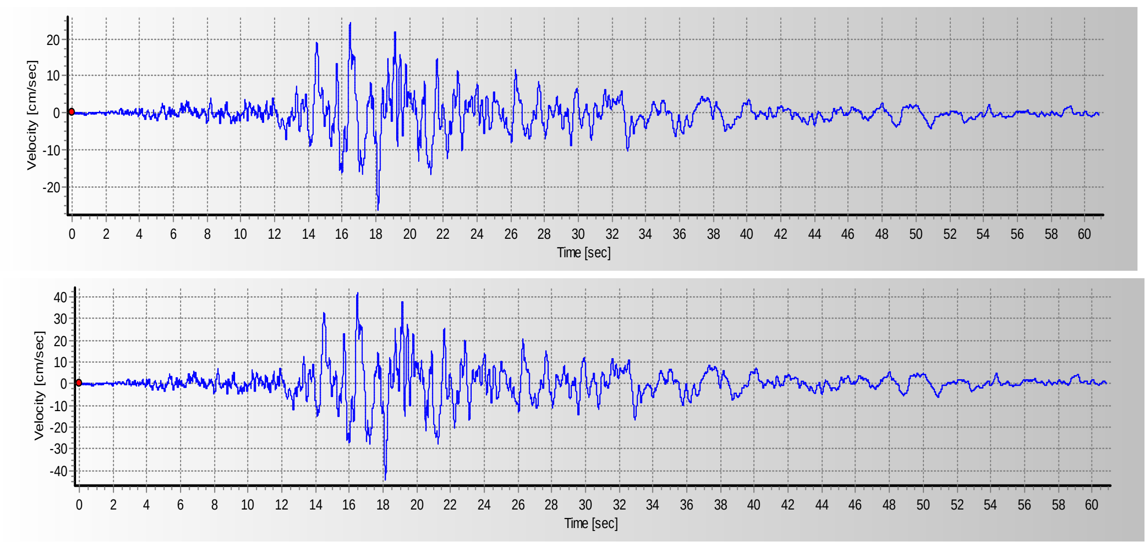


Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.9)

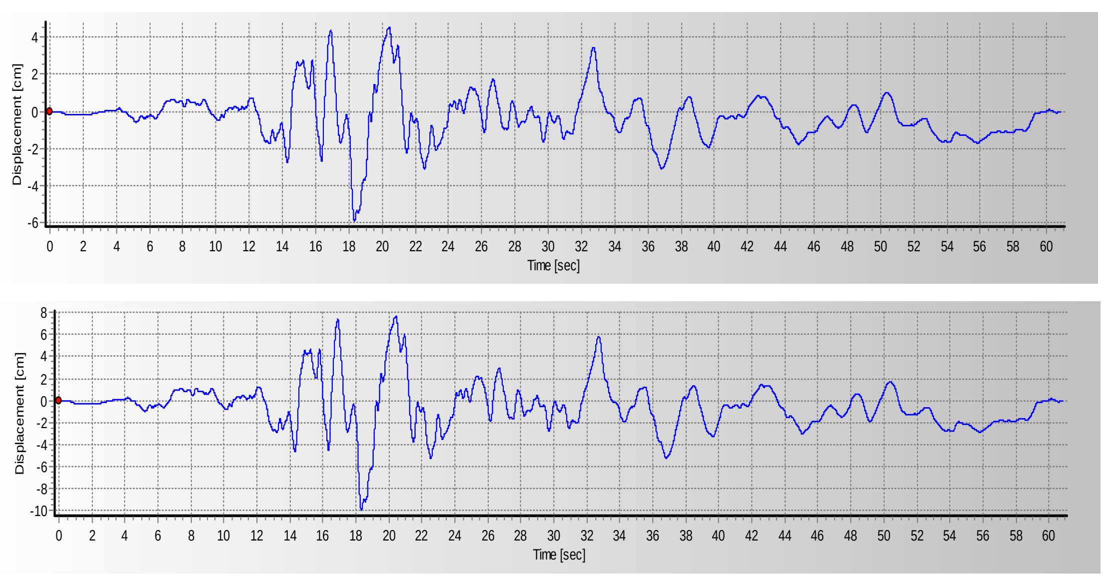
PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**Acceleration, Velocity, and Displacement Time Series Michoacán, Mexico, 1997 (Sta: Caleta De Campos) Component: S00E**	
		Project No. 19-340	Figure No. **B-4**



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.7)

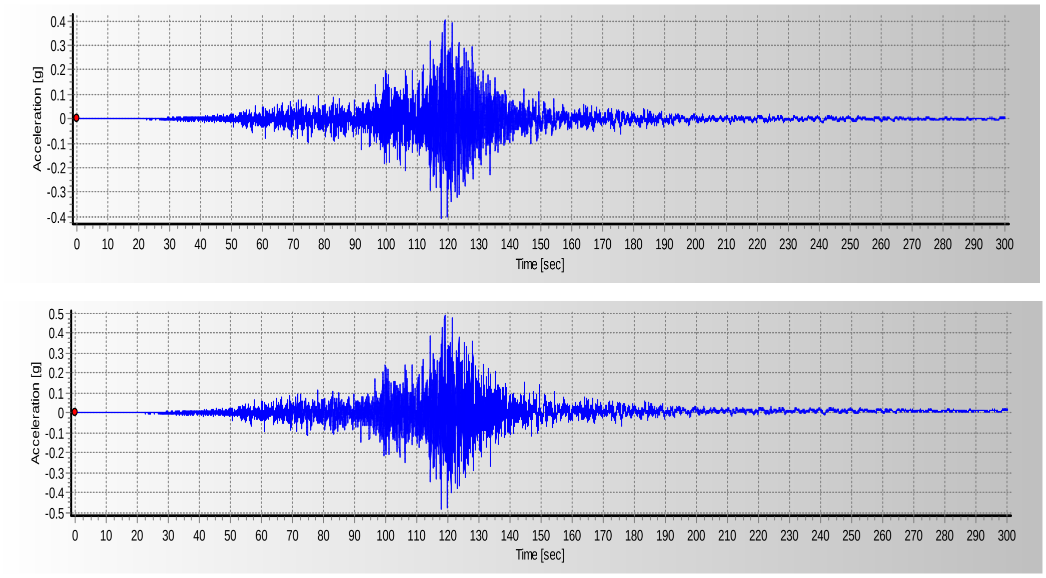


Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.7)

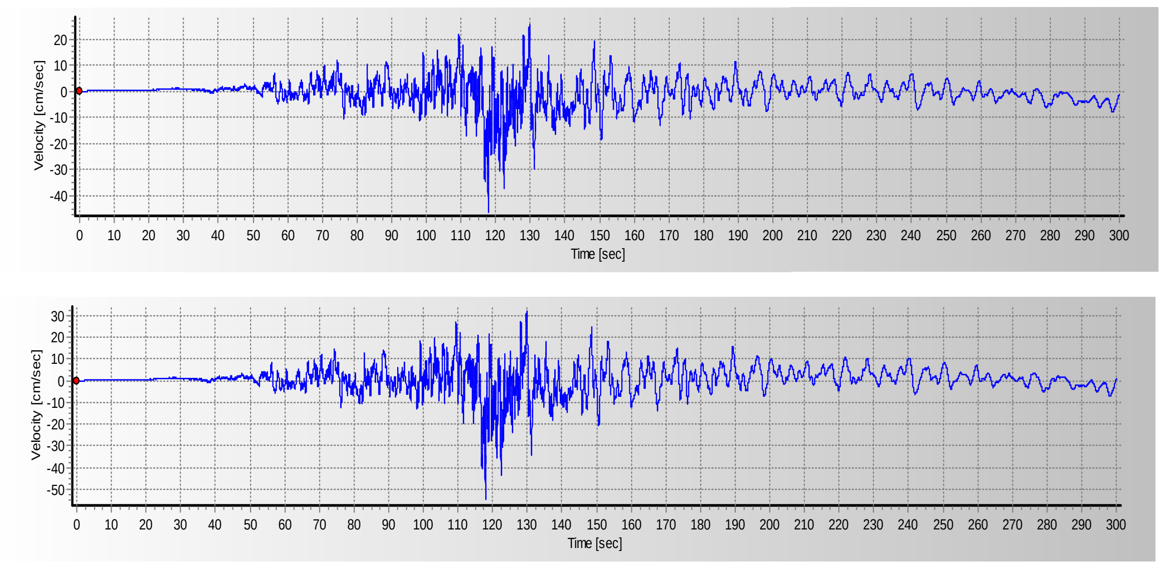


Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.7)

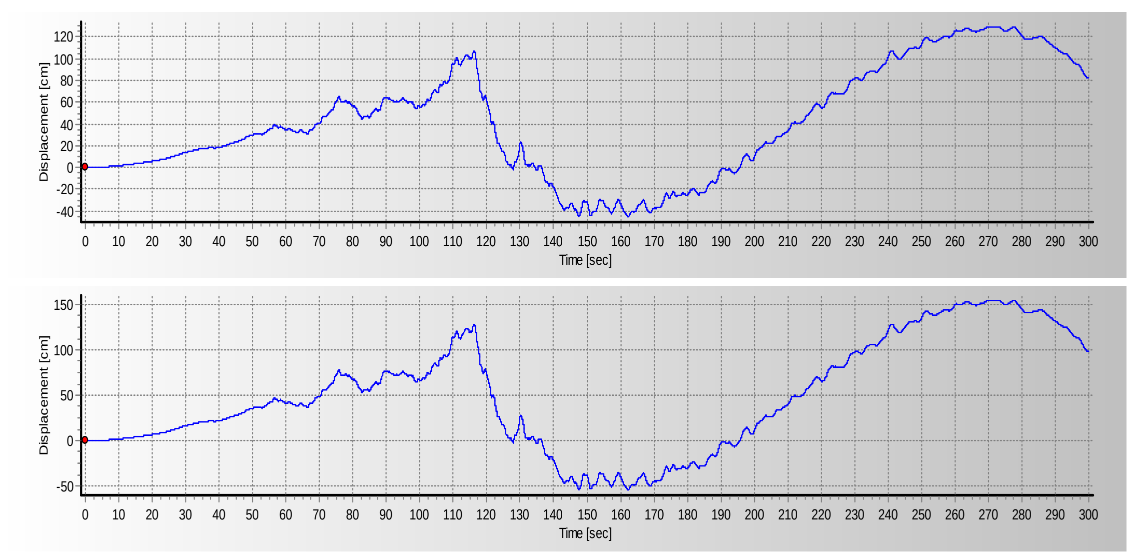
PanGEO INCORPORATED	**Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA**	**Acceleration, Velocity, and Displacement Time Series El Salvador, Guatemala, 2001 (Sta: Observatorio) Component: 090**	
		Project No. 19-340	Figure No. **B-5**



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.2)



Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.2)



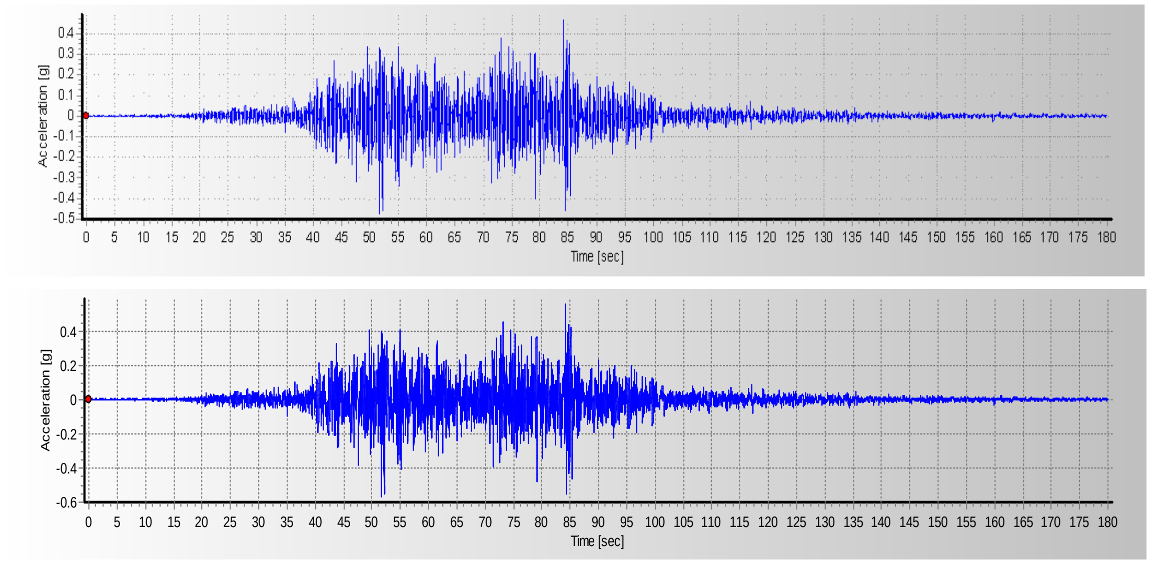
Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.2)

PanGEO INCORPORATED

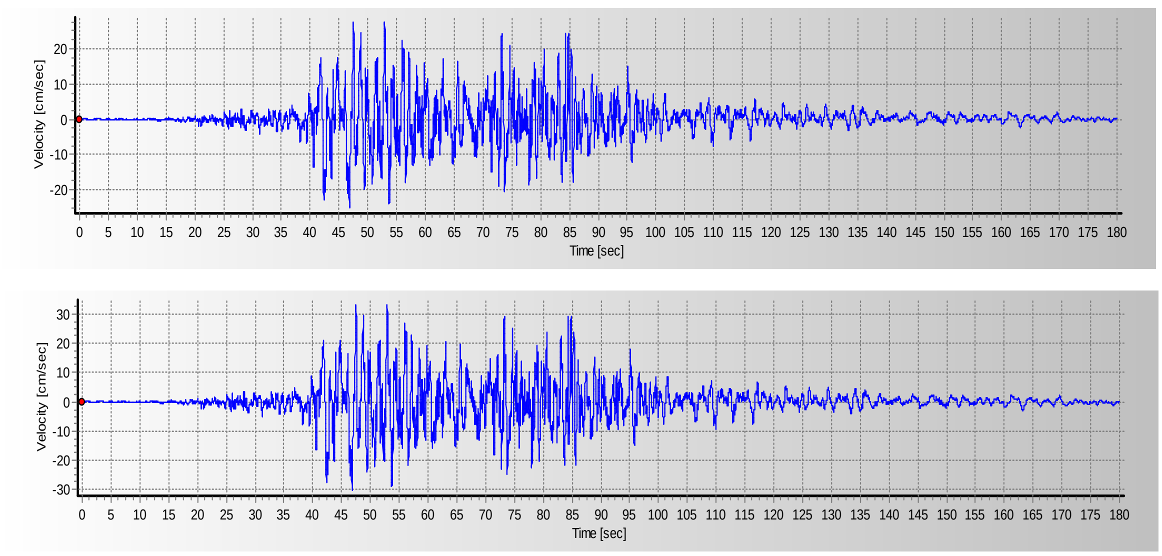
Site-Specific Seismic Ground Response Analysis Fishermen's Terminal Redevelopment Seattle, WA

Acceleration, Velocity, and Displacement Time Series Tonoku, Japan, 2011 (Sta: Ujiie) Component: TCGH12-EW2

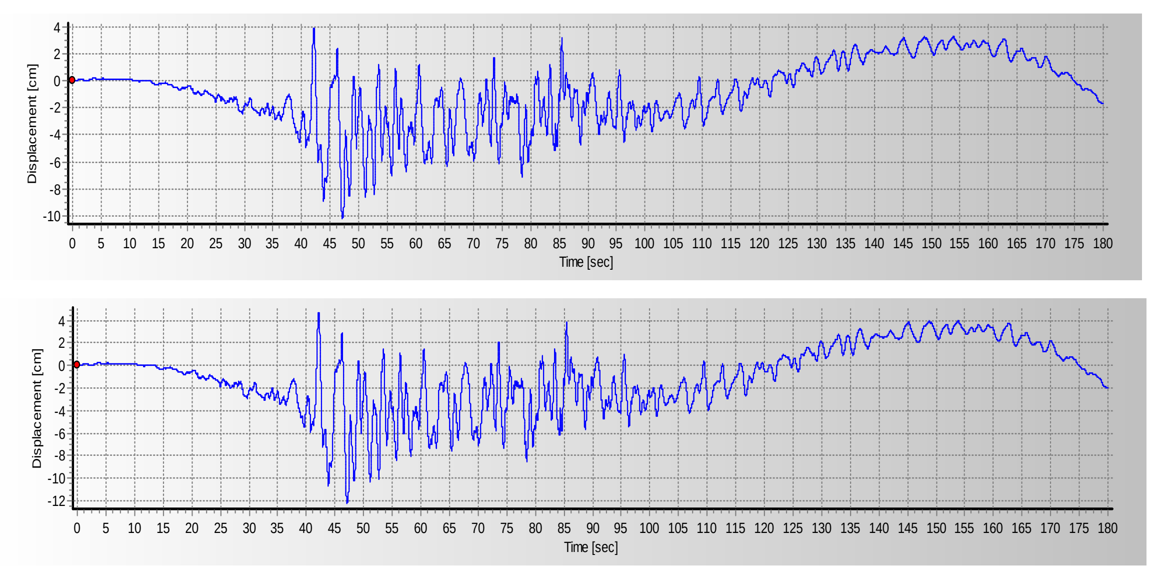
Project No.	Figure No.
19-340	**B-6**



Acceleration (Top Chart: SF=1.0, Bottom Chart SF=1.2)



Velocity (Top Chart: SF=1.0, Bottom Chart SF=1.2)



Displacement (Top Chart: SF=1.0, Bottom Chart SF=1.2)

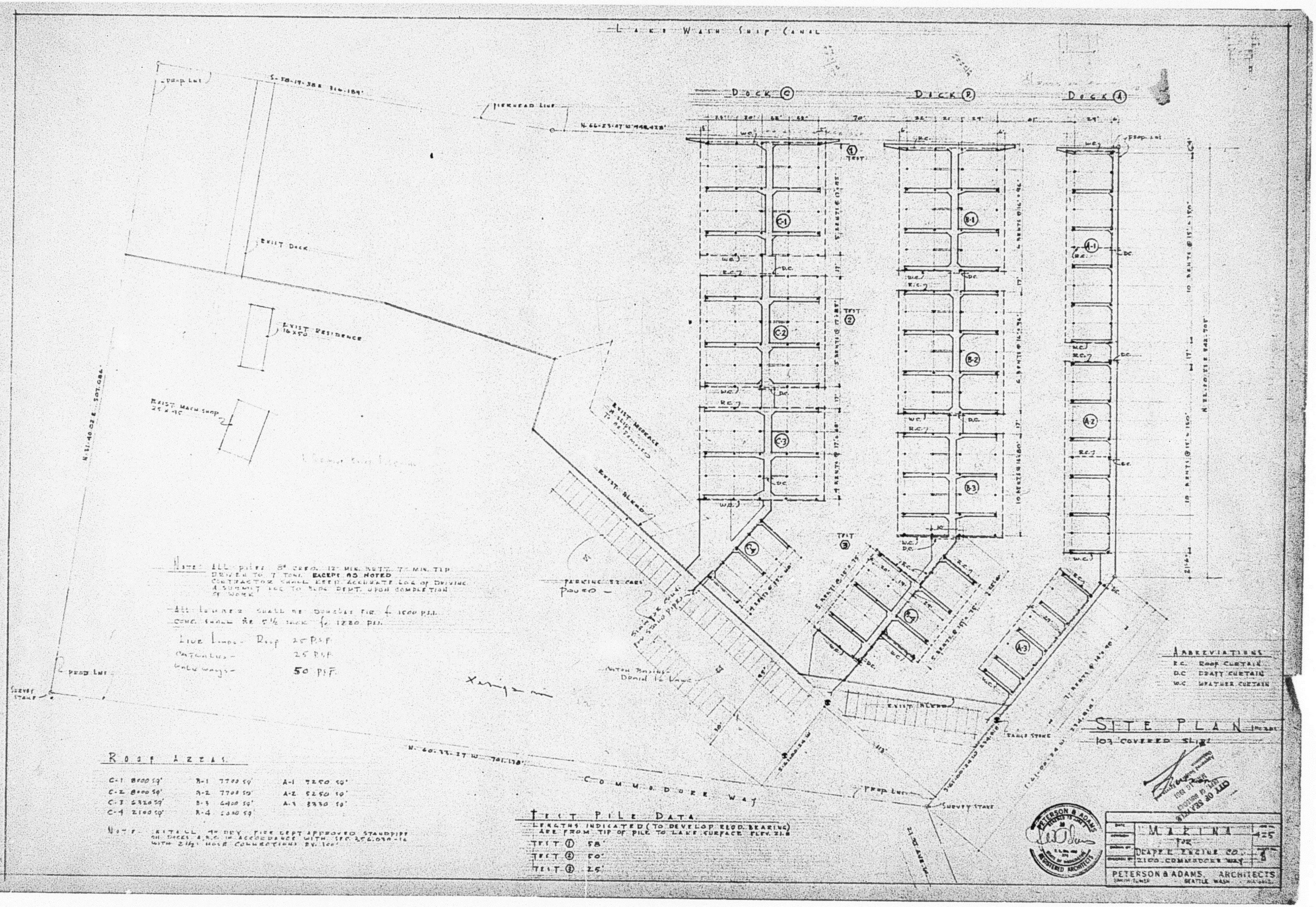
PanGEO INCORPORATED

Site-Specific Seismic Ground Response Analysis
Fishermen's Terminal Redevelopment
Seattle, WA

Acceleration, Velocity, and Displacement Time Series
Offshore near Biobio, Chile 2010 (Sta: Curico)
Component: CUR-NS

Project No.	Figure No.
19-340	**B-7**

Appendix B. Test Pile Information



LAKE WASH. SHIP CANAL
DOCK (C)
DOCK (B)
DOCK (A)
PIERHEAD LINE
PROP. LINE
EXIST. DOCK
EXIST. RESIDENCE 16x50
EXIST. MACH SHOP
EXIST. BLKHD.
PARKING
PAVED
COMMODORE WAY
SURVEY STAKE
TEST (1)
TEST (2)
TEST (3)
C-1
C-2
C-3
B-1
B-2
B-3
A-1
A-2
A-3
NOTE: ALL PILES 8" CREO. 12" MIN. BUTT 7" MIN. TIP
DRIVEN TO 7 TONS EXCEPT AS NOTED
CONTRACTOR SHALL KEEP ACCURATE LOG OF DRIVING
& SUBMIT LOG TO BLDG. DEPT. UPON COMPLETION
OF WORK
ALL LUMBER SHALL BE DOUGLAS FIR f 1500 P.S.I.
CONC. SHALL BE 5½ SACK fc 1220 P.S.I.
LIVE LOADS - ROOF 25 P.S.F.
CATWALKS - 25 P.S.F.
WALKWAYS - 50 P.S.F.
ROOF AREAS
C-1 8000 SQ'
C-2 8000 SQ'
C-3 6320 SQ'
C-4 2100 SQ'
B-1 7700 SQ'
B-2 7700 SQ'
B-3 6400 SQ'
B-4 2380 SQ'
A-1 7250 SQ'
A-2 5250 SQ'
A-3 3330 SQ'
NOTE: INSTALL 4" DRY FIRE DEPT APPROVED STANDPIPE ON DOCKS A, B, C IN ACCORDANCE WITH SEC. 256.030-16 WITH 2½" HOSE CONNECTIONS EV. 100'
TEST PILE DATA
LENGTHS INDICATED (TO DEVELOP REQD. BEARING) ARE FROM TIP OF PILE TO LAKE SURFACE ELEV. 21.8
TEST (1) 58'
TEST (2) 50'
TEST (3) 25'
ABBREVIATIONS
R.C. ROOF CURTAIN
D.C. DRAFT CURTAIN
W.C. WEATHER CURTAIN
SITE PLAN
103 COVERED SLIPS
PETERSON & ADAMS REGISTERED ARCHITECTS
CITY OF SEATTLE
MARINA
FOR
DRAPER ENGINE CO.
2100 COMMODORE WAY
PETERSON & ADAMS. ARCHITECTS
SEATTLE, WASH.

Appendix D. Concept Design Cost Estimate

Salmon Bay Marina
Docks A-C Roof Safety

Seattle, WA

30% Options 1+2 Cost Estimates

December 17, 2024
Revised March 18, 2025

Prepared for:

Jacobs Engineering Group Inc.
1100 112th Avenue NE
Suite 500
Bellevue, WA 98004-5118

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PROJECT MANAGEMENT SERVICES

520 Kirkland Way, Suite 301
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Master Estimate Summary

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fax: (425) 828-0700
www.prodims.com

Name:	Salmon Bay Marina - Docks A-C Roof Safety
Second Name:	Master Summary
Location:	Seattle, WA
Design Phase:	30% Cost Estimate
Date of Estimate:	December 17, 2024
Date of Revision:	March 18, 2025
Month of Cost Basis:	December, 2024

Master Estimate Summary

Summary by Option	Total Construction Cost
Option 1 Roof Replacement	
Option 1 Roof Replacement - Base Bid	$ 67,449,165
Option 1 Roof Replacement - ADA Dock Area - Alternative	$ 270,805
TOTAL ESTIMATED CONSTRUCTION COST of BASE Bid and Alternative - Option 1 Roof Replacement →	$ 67,719,970
Option 2 Roof Removal	
Option 2 Roof Removal - Base Bid	$ 10,656,004
Option 2 Roof Removal - ADA Dock Area - Alternative	$ 259,085
TOTAL ESTIMATED CONSTRUCTION COST of BASE Bid and Alternative - Option 2 Roof Removal →	$ 10,915,089

Option 1 Roof Replacement Estimate Summary & Detail

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www.prodims.com

Name:	**Salmon Bay Marina - Docks A-C Roof Safety**
Second Name:	**Option 1 Roof Replacement**
Location:	**Seattle, WA**
Design Phase:	**30% Cost Estimate**
Date of Estimate:	**December 17, 2024**
Date of Revision:	**March 18, 2025**
Month of Cost Basis:	**December, 2024**

Estimate Summary - Option 1 Roof Replacement

	Percentage of Previous Subtotal		Amount		
				Direct Cost $	**31,486,588**
Scope Contingency	10.0%	$	3,148,659	Subtotal $	34,635,247
General Conditions/Mobilization	15.0%	$	5,195,287	Subtotal $	39,830,534
Additional Mob/Demob for Fish Window - Two Fish Windows That Need Mobilization For During Project	10.0%	$	3,983,053	Subtotal $	43,813,587
Home Office Overhead	6.0%	$	2,628,815	Subtotal $	46,442,402
Profit	8.0%	$	3,715,392	Subtotal $	50,157,794
Escalation to December, 2029 Is 61 Months of Escalation	34.47%	$	17,291,371	Subtotal $	67,449,165

Escalation Calculation is =((1.06^(# of Months to Midpoint/12)-1))

TOTAL ESTIMATED CONSTRUCTION COST - Option 1 Roof Replacement - BASE Bid	→	**$ 67,449,165**

Alternative Cost Estimate - Option 1 Roof Replacement

Alternative		Direct Cost	with Markups from Above	Total of Each Alternative
Option 1 Roof Replacement - ADA Dock Area - Alternative	$	126,417	114.22%	**$ 270,805**

TOTAL ESTIMATED CONSTRUCTION COST of Alternative	→	**$ 270,805**
TOTAL ESTIMATED CONSTRUCTION COST of BASE Bid and Alternative - Option 1 Roof Replacement	→	**$ 67,719,970**

Estimate Assumptions:

This estimate is based on the 30% Design received 12-10-24 and Schedule of 3-13-25.
Schedule for Escalation and Fish Window Including Only the Demoltion of Docks B and C Labor at 5 Days per week at 10 hours per day (5x10).
The rest of the project schedule is planed at 5 days per week at 8 hours per day (5x8) as developed in the Schedule of 3-13-25
Schedule of work after Last Fish Window is only Netting Removal Therefore there is one less Mobilization Cost for this limited scope.
This estimate does not include Washington State Sales Tax.
All soft costs are the owner's responsibility to determine and verify. The Soft costs estimate has been excluded from the construction cost estimate.
Escalation rate of 6.0% per year is included. Costs are escalated to mid-point of construction of December, 2029
An escalation rate above 6.0% per year is not included in the estimate. This is important if general inflation exceeds this rate.

Estimate Qualifications:

Summary sheet markups are cumulative, not additive. Percentages are added to the previous subtotal rather than the direct cost subtotal.
Estimated labor is based on an 8 hour per day 5 days a week. Accelerated schedule overtime work has not been included.
Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
If only 1 or 2 bids are received the bids could be 40% to 100% more than the cost estimate based on empirical experience.
Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
Division 0/ Division 1 specifications are presumed to have normal ranges for liquidated damages, construction schedule and terms & conditions.
These divisions are typically written after the final estimate. Please contact the cost estimator for a review, if desired.

<Estimate Qualifications Continue on the Next Page>

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fax: (425) 828-0700
www.prodims.com

Name:	**Salmon Bay Marina - Docks A-C Roof Safety**
Second Name:	**Option 1 Roof Replacement**
Location:	**Seattle, WA**
Design Phase:	**30% Cost Estimate**
Date of Estimate:	**December 17, 2024**
Date of Revision:	**March 18, 2025**
Month of Cost Basis:	**December, 2024**

Estimate Summary - Option 1 Roof Replacement

Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.
The construction cost estimate does not include an estimate of owner soft costs such as taxes, A/E fees, owner contingencies and permit fees.
Construction reserve contingency for change orders is not included in the estimate.
Any modifications to the plans via addendums and code review for permits will cause cost increases and are not included in this estimate.
Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.
Imposition of tariffs and market instability of resources such as fuel, insurance and labor occurring after estimate date are not included.
Contractors imposing different bidding conditions from plans and specifications on subcontractors are not bidding from the plans and specifications.
Modifications to the proposed construction schedule and modifying the phasing plans after this estimate will affect construction cost and are not included.
The estimate includes a reasonable construction escalation that can be determined based on market conditions for up to the next 6 months.
Since this project has a midpoint of construction further than 6 months, increases in escalation are not included beyond the rate shown in the estimate.

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Salmon Bay Marina - Docks A-C Roof
Name: **Safety**
Second Name: **Option 1 Roof Replacement - Base Bid**
Location: **Seattle, WA**
Design Phase: **30% Cost Estimate**
Date of Estimate: **December 17, 2024**
Date of Revision: **March 18, 2025**
Month of Cost Basis: **December, 2024**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Abbreviation Note on 5x8 and 5x10: 5 days per week at 8 hours per day is 5x8 and 5 Days per week at 10 hours per day is 5x10.											
G- Sitework											
G10- Site Preparation											
G1030- Site Demolition & Relocations											
	Demolition - Dock A is 5x8 and Dock B+C is 5x10 - Remove Existing Floor System and Wood Creosote Piles - Transport via Barge Scow - Includes Unloading and Disposal Costs	11,640	sqft	$ 20.24	$ 235,635.88	$ 16.56	$ 192,792.99	$ 2.21	$ 25,705.73	$ 39.02	$ 454,134.60
	Demolition - Dock A ix 5x8 and Dock B+C is 5x10 - Remove Existing Roof System and Roofing - Transport via Barge Scow - Includes Unloading and Disposal Costs	72,700	sqft	$ 13.09	$ 951,409.81	$ 3.27	$ 237,852.45	$ 0.98	$ 71,355.74	$ 17.34	$ 1,260,618.00
	Note: Dock A Demo is 5x8 and Docks B+C will be Worked at 5 days at 10 hours a day 5x10 for demolition So Partial Increase in Unit Cost for 5x10 work.										
Totals	**G10- Site Preparation**										**$ 1,714,752.60**
G20- Site Improvements											
G2040- Site Development											
	Replace Flooring and Roofing System										
	In Water Supply and Logistics Equipment - Tugs, Cranes, Barges and Crews										
	Marine Work - Equipment - Need 1 Set of: Tug, Barge with Crane, Material Barge, Work Platform Barge Relocated throughout Project Spudded in, Skiff, 2 Demolition Scows, Transport Tug.	942	day	$ -	$ -	$ 250.00	$ 235,500.00	$ 2,400.00	$ 2,260,800.00	$ 2,650.00	$ 2,496,300.00
	5x8 - Marine Crew - Need 1 Crew: 2 Tug Operators, Crane Operator, 2 Riggers, Oiler, 4 Longshoreman - 10 Person Crew, 10 Hour Day	633	crew-day	$ 19,900.00	$ 12,596,700.00	$ -	$ -	$ -	$ -	$ 19,900.00	$ 12,596,700.00
	5x10 - Demolition of Decks B+C - Marine Crew - Need 1 Crew: 2 Tug Operators, Crane Operator, 2 Riggers, Oiler, 4 Longshoreman - 10 Person Crew, 10 Hour Day	39	crew-day	$ 22,387.50	$ 873,112.50	$ -	$ -	$ -	$ -	$ 22,387.50	$ 873,112.50

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Abbreviation Note on 5x8 and 5x10: 5 days per week at 8 hours per day is 5x8 and 5 Days per week at 10 hours per day is 5x10.											
	All Work is 5x8 on this Page										
	Pile - Galv Structural Steel with Epoxy Coating at Splash Zone 3/8" Thick										
	12" Dia x Length										
	35 Feet	19	each	$ 5,027.83	$ 95,528.77	$ 887.26	$ 16,858.02	$ 354.91	$ 6,743.21	$ 6,270.00	$ 119,130.00
	50 Feet	41	each	$ 5,599.62	$ 229,584.53	$ 2,287.17	$ 93,773.96	$ 473.21	$ 19,401.51	$ 8,360.00	$ 342,760.00
	65 Feet	47	each	$ 8,083.96	$ 379,946.23	$ 1,774.53	$ 83,402.83	$ 591.51	$ 27,800.94	$ 10,450.00	$ 491,150.00
	18" Dia x Length										
	35 Feet	33	each	$ 2,789.43	$ 92,051.32	$ 5,927.55	$ 195,609.06	$ 523.02	$ 17,259.62	$ 9,240.00	$ 304,920.00
	50 Feet	56	each	$ 3,719.25	$ 208,277.74	$ 7,903.40	$ 442,590.19	$ 697.36	$ 39,052.08	$ 12,320.00	$ 689,920.00
	65 Feet	58	each	$ 4,649.06	$ 269,645.28	$ 9,879.25	$ 572,996.23	$ 871.70	$ 50,558.49	$ 15,400.00	$ 893,200.00
	Steel Beam Bucket/Flitch Plates attached to Steel Pipe Piles	297	each	$ 520.00	$ 154,440.00	$ 280.00	$ 83,160.00	$ 48.00	$ 14,256.00	$ 848.00	$ 251,856.00
	Floor Deck										
	Steel Grating	11,640	sqft	$ 9.90	$ 115,236.00	$ 35.10	$ 408,564.00	$ 2.70	$ 31,428.00	$ 47.70	$ 555,228.00
	Wood Framing includes Hardware										
	2x12 Joist	3,201	lnft	$ 3.40	$ 10,883.40	$ 13.60	$ 43,533.60	$ 1.02	$ 3,265.02	$ 18.02	$ 57,682.02
	6x16 Timber beam Bolted to Steel Pile System	3,428	lnft	$ 10.20	$ 34,965.60	$ 57.80	$ 198,138.40	$ 4.08	$ 13,986.24	$ 72.08	$ 247,090.24
	Roof Deck										
	Wood Framing includes Hardware										
	2x12 Blocking	19,386	lnft	$ 6.12	$ 118,642.32	$ 14.28	$ 276,832.08	$ 1.22	$ 23,728.46	$ 21.62	$ 419,202.86
	2x12 Joist	37,332	lnft	$ 3.40	$ 126,928.80	$ 13.60	$ 507,715.20	$ 1.02	$ 38,078.64	$ 18.02	$ 672,722.64
	2x12 Bracing	8,383	lnft	$ 5.05	$ 42,325.77	$ 13.65	$ 114,436.33	$ 1.12	$ 9,405.73	$ 19.82	$ 166,167.83
	5-1/2x18 Glulam Beam Marine Grade Bolted to Steel Pile System	2,148	lnft	$ 11.48	$ 24,648.30	$ 45.90	$ 98,593.20	$ 3.44	$ 7,394.49	$ 60.82	$ 130,635.99
	10-3/4x18 Glulam Beam Marine Grade Bolted to Steel Pile System	6,196	lnft	$ 22.95	$ 142,198.20	$ 91.80	$ 568,792.80	$ 6.89	$ 42,659.46	$ 121.64	$ 753,650.46
	2x Wood Decking	72,700	sqft	$ 3.27	$ 237,910.75	$ 6.08	$ 441,834.25	$ 0.56	$ 40,784.70	$ 9.91	$ 720,529.70
	Wall										
	Wall System - Rain Screen Curtain - Composite Decking	1,520	sqft	$ 16.50	$ 25,080.00	$ 13.50	$ 20,520.00	$ 1.80	$ 2,736.00	$ 31.80	$ 48,336.00
	Wall System - Louver	1,700	sqft	$ 31.50	$ 53,550.00	$ 58.50	$ 99,450.00	$ 5.40	$ 9,180.00	$ 95.40	$ 162,180.00

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Abbreviation Note on 5x8 and 5x10: 5 days per week at 8 hours per day is 5x8 and 5 Days per week at 10 hours per day is 5x10.											
	All Work is 5x8 on this Page										
	Roofing										
	Roofing System - Sloped Metal System with Flashing/Trim and Gutters and Downspouts	72,700	sqft	$ 7.70	$ 559,790.00	$ 6.30	$ 458,010.00	$ 0.84	$ 61,068.00	$ 14.84	$ 1,078,868.00
	5'x10' Translucent Skylight	194	each	$ 940.00	$ 182,360.00	$ 3,760.00	$ 729,440.00	$ 282.00	$ 54,708.00	$ 4,982.00	$ 966,508.00
	Anchor/Cable Support Post with Flashing and Structural Framing	92	each	$ 1,440.00	$ 132,480.00	$ 1,760.00	$ 161,920.00	$ 192.00	$ 17,664.00	$ 3,392.00	$ 312,064.00
	Anchor/Cable Support Post with Flashing and Structural Framing	1,056	lnft	$ 22.00	$ 23,231.56	$ 18.00	$ 19,007.64	$ 2.40	$ 2,534.35	$ 42.40	$ 44,773.55
	Fire Protection Systems										
	New Fire Protection System - Complete Piping/Risers, Pumps, Seismic Joints at Shoreline and FACP For Control of Fire Pump and Sprinkler Equipment	72,700	sqft	$ 7.39	$ 537,534.20	$ 6.05	$ 439,800.71	$ 0.81	$ 58,640.09	$ 14.25	$ 1,035,975.00
	Fire Pump Building - Prefab on Slab	220	sqft	$ 113.21	$ 24,905.66	$ 641.51	$ 141,132.08	$ 45.28	$ 9,962.26	$ 800.00	$ 176,000.00
Totals	**G20- Site Improvements**										**$ 26,606,662.79**
G30- Site Plumbing Utilities											
G3010- Site Water Supply & Distribution System											
	New Potable Water - 8" Pipe Water System Includes Valves, Fittings, Heat Trace and Insulation and Connections as Required.	1,700	lnft	$ 72.64	$ 123,490.57	$ 59.43	$ 101,037.74	$ 7.92	$ 13,471.70	$ 140.00	$ 238,000.00
Totals	**G30- Site Plumbing Utilities**										**$ 238,000.00**
G50- Site Electrical Utilities											
G5010- Site Electrical Distribution											
	Electrical Room Building - Prefab on Slab	800	sqft	$ 102.59	$ 82,075.47	$ 581.37	$ 465,094.34	$ 41.04	$ 32,830.19	$ 725.00	$ 580,000.00
	Electrical Costs from Elcon Associates - Option 1 - See Backup for Detail	1	set	$ 1,364,642.75	$ 1,364,642.75	$ 849,670.91	$ 849,670.91	$ 132,858.82	$ 132,858.82	$ 2,347,172.49	$ 2,347,172.49
G5040- Other Site Electrical Utilities											
Totals	**G50- Site Electrical Utilities**										**$ 2,927,172.49**
										Option 1 Roof Replacement - Base Bid: Total Direct Costs ->	**$ 31,486,588**

PRODIMS PROJECT MANAGEMENT SERVICES

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Name: **Salmon Bay Marina - Docks A-C Roof Safety**
Second Name: **Option 1 Roof Replacement - ADA Dock Area - Alternative**
Location: **Seattle, WA**
Design Phase: **30% Cost Estimate**
Date of Estimate: **December 17, 2024**
Date of Revision: **March 18, 2025**
Month of Cost Basis: **December, 2024**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Abbreviation Note: 5 Days per week at 10 hours per day is 5x10. All Work on this page is 5x10											
G- Sitework											
G10- Site Preparation											
G1030- Site Demolition & Relocations											
	5x10 - Demolition - Remove Existing Floor System and Wood Creosote Piles - Transport via Barge Scow - Includes Unloading and Disposal Costs	1,160	sqft	$ 22.77	$ 26,417.94	$ 18.63	$ 21,614.68	$ 2.48	$ 2,881.96	$ 43.89	$ 50,914.58
Totals	**G10- Site Preparation**										**$ 50,914.58**
G20- Site Improvements											
G2040- Site Development - 4x10 for New Construction in This Section											
	ADA Flooring Area - Allowance										
	Floor Deck										
	Steel Grating	1,160	sqft	$ 9.90	$ 11,484.00	$ 35.10	$ 40,716.00	$ 2.70	$ 3,132.00	$ 47.70	$ 55,332.00
	Wood Framing includes Hardware										
	2x12 Joist	638	lnft	$ 3.40	$ 2,169.20	$ 13.60	$ 8,676.80	$ 1.02	$ 650.76	$ 18.02	$ 11,496.76
	6x16 Timber beam Bolted to Steel Pile System	120	lnft	$ 10.20	$ 1,227.40	$ 57.80	$ 6,955.28	$ 4.08	$ 490.96	$ 72.08	$ 8,673.65
Totals	**G20- Site Improvements**										**$ 75,502.41**

Option 1 Roof Replacement - ADA Dock Area - Alternative: Total Direct Costs -> $ 126,417

Option 2 Roof Removal Estimate Summary & Detail

PRODIMS PROJECT MANAGEMENT SERVICES

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Name:	**Salmon Bay Marina - Docks A-C Roof Safety**
Second Name:	**Option 2 Roof Removal**
Location:	**Seattle, WA**
Design Phase:	**30% Cost Estimate**
Date of Estimate:	**December 17, 2024**
Date of Revision:	**March 18, 2025**
Month of Cost Basis:	**December, 2024**

Estimate Summary - Option 2 Roof Removal

	Percentage of Previous Subtotal		Amount		
				Direct Cost $	**5,800,186**
Scope Contingency	10.0%	$	580,019	Subtotal $	6,380,205
General Conditions/Mobilization	15.0%	$	957,031	Subtotal $	7,337,236
Home Office Overhead	6.0%	$	440,234	Subtotal $	7,777,470
Profit	8.0%	$	622,198	Subtotal $	8,399,667
Escalation to December, 2028 Is 49 Months of Escalation	26.86%	$	2,256,337	Subtotal $	10,656,004

Escalation Calculation is =((1.06^(# of Months to Midpoint/12)-1))

TOTAL ESTIMATED CONSTRUCTION COST - Option 2 Roof Removal BASE Bid → $ 10,656,004

Alternative Cost Estimate - Option 2 Roof Removal

Alternative		Direct Cost	with Markups from Above		Total of Each Alternative
Option 2 Roof Removal - ADA Dock Area - Alternative	$	141,023	83.72%	**$**	**259,085**

TOTAL ESTIMATED CONSTRUCTION COST of Alternative → $ 259,085

TOTAL ESTIMATED CONSTRUCTION COST of BASE Bid and Alternative - Option 2 Roof Removal → $ 10,915,089

<u>Estimate Assumptions:</u>

This estimate is based on the 30% Design received 12-10-24 and Schedule of 3-13-25.
Schedule for Escalation and Fish Window Including all Labor at 5 Days per week at 10 hours per day (5x10) as developed in the Schedule of 3-13-25
Schedule of work after Fish Window is only Netting Removal Therefore there is one less Mobilization Cost for this limited scope.
This estimate does not include Washington State Sales Tax.
All soft costs are the owner's responsibility to determine and verify. The Soft costs estimate has been excluded from the construction cost estimate.
Escalation rate of 6.0% per year is included. Costs are escalated to mid-point of construction of December, 2028
An escalation rate above 6.0% per year is not included in the estimate. This is important if general inflation exceeds this rate.

<u>Estimate Qualifications:</u>

Summary sheet markups are cumulative, not additive. Percentages are added to the previous subtotal rather than the direct cost subtotal.
Estimated labor is based on an 8 hour per day 5 days a week. Accelerated schedule overtime work has not been included.
Estimate is based on a competitive public bid with at least 3 bona fide submitted and unrescinded general contractor bids.
Estimate is based on a competitive public bid with a minimum 6 week bidding schedule and no significant addendums within 2 weeks of bid opening.
If only 1 or 2 bids are received the bids could be 40% to 100% more than the cost estimate based on empirical experience.
Estimated construction cost is for the entire project. This estimate is not intended to be used for other projects.
Division 0/ Division 1 specifications are presumed to have normal ranges for liquidated damages, construction schedule and terms & conditions. These divisions are typically written after the final estimate. Please contact the cost estimator for a review, if desired.
Please consult the cost estimator for any modifications to this estimate. Unilaterally adding and deleting markups, scope of work, schedule, specifications, plans and bid forms could incorrectly restate the project construction cost.

<Estimate Qualifications Continue on the Next Page>

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Name:	**Salmon Bay Marina - Docks A-C Roof Safety**
Second Name:	**Option 2 Roof Removal**
Location:	**Seattle, WA**
Design Phase:	**30% Cost Estimate**
Date of Estimate:	**December 17, 2024**
Date of Revision:	**March 18, 2025**
Month of Cost Basis:	**December, 2024**

Estimate Summary - Option 2 Roof Removal

The construction cost estimate does not include an estimate of owner soft costs such as taxes, A/E fees, owner contingencies and permit fees.
Construction reserve contingency for change orders is not included in the estimate.
Any modifications to the plans via addendums and code review for permits will cause cost increases and are not included in this estimate.
Sole source supply of materials and/ or installers typically results in a 40% to 100% premium on costs over open specifications.
Imposition of tariffs and market instability of resources such as fuel, insurance and labor occurring after estimate date are not included.
Contractors imposing different bidding conditions from plans and specifications on subcontractors are not bidding from the plans and specifications.
Modifications to the proposed construction schedule and modifying the phasing plans after this estimate will affect construction cost and are not included.
The estimate includes a reasonable construction escalation that can be determined based on market conditions for up to the next 6 months.
Since this project has a midpoint of construction further than 6 months, increases in escalation are not included beyond the rate shown in the estimate.

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Salmon Bay Marina - Docks A-C Roof
Name: **Safety**
Second Name: **Option 2 Roof Removal - Base Bid**
Location: **Seattle, WA**
Design Phase: **30% Cost Estimate**
Date of Estimate: **December 17, 2024**
Date of Revision: **March 18, 2025**
Month of Cost Basis: **December, 2024**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Abbreviation Note: 5 Days per week at 10 hours per day is 5x10. All Work on this page is 5x10											
G- Sitework											
G10- Site Preparation											
G1030- Site Demolition & Relocations											
	5x10 - Demolition - Remove Existing Roof System and Roofing - Transport via Barge Scow - Includes Unloading and Disposal Costs	72,700	sqft	$ 14.72	$ 1,070,336.04	$ 3.68	$ 267,584.01	$ 1.10	$ 80,275.20	$ 19.51	$ 1,418,195.25
Totals	**G10- Site Preparation**										**$ 1,418,195.25**
G20- Site Improvements											
G2040- Site Development											
	Remove Roof System										
	In Water Supply and Logistics Equipment - Tugs, Cranes, Barges and Crews										
	Marine Work - Equipment - Need 1 Set of: Tug, Barge with Crane, Work Platform Barge Relocated throughout Project Spudded in, Skiff, 2 Demolition Scows, Transport Tug. - This is for Over Water Work	205	day	$ -	$ -	$ 260.02	$ 53,304.83	$ 2,189.98	$ 448,945.17	$ 2,450.00	$ 502,250.00
	5x10 - Marine Crew - Need 1 Crew: 2 Tug Operators, Crane Operator, 2 Riggers, Oiler, 4 Longshoreman - 10 Person Crew, 10 Hour Day	146	crew-day	$ 22,387.50	$ 3,268,575.00	$ -	$ -	$ -	$ -	$ 22,387.50	$ 3,268,575.00
Totals	**G20- Site Improvements**										**$ 3,770,825.00**
G50- Site Electrical Utilities											
G5010- Site Electrical Distribution											
	5x10 - Electrical Costs from Elcon Associates - Option 2 - See Backup for Detail	1	set	$ 243,132.46	$ 243,132.46	$ 333,439.21	$ 333,439.21	$ 34,594.30	$ 34,594.30	$ 611,165.97	$ 611,165.97
	Note: ProDims Added Overtime Labor Costs for 5-10 Hour Days										
G5040- Other Site Electrical Utilities											
Totals	**G50- Site Electrical Utilities**										**$ 611,165.97**

Option 2 Roof Removal - Base Bid: Total Direct Costs -> $ 5,800,186

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Name: **Salmon Bay Marina - Docks A-C Roof Safety**
Second Name: **Option 2 Roof Removal - ADA Dock Area - Alternative**
Location: **Seattle, WA**
Design Phase: **30% Cost Estimate**
Date of Estimate: **December 17, 2024**
Date of Revision: **March 18, 2025**
Month of Cost Basis: **December, 2024**

WBS	Description	Quantity	U of M	Labor	Labor Total	Material	Material Total	Equipment	Equipment Total	Total $/U of M	Direct Cost
Abbreviation Note: 5 Days per week at 10 hours per day is 5x10. All Work on this page is 5x10											
G- Sitework											
G10- Site Preparation											
G1030- Site Demolition & Relocations											
	5x10 - Demolition - Remove Existing Floor System and Wood Creosote Piles - Transport via Barge Scow - Includes Unloading and Disposal Costs	1,160	sqft	$ 22.77	$ 26,417.94	$ 18.63	$ 21,614.68	$ 2.48	$ 2,881.96	$ 43.89	$ 50,914.58
Totals	**G10- Site Preparation**										**$ 50,914.58**
G20- Site Improvements											
G2040- Site Development											
	ADA Flooring Area - Allowance										
	Floor Deck										
	Small Quanity Factor Allowance at Option 2	1,160	sqft	$ 2.26	$ 2,622.18	$ 8.01	$ 9,296.82	$ 0.62	$ 715.14	$ 10.89	$ 12,634.14
	Steel Grating	1,160	sqft	$ 10.17	$ 11,799.81	$ 36.07	$ 41,835.69	$ 2.77	$ 3,218.13	$ 49.01	$ 56,853.63
	Wood Framing includes Hardware										
	2x12 Joist	638	lnft	$ 3.49	$ 2,223.43	$ 13.94	$ 8,893.72	$ 1.05	$ 667.03	$ 18.47	$ 11,784.18
	6x16 Timber beam Bolted to Steel Pile System	120	lnft	$ 10.39	$ 1,250.42	$ 58.88	$ 7,085.70	$ 4.16	$ 500.17	$ 73.43	$ 8,836.28
Totals	**G20- Site Improvements**										**$ 90,108.23**

Option 2 Roof Removal - ADA Dock Area - Alternative: Total Direct Costs -> $ 141,023

Estimate Backup - Electrical Estimate

OPINION OF ELECTRICAL CONSTRUCTION COST

ELCON ASSOCIATES, INC.

Project Name:	Salmon Bay Marina - Option 1	Prepared by:	CMS
Project Number:	5653-035.01	Checked by:	DKS
Sheet description:	Summary	Date:	2024-09-30

Summary

Sheet description	Total material	Total labor	Total contingency	Total
Site Power	$686,705.63	$173,722.02	$215,106.91	$1,075,534.56
Dock Power	$568,923.75	$581,156.66	$200,958.25	$1,351,038.66
Dock Lighting	$59,390.00	$63,895.10	$30,821.28	$154,106.38
Dock Communications	$0.00	$0.00	$0.00	$0.00
Total across all sheets:	**$1,315,019.38**	**$818,773.79**	**$446,886.44**	**$2,580,679.60**

	10.0%	Mobilization	$258,067.96
Notes for this project:		Subtotal:	$2,838,747.56
1. See individual sheets for informantion regarding contingency adjustments.	0.0%		$0.00
		Subtotal:	$2,838,747.56
	0.0%		$0.00
		Subtotal:	$2,838,747.56
	0.0%	Tax:	$0.00
		Total:	**$2,838,747.56**

OPINION OF ELECTRICAL CONSTRUCTION COST

ELCON ASSOCIATES, INC.

Project Name:	Salmon Bay Marina - Option 1	Prepared by:	CMS
Project Number:	5653-035.01	Checked by:	DKS
Sheet description:	Site Power	Date:	2024-09-30

Description		Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
Seattle City Light service connection		1	LS	$100,000		$125,000.00		$125,000.00
800 square foot building for new service - by others with double doors and panic hardware								
Switchboard incoming section, NEMA 1		1	EA	$9,975	25.81	$12,468.75	$4,168.28	$16,637.03
Switchboard CT section, NEMA 1		1	EA	$24,150	28.57	$30,187.50	$4,614.89	$34,802.39
Switchboard main breaker section, NEMA 1		2	EA	$24,250	20.00	$60,625.00	$6,460.94	$67,085.94
Switchboard distribution section, NEMA 1		1	EA	$12,650	25.81	$15,812.50	$4,168.28	$19,980.78
Switchboard distribution breakers LA frame		4	EA	$4,350	3.48	$21,750.00	$2,247.12	$23,997.12
Switchboard distribution breakers KA frame		4	EA	$2,650	2.50	$13,250.00	$1,615.24	$14,865.24
Automatic Transfer Switch 1200A, NEMA 1		1	EA	$26,100	22.86	$32,625.00	$3,691.94	$36,316.94
300kW Generator, NEMA 1		1	EA	$64,500	90.91	$80,625.00	$14,683.95	$95,308.95
4" Sch 40 PVC conduit		2,190	LF	$10	0.10	$28,059.38	$35,373.67	$63,433.04
Trenching	Per Civil	600	LF					
Backfill and restoration	Per Civil	600	LF					
600KCM XHHW-2 CU wire		90	CLF	$2,275	6.15	$255,937.50	$89,461.46	$345,398.96
#3/0 XHHW-2 CU wire		10	CLF	$650	3.20	$8,125.00	$5,168.76	$13,293.76
#3 XHHW-2 CU wire		8	CLF	$224	1.60	$2,240.00	$2,067.50	$4,307.50

Total material this sheet:	$686,706	Total hours this sheet:	1,075.5	Total labor this sheet:	$173,722.02		
Material contingency:	+25.0%	Labor contingency:	+25.0%			Contingency this sheet:	$215,106.91
						Subtotal:	$1,075,534.56
					0.0%	Tax:	$0.00
						Total this sheet:	**$1,075,534.56**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
5. Pricing is for current material/labor rates only and does not reflect other disciplines nor general contractor markup.

OPINION OF ELECTRICAL CONSTRUCTION COST

ELCON ASSOCIATES, INC.

Project Name:	Salmon Bay Marina - Option 1	Prepared by:	CMS
Project Number:	5653-035.01	Checked by:	DKS
Sheet description:	Dock Power	Date:	2024-09-30

	Description	Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
1	400A disconnect	3	EA	$2,500.00	10.00	$9,375.00	$4,845.71	$14,220.71
2	200kVA 480-240v transformer	3	EA	$27,000.00	23.53	$101,250.00	$11,401.47	$112,651.47
3	800A MCB panelboard with ground fault protection	3	EA	$13,900.00	42.11	$52,125.00	$20,402.85	$72,527.85
4	200A 240v disconnect	21	EA	$835.00	10.00	$21,918.75	$33,921.65	$55,840.40
5	Shorepower pedestals	69	EA	$1,500.00	8.57	$129,375.00	$95,524.90	$224,899.90
6	2" Sch 40 PVC conduit	6,300	LF	$9.00	0.22	$70,875.00	$226,415.71	$297,290.71
7	#3/0 XHHW-2 CU wire	210	CLF	$650	4.80	$170,625.00	$162,815.79	$333,440.79
8	#6 XHHW-2 CU wire	84	CLF	$116	1.85	$12,180.00	$25,053.28	$37,233.28
9	#2 Solid ground wire	3	CLF	$320	1.60	$1,200.00	$775.31	$1,975.31
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Total material this sheet:	$568,923.75	Total hours this sheet:	3,598.0	Total labor this sheet:	$581,156.66		
Material contingency:	+20.0%	Labor contingency:	+15.0%			Contingency this sheet:	$200,958.25
						Subtotal:	$1,351,038.66
				0.0%		Tax:	$0.00
						Total this sheet:	**$1,351,038.66**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
5. Pricing is for current material/labor rates only and does not reflect other disciplines nor general contractor markup.

OPINION OF ELECTRICAL CONSTRUCTION COST

Project Name: Salmon Bay Marina - Option 1 | Prepared by: CMS

Project Number: 5653-035.01 | Checked by: DKS

Sheet description: Dock Lighting | Date: 2024-09-30

ELCON ASSOCIATES, INC.

#	Description		Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
1	Lighting demolition	Dock A	480	LF		0.07		$5,427.19	$5,427.19
2	Lighting demolition	Dock B	460	LF		0.07		$5,201.06	$5,201.06
3	Lighting demolition	Dock C	400	LF		0.07		$4,522.66	$4,522.66
7	New lighting bollards	Dock A	30	EA	$500.00	1.4115	$18,750.00	$6,839.72	$25,589.72
8	New lighting conduit	Dock A	480	LF	$2.20	0.11	$1,320.00	$8,528.45	$9,848.45
9	New lighting wire	Dock A	15	CLF	$48.00	0.8	$900.00	$1,938.28	$2,838.28
10	New lighting bollards	Dock B	30	EA	$500.00	1.4115	$18,750.00	$6,839.72	$25,589.72
11	New lighting conduit	Dock B	460	LF	$2.20	0.11	$1,265.00	$8,173.09	$9,438.09
12	New lighting wire	Dock B	15	CLF	$48.00	0.8	$900.00	$1,938.28	$2,838.28
13	New lighting bollards	Dock C	25	EA	$500.00	1.4115	$15,625.00	$5,699.76	$21,324.76
14	New lighting conduit	Dock C	400	LF	$2.20	0.11	$1,100.00	$7,107.04	$8,207.04
15	New lighting wire	Dock C	13	CLF	$48.00	0.8	$780.00	$1,679.85	$2,459.85

Total material this sheet:	$59,390.00	Total hours this sheet:	395.6	Total labor this sheet:	$63,895.10		
Material contingency:	+25.0%	Labor contingency:	+25.0%			Contingency this sheet:	$30,821.28
						Subtotal:	$154,106.38
					0.0%	Tax:	$0.00
						Total this sheet:	**$154,106.38**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
5. Pricing is for current material/labor rates only and does not reflect other disciplines nor general contractor markup.

OPINION OF ELECTRICAL CONSTRUCTION COST

ELCON
ASSOCIATES, INC.

Project Name: Salmon Bay Marina - Option 1
Project Number: 5653-035.01
Sheet description: Dock Communications

Prepared by: CMS
Checked by: DKS
Date: 2024-09-30

Description	Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
All demolition of low voltage wiring assumed to be done as part of general demolition							
No pricing for new communications wiring included at this time							

Total material this sheet:	$0.00	Total hours this sheet:	0.0	Total labor this sheet:	$0.00
Material contingency:	+25.0%	Labor contingency:	+25.0%	Contingency this sheet:	$0.00
				Subtotal:	$0.00
			0.0%	Tax:	$0.00
				Total this sheet:	**$0.00**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
5. Pricing is for current material/labor rates only and does not reflect other disciplines nor general contractor markup.

OPINION OF ELECTRICAL CONSTRUCTION COST

Project Name: Salmon Bay Marina - Option 2
Project Number: 5653-035.01
Sheet description: Summary

Prepared by: CMS
Checked by: DKS
Date: 2024-09-30

ELCON ASSOCIATES, INC.

Summary

	Sheet description	Total material	Total labor	Total contingency	Total
1	Dock Transformers	$148,916.25	$161,201.07	$77,529.33	$387,646.65
2	Dock Panelboards	$0.00	$97,638.59	$24,409.65	$122,048.24
3	Dock Lighting	$59,390.00	$63,895.10	$30,821.28	$154,106.38
4	Dock Communications	$0.00	$0.00	$0.00	$0.00
	Total across all sheets:	**$208,306.25**	**$322,734.76**	**$132,760.25**	**$663,801.27**

	10.0%	Mobilization	$66,380.13
		Subtotal:	$730,181.40
	0.0%		$0.00
		Subtotal:	$730,181.40
	0.0%		$0.00
		Subtotal:	$730,181.40
	0.0%	Tax:	$0.00
		Total:	**$730,181.40**

Notes for this project:

1. See individual sheets for informantion regarding contingency adjustments.

OPINION OF ELECTRICAL CONSTRUCTION COST

Project Name: Salmon Bay Marina - Option 2
Project Number: 5653-035.01
Sheet description: Dock Transformers

Prepared by: CMS
Checked by: DKS
Date: 2024-09-30

ELCON ASSOCIATES, INC.

Description	Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
Transformer T6 Dock C							
Transformer removal from rafters	1	EA		15		$2,422.85	$2,422.85
Conduit demolition	70	LF		0.1068		$1,207.55	$1,207.55
Wiring demolition	3	CLF		2.4616		$1,192.82	$1,192.82
Transformer installation on deck	1	EA		37.5		$6,057.14	$6,057.14
Conduit	720	LF	$12.60	0.435	$11,340.00	$50,589.19	$61,929.19
Wire	24	CLF	$2,275.00	6.154	$68,250.00	$23,856.39	$92,106.39
Note: does not include new decking or decking supports							
Transformer T4 Dock B							
Transformer removal from rafters	1	EA		15		$2,422.85	$2,422.85
Conduit demolition	120	LF		0.1068		$2,070.09	$2,070.09
Wiring demolition	4	CLF		2.4616		$1,590.43	$1,590.43
Transformer installation on deck	1	EA		37.5		$6,057.14	$6,057.14
Conduit	610	LF	$12.60	0.435	$9,607.50	$42,860.29	$52,467.79
Wire	21	CLF	$2,275.00	6.154	$59,718.75	$20,874.34	$80,593.09
Note: does not include new decking or decking supports							

Total material this sheet:	$148,916.25	Total hours this sheet:	998.0	Total labor this sheet:	$161,201.07		
Material contingency:	+25.0%	Labor contingency:	+25.0%			Contingency this sheet:	$77,529.33
						Subtotal:	$387,646.65
					0.0%	Tax:	$0.00
						Total this sheet:	**$387,646.65**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
5. Pricing is for current material/labor rates only and does not reflect other disciplines nor general contractor markup.

OPINION OF ELECTRICAL CONSTRUCTION COST

Project Name: Salmon Bay Marina - Option 2
Project Number: 5653-035.01
Sheet description: Dock Panelboards

Prepared by: CMS
Checked by: DKS
Date: 2024-09-30

ELCON
ASSOCIATES, INC.

Description	Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
Dock A							
Remove Panels A1, A2, A3 for wall replacement	3	EA		14.1174		$6,840.88	$6,840.88
Reinstall Panels A1, A3, A3	3	EA		35.2935		$17,102.20	$17,102.20
Note: does not include new wall/support structure							
Dock B							
Remove Disconnect T4 for wall replacement	1	EA		5.3334		$861.47	$861.47
Remove Panel F3 for wall replacement	1	EA		10.4346		$1,685.43	$1,685.43
Remove Panels B1, B2, B3, B4 for wall replacement	4	EA		14.1174		$9,121.17	$9,121.17
Reinstall Disconnect T4	1	EA		13.3335		$2,153.67	$2,153.67
Reinstall Panel F3	1	EA		26.0865		$4,213.59	$4,213.59
Reinstall Panels B1, B2, B3, B4	4	EA		35.2935		$22,802.93	$22,802.93
Note: does not include new wall/support structure							
Dock C							
Remove Disconnect T6 for wall replacement	1	EA		5.3334		$861.47	$861.47
Remove Panel F5 for wall replacement	1	EA		10.4346		$1,685.43	$1,685.43
Remove Panels C2, C3, C4 for wall replacement	3	EA		14.1174		$6,840.88	$6,840.88
Reinstall Disconnect T6	1	EA		13.3335		$2,153.67	$2,153.67
Reinstall Panel F5	1	EA		26.0865		$4,213.59	$4,213.59
Reinstall Panels C2, C3, C4	3	EA		35.2935		$17,102.20	$17,102.20
Note: does not include new wall/support structure							

Total material this sheet: $0.00 Total hours this sheet: 604.5 Total labor this sheet: $97,638.59

Material contingency: +25.0% Labor contingency: +25.0% Contingency this sheet: $24,409.65

Subtotal: $122,048.24

0.0% Tax: $0.00

Total this sheet: $122,048.24

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
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OPINION OF ELECTRICAL CONSTRUCTION COST

Project Name: Salmon Bay Marina - Option 2
Project Number: 5653-035.01
Sheet description: Dock Lighting

Prepared by: CMS
Checked by: DKS
Date: 2024-09-30

ELCON
ASSOCIATES, INC.

#	Description		Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
1	Lighting demolition	Dock A	480	LF		0.07		$5,427.19	$5,427.19
2	Lighting demolition	Dock B	460	LF		0.07		$5,201.06	$5,201.06
3	Lighting demolition	Dock C	400	LF		0.07		$4,522.66	$4,522.66
4									
5									
6									
7	New lighting bollards	Dock A	30	EA	$500.00	1.4115	$18,750.00	$6,839.72	$25,589.72
8	New lighting conduit	Dock A	480	LF	$2.20	0.11	$1,320.00	$8,528.45	$9,848.45
9	New lighting wire	Dock A	15	CLF	$48.00	0.8	$900.00	$1,938.28	$2,838.28
10	New lighting bollards	Dock B	30	EA	$500.00	1.4115	$18,750.00	$6,839.72	$25,589.72
11	New lighting conduit	Dock B	460	LF	$2.20	0.11	$1,265.00	$8,173.09	$9,438.09
12	New lighting wire	Dock B	15	CLF	$48.00	0.8	$900.00	$1,938.28	$2,838.28
13	New lighting bollards	Dock C	25	EA	$500.00	1.4115	$15,625.00	$5,699.76	$21,324.76
14	New lighting conduit	Dock C	400	LF	$2.20	0.11	$1,100.00	$7,107.04	$8,207.04
15	New lighting wire	Dock C	13	CLF	$48.00	0.8	$780.00	$1,679.85	$2,459.85
16									
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36									

Total material this sheet:	$59,390.00	Total hours this sheet:	395.6	Total labor this sheet:	$63,895.10		
Material contingency:	+25.0%	Labor contingency:	+25.0%			Contingency this sheet:	$30,821.28
						Subtotal:	$154,106.38
				0.0%		Tax:	$0.00
						Total this sheet:	**$154,106.38**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
4. Total cost does not include additional markups (contingency, tax) as listed at bottom of this page and/or on summary sheet.
5. Pricing is for current material/labor rates only and does not reflect other disciplines nor general contractor markup.

OPINION OF ELECTRICAL CONSTRUCTION COST

Project Name: Salmon Bay Marina - Option 2
Project Number: 5653-035.01
Sheet description: Dock Communications

Prepared by: CMS
Checked by: DKS
Date: 2024-09-30

ELCON ASSOCIATES, INC.

Description	Qty	Unit	Material $/Unit [1]	Hours/ Unit [1]	Material with markup [2]	Labor with markup [3]	Total cost [4]
All demolition of low voltage wiring assumed to be done as part of general demolition							
No pricing for new communications wiring included at this time							

Total material this sheet:	$0.00	Total hours this sheet:	0.0	Total labor this sheet:	$0.00
Material contingency:	+25.0%	Labor contingency:	+25.0%	Contingency this sheet:	$0.00
				Subtotal:	$0.00
			0.0%	Tax:	$0.00
				Total this sheet:	**$0.00**

Notes this sheet

1. Material and manhour costs per RSMeans 2024 and Electrical Marketing's Electrical Price Index where available, prior job experience and/or distributor pricing used where a direct comparison is not listed within these publications.
2. Material adjustment of +25.0% to reflect current bidding / parts supply climate.
3. Base rate per Means of $76.92 per hour plus overhead adjustment of +110% = $161.52 per hour to reflect current bidding climate.
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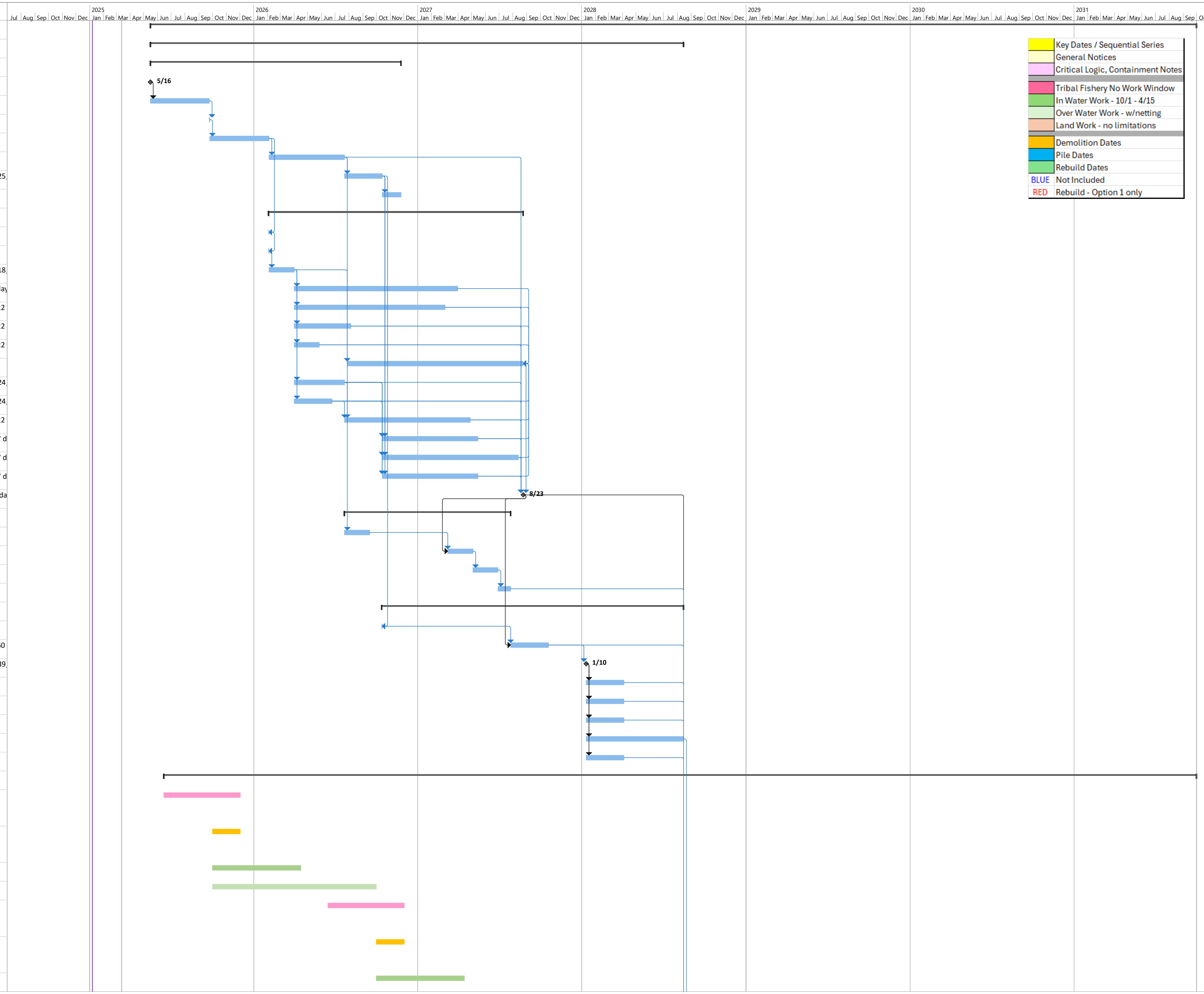
Appendix E. Project Schedule

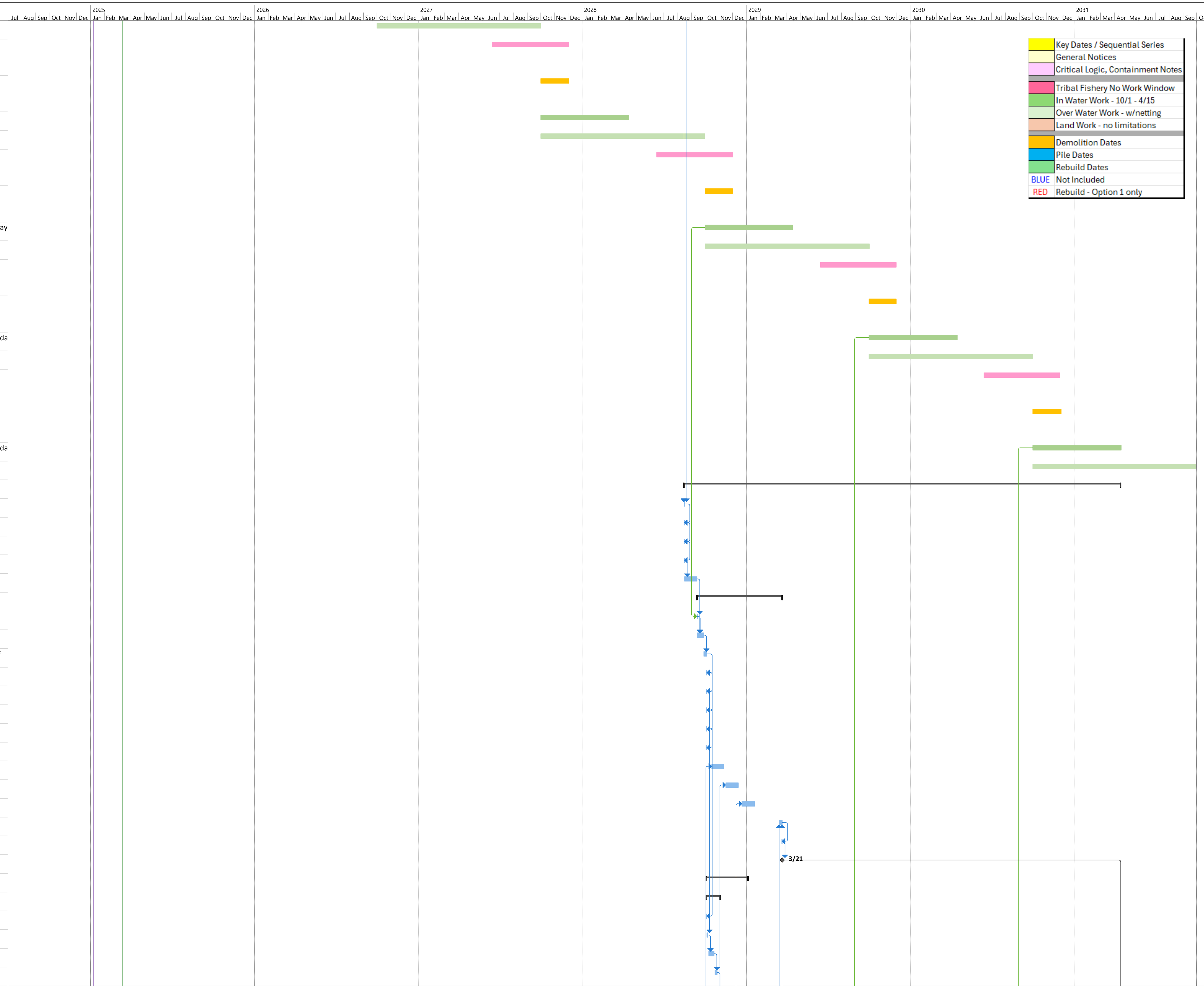
PORT OF SEATTLE - Salmon Bay - Option #1 - REMOVE / REPLACE - ROOF, STRUCTURE, WALLS, DECKING, PILES

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
1	**SALMON BAY - Option 1 - REPLACE ALL**		**5/16/25**	**9/30/31**	**1656 days**		
2	**PROJECT PLANNING**		**5/16/25**	**8/14/28**	**840 days**		
3	**Design**		**5/16/25**	**11/24/26**	**391 days**		
4	Start Project		5/16/25	5/16/25	0 days		5
5	Bid / Award Designer		5/16/25	9/23/25	90 days	4	6
6	design dates are approximate		9/24/25	9/24/25	1 day	5	7
7	30% Design For Permitting & Surveys		9/25/25	2/3/26	90 days	6	8,12FF
8	60% Design Progress		2/4/26	7/21/26	120 days	7	9,28,26
9	90% Design Progress		7/22/26	10/13/26	60 days	8	10,23,24,25,
10	100% Design Progress		10/14/26	11/24/26	30 days	9	
11	**Port Permits**		**2/3/26**	**8/23/27**	**405 days**		
12	permit dates are approximate		2/3/26	2/3/26	1 day	7FF	13FF
13	start permits after 30% design		2/3/26	2/3/26	1 day	12FF	14
14	Prepare JARPA Based on 30% Design		2/4/26	3/31/26	40 days	13	15,16,17,18,
15	Section 10		4/1/26	3/30/27	260 days	14	19FF+22 day
16	Section 7		4/1/26	3/2/27	240 days	14	26,19FF+22
17	Section 106		4/1/26	8/4/26	90 days	14	26,19FF+22
18	HPA		4/1/26	5/26/26	40 days	14	26,19FF+22
19	DNR Waterway Use Authorization		7/28/26	8/23/27	280 days	15FF+22 day	26
20	Preliminary Application and Preparation		4/1/26	7/21/26	80 days	14	26,22,23,24,
21	SEPA		4/1/26	6/23/26	60 days	14	22,26,23,24,
22	Master Use Permit (SDP)		7/22/26	4/27/27	200 days	21,20	26,19FF+22
23	Demolition Permit (7 months)		10/14/26	5/14/27	153 days	20,21,9	26,19FF+7 d
24	Construction Permit (10 months)		10/14/26	8/12/27	217 days	20,21,9	26,19FF+7 d
25	Grading Permit (7 months)		10/14/26	5/14/27	153 days	20,21,9	26,19FF+7 d
26	All Port Obtained Permits Ready		8/23/27	8/23/27	0 days	8,25,24,23,2	29FS-120 da
27	**Moorage Customer / External Relations**		**7/22/26**	**7/26/27**	**264 days**		
28	Public Meetings		7/22/26	9/15/26	40 days	8	29
29	Initial Notice to Vacate		3/9/27	5/3/27	40 days	28,26FS-120	30
30	Final Notice to Vacate		5/4/27	6/28/27	40 days	29	31
31	Last Day to Occupy		6/29/27	7/26/27	20 days	30	67
32	**Contractor Preparation**		**10/13/26**	**8/14/28**	**480 days**		
33	after 90% design		10/13/26	10/13/26	1 day	9FF	34
34	Contractor Bid / Award		7/27/27	10/18/27	60 days	33,26FS-20 (	67,35FS+60
35	Notice to Proceed - Planning / Prep		1/10/28	1/10/28	0 days	34FS+60 day	36,37,38,39,
36	Contractor Obtained Permits - Elec		1/11/28	4/3/28	60 days	35	67
37	Contractor Obtained Permits - Mech		1/11/28	4/3/28	60 days	35	67
38	Contractor Obtained Permits - Plumb		1/11/28	4/3/28	60 days	35	67
39	Contractor Obtained Permits - NPDES		1/11/28	8/14/28	155 days	35	67
40	Materials & Equip		1/11/28	4/3/28	60 days	35	67
41	**ALLOWED WORK WINDOWS**		**6/15/25**	**9/30/31**	**1636 days**		
42	Tribal Fishery No Work 06/16 to 12/01 - N/A as assumes Tribal Fishery Agreement		6/15/25	12/1/25	117 days		
43	Tribal Fishery Agreement (assumed based on in water work window)		10/1/25	12/1/25	42 days		
44	IN WATER Work #1 - Oct 1 to Apr 15 2026		10/1/25	4/15/26	137 days		
45	OVER WATER #1 - all year (with netting)		10/1/25	9/30/26	257 days		
46	Tribal Fishery No Work 06/16 to 12/01 - N/A as assumes Tribal Fishery Agreement		6/15/26	12/1/26	122 days		
47	Tribal Fishery Agreement (assumed based on in water work window)		10/1/26	12/1/26	44 days		
48	IN WATER Work #2 - Oct 1 to Apr 15 2027		10/1/26	4/14/27	140 days		

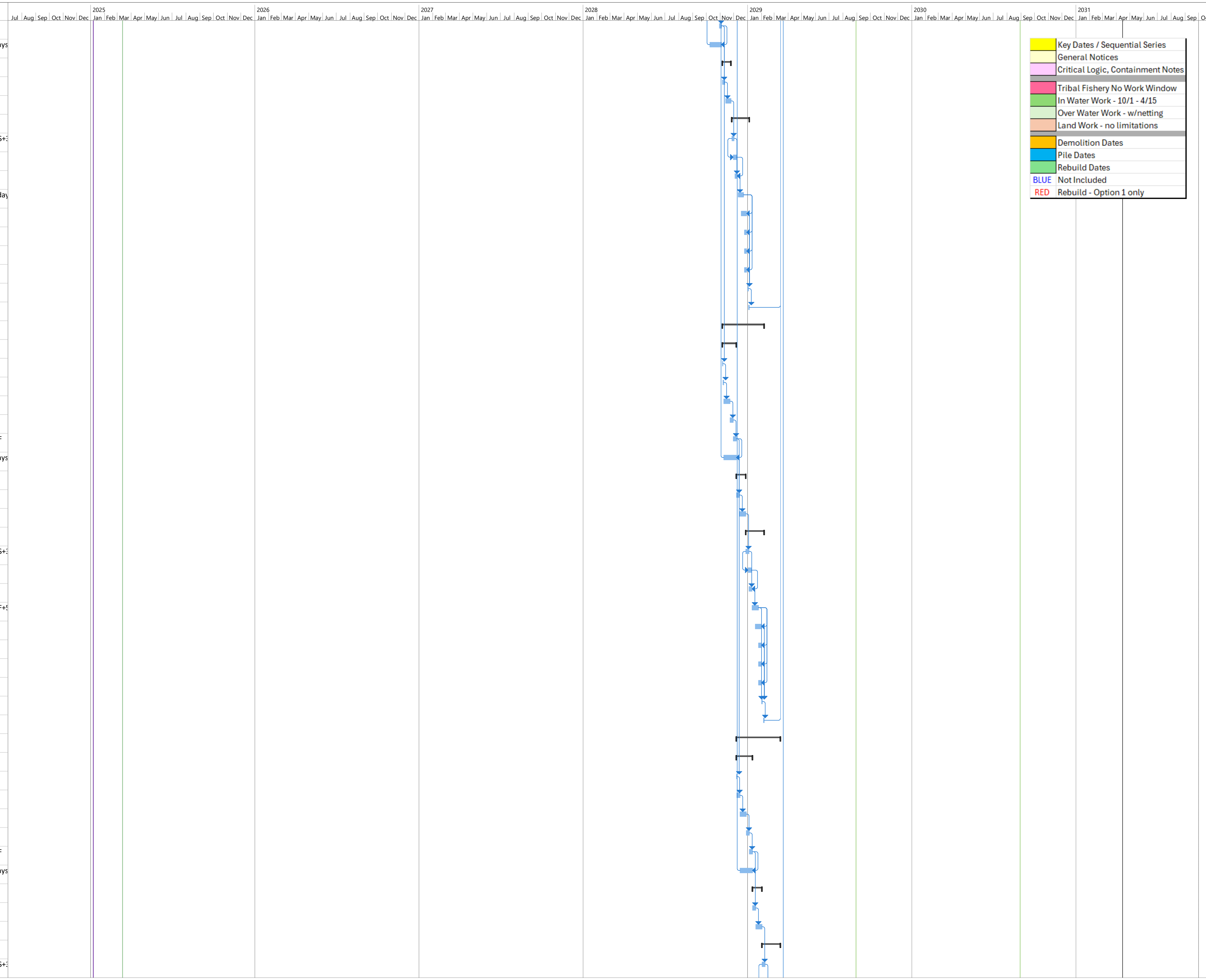


Calendar is working days, simple 5 day 8 hours / day = 40 hour work week, with basic holidays

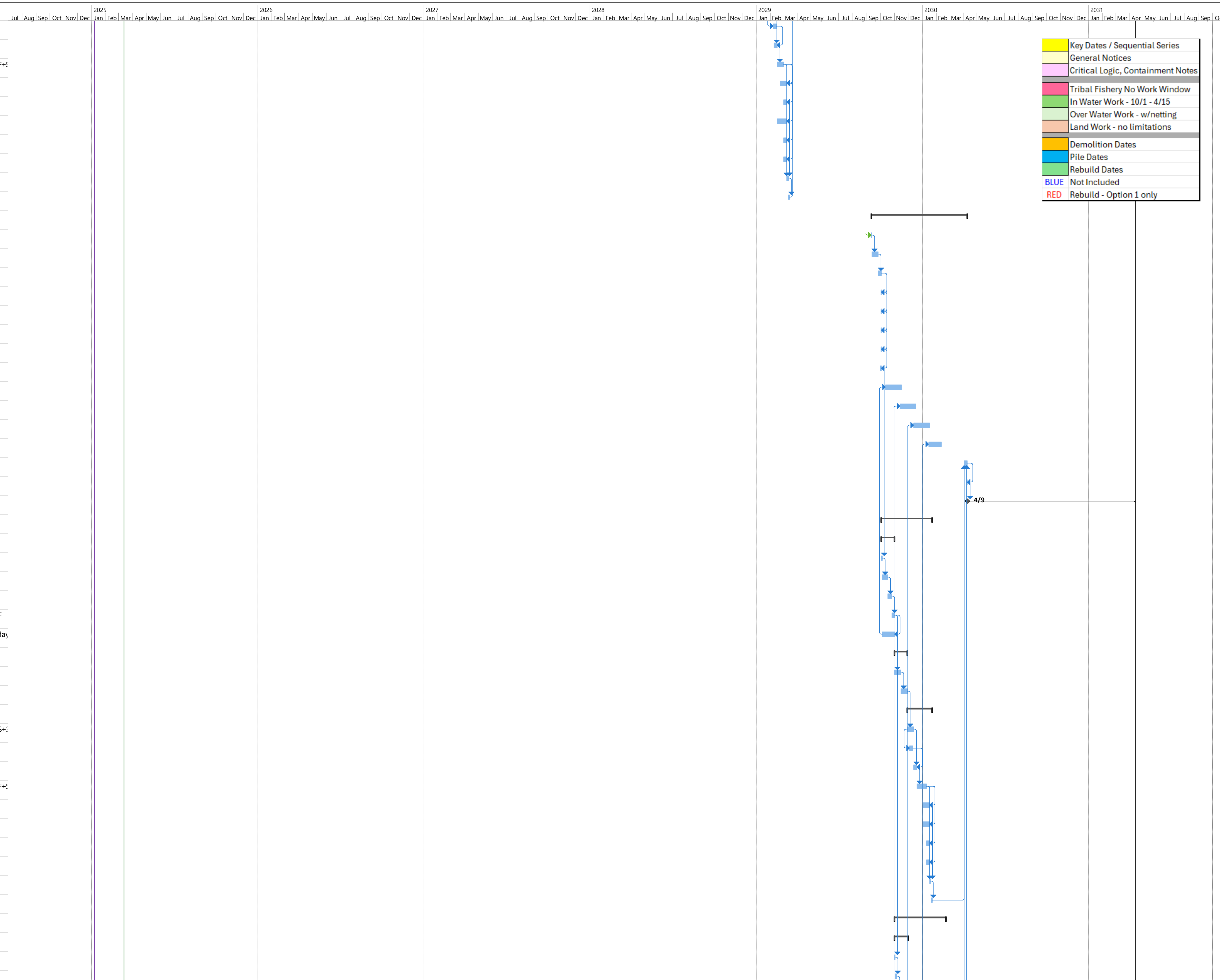
ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
49	OVER WATER #2 - all year (with netting)		10/1/26	9/30/27	261 days		
50	Tribal Fishery No Work 06/16 to 12/01 - N/A as assumes Tribal Fishery Agreement		6/15/27	12/1/27	122 days		
51	Tribal Fishery Agreement (assumed based on in water work window)		10/1/27	12/1/27	44 days		
52	IN WATER Work #3 - Oct 1 to Apr 15 2028		10/1/27	4/13/28	140 days		
53	OVER WATER #3 - all year (with netting)		10/1/27	9/29/28	261 days		
54	Tribal Fishery No Work 06/16 to 12/01 - N/A as assumes Tribal Fishery Agreement		6/15/28	12/1/28	122 days		
55	Tribal Fishery Agreement (assumed based on in water work window)		10/1/28	11/30/28	44 days		
56	IN WATER Work #4 - Oct 1 to Apr 15 2029		10/1/28	4/13/29	140 days		73SS-14 day
57	OVER WATER #4 - al year (with netting)		10/1/28	10/1/29	261 days		
58	Tribal Fishery No Work 06/16 to 12/01 - N/A as assumes Tribal Fishery Agreement		6/15/29	11/30/29	121 days		
59	Tribal Fishery Agreement (assumed based on in water work window)		10/1/29	11/30/29	45 days		
60	IN WATER Work #5 - Oct 1 to Apr 15 2030		10/1/29	4/15/30	141 days		155SS-14 da
61	OVER WATER #5 - all year (with netting)		10/1/29	9/30/30	261 days		
62	Tribal Fishery No Work 06/16 to 12/01 - N/A as assumes Tribal Fishery Agreement		6/14/30	11/29/30	121 days		
63	Tribal Fishery Agreement (assumed based on in water work window)		10/1/30	12/2/30	45 days		
64	IN WATER Work #6 - Oct 1 to Apr 15 2031		10/1/30	4/15/31	141 days		261SS-14 da
65	OVER WATER #6 - all year (with netting)		10/1/30	9/30/31	261 days		
66	**CONSTRUCTION (demo, piles, rebuild)**		**8/15/28**	**4/14/31**	**695 days**		
67	after all permits ready		8/15/28	8/15/28	1 day	26,31,34,36,	68FF
68	Work in Sequence - demo, piles, rebuild		8/15/28	8/15/28	1 day	67FF	69FF
69	3 specialized crews - demo, pile, rebuild		8/15/28	8/15/28	1 day	68FF	70FF
70	Notice To Proceed - Construction		8/15/28	8/15/28	1 day	69FF	71
71	Contractor Preparation		8/16/28	9/12/28	20 days	70	74,73
72	**Dock A**		**9/13/28**	**3/21/29**	**136 days**		
73	delay start to Fall 2028		9/13/28	9/13/28	1 day	71,56SS-14 (	74
74	Initial Project Mobilization		9/14/28	9/27/28	10 days	71,73	75
75	Mobilize for Dock A		9/28/28	10/4/28	5 days	74	76FF,89FF
76	Review Safety and Work Conditions		10/4/28	10/4/28	1 day	75FF	77FF
77	Haz Mat / Safety Inspections		10/4/28	10/4/28	1 day	76FF	90,78FF
78	Not Incl - Haz Mat Remediation		10/4/28	10/4/28	1 day	77FF	79FF
79	Install Debris Containment Boom 5x10	IN	10/4/28	10/4/28	1 day	78FF	80FF
80	De-energize / Disable Utilities	land	10/3/28	10/4/28	2 days	79FF	
81	Haul Away A-1 Shore Debris	land	10/16/28	11/10/28	20 days	94SS+5 days	
82	Haul Away A-2 Shore Debris	land	11/16/28	12/13/28	20 days	116SS+5 day	
83	Haul Away A-3 Shore Debris	land	12/22/28	1/18/29	20 days	138SS+5 day	
84	Re-energize / Re-enable Utilities	land	3/15/29	3/21/29	5 days	108,130,153	85FF
85	Remove Debris Containment Boom 5x10	IN	3/21/29	3/21/29	1 day	84FF	86
86	Dock A Construction Complete		3/21/29	3/21/29	0 days	85	388
87	**Roof A-1**		**10/4/28**	**1/4/29**	**67 days**		
88	**Demolition**		**10/4/28**	**11/3/28**	**23 days**		
89	Mobilize for Roof A-1		10/4/28	10/4/28	1 day	75FF	90
90	Remove Disconnected Utilities	**IN / ov**	10/5/28	10/6/28	2 days	77,89	91
91	Remove Roof	**over**	10/9/28	10/20/28	10 days	90	92
92	Remove Structure / Walls	**over**	10/23/28	10/27/28	5 days	91	93



ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
93	Remove Decking / Supports	over	10/30/28	11/3/28	5 days	92	96,94FF
94	Remove Debris to Shore	over	10/9/28	11/3/28	20 days	93FF	81SS+5 days
95	**Piles**		**11/6/28**	**11/24/28**	**15 days**		
96	Remove Piles	IN	11/6/28	11/10/28	5 days	93	97
97	Install New Piles	IN	11/13/28	11/24/28	10 days	96	99
98	**Rebuild**		**11/27/28**	**1/4/29**	**29 days**		
99	Install New Floor Structure	IN	11/27/28	12/1/28	5 days	97	101,100SS+3
100	Reinstall Utilities Under Floor	IN	11/30/28	12/6/28	5 days	99SS+3 days	101FF
101	Install New Decking	over	12/4/28	12/8/28	5 days	99,100FF	102
102	Install New Roof	over	12/11/28	12/22/28	10 days	101	104FF+5 day
103	Install New Fire Sprinkler Piping	over	12/18/28	12/29/28	10 days	102FF+5 day	107
104	Install New Skylights	over	12/25/28	12/29/28	5 days	102FF+5 day	107
105	Finishes / Sealants	over	12/25/28	12/29/28	5 days	102FF+5 day	107
106	Reinstall Utilities Above Floor	over	12/25/28	12/29/28	5 days	102FF+5 day	107
107	Clean Area	over	1/1/29	1/2/29	2 days	105,106,104	108
108	Final Inspection	over	1/3/29	1/4/29	2 days	107	84
109	**Roof A-2**		**11/6/28**	**2/6/29**	**67 days**		
110	**Demolition**		**11/6/28**	**12/6/28**	**23 days**		
111	Mobilize for Roof A-2		11/6/28	11/6/28	1 day	94	112
112	Remove Disconnected Utilities	IN / ov	11/7/28	11/8/28	2 days	111	113
113	Remove Roof	over	11/9/28	11/22/28	10 days	112	114
114	Remove Structure / Walls	over	11/23/28	11/29/28	5 days	113	115
115	Remove Decking / Supports	over	11/30/28	12/6/28	5 days	114	118,116FF
116	Remove Debris to Shore	over	11/9/28	12/6/28	20 days	115FF	82SS+5 days
117	**Piles**		**12/7/28**	**12/27/28**	**15 days**		
118	Remove Piles	IN	12/7/28	12/13/28	5 days	115	119
119	Install New Piles	IN	12/14/28	12/27/28	10 days	118	121
120	**Rebuild**		**12/28/28**	**2/6/29**	**29 days**		
121	Install New Floor Structure	IN	12/28/28	1/3/29	5 days	119	123,122SS+3
122	Reinstall Utilities Under Floor	IN	1/2/29	1/8/29	5 days	121SS+3 day	123FF
123	Install New Decking	over	1/4/29	1/10/29	5 days	121,122FF	124
124	Install New Roof	over	1/11/29	1/24/29	10 days	123	129,126FF+5
125	Install New Fire Sprinkler Piping	over	1/18/29	1/31/29	10 days	124FF+5 day	129
126	Install New Skylights	over	1/25/29	1/31/29	5 days	124FF+5 day	129
127	Finishes / Sealants	over	1/25/29	1/31/29	5 days	124FF+5 day	129
128	Reinstall Utilities Above Floor	over	1/25/29	1/31/29	5 days	124FF+5 day	129
129	Clean Area	over	2/1/29	2/2/29	2 days	124,127,128	130
130	Final Inspection	over	2/5/29	2/6/29	2 days	129	84
131	**Roof A-3**		**12/7/28**	**3/14/29**	**70 days**		
132	**Demolition**		**12/7/28**	**1/11/29**	**26 days**		
133	Mobilize for Roof A-3		12/7/28	12/7/28	1 day	116	134
134	Remove Disconnected Utilities	IN / ov	12/8/28	12/14/28	5 days	133	135
135	Remove Roof	over	12/15/28	12/28/28	10 days	134	136
136	Remove Structure / Walls	over	12/29/28	1/4/29	5 days	135	137
137	Remove Decking / Supports	over	1/5/29	1/11/29	5 days	136	140,138FF
138	Remove Debris to Shore	over	12/15/28	1/11/29	20 days	137FF	83SS+5 days
139	**Piles**		**1/12/29**	**2/1/29**	**15 days**		
140	Remove Piles	IN	1/12/29	1/18/29	5 days	137	141
141	Install New Piles	IN	1/19/29	2/1/29	10 days	140	143
142	**Rebuild**		**2/2/29**	**3/14/29**	**29 days**		
143	Install New Floor Structure	IN	2/2/29	2/8/29	5 days	141	145,144SS+3

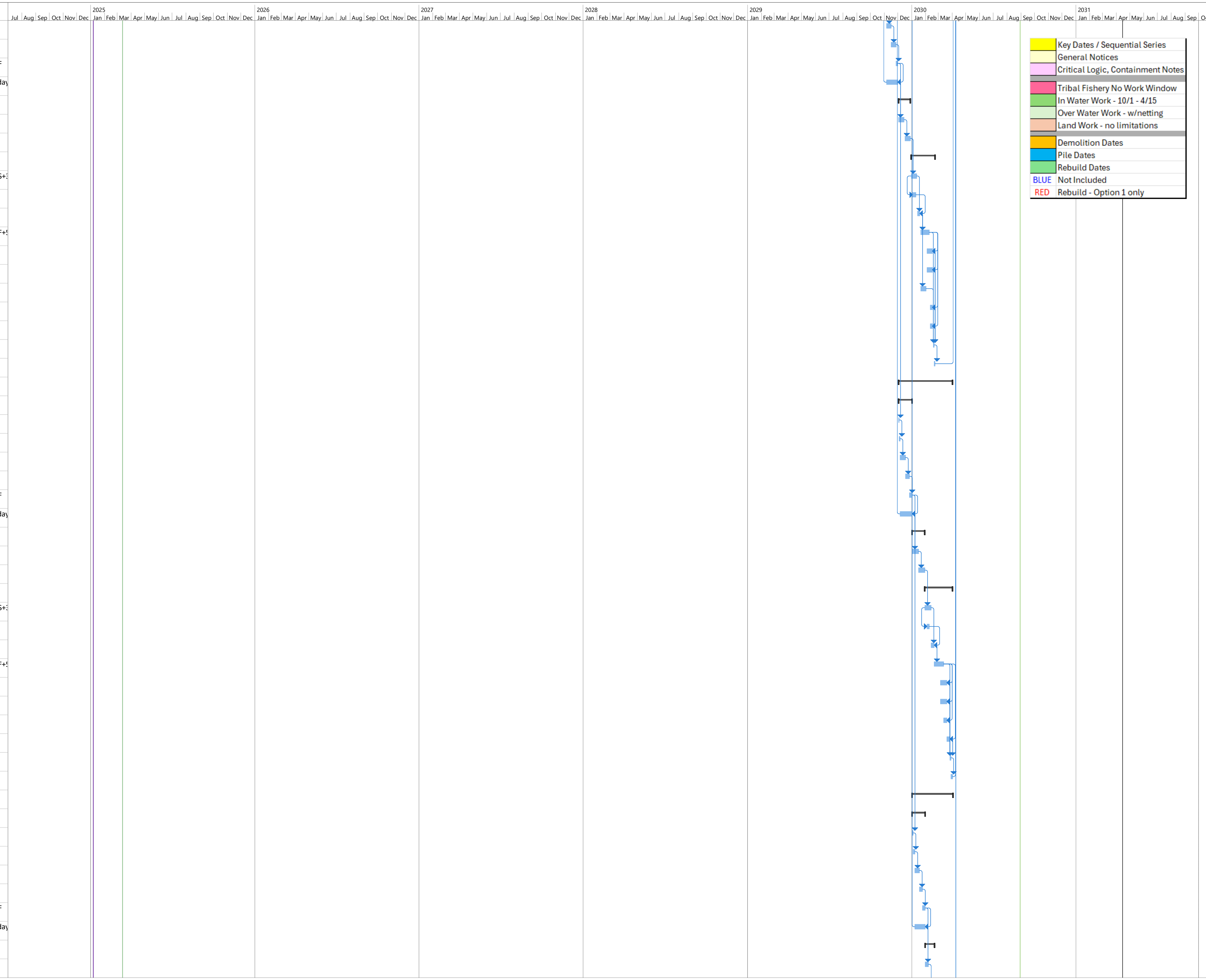


ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
144	Reinstall Utilities Under Floor	IN	2/7/29	2/13/29	5 days	143SS+3 day	145FF
145	Install New Decking	over	2/9/29	2/15/29	5 days	143,144FF	146
146	Install New Roof	over	2/16/29	3/1/29	10 days	145	152,148FF+5
147	Install New Fire Sprinkler Piping	over	2/23/29	3/8/29	10 days	146FF+5 day	149FF
148	Install New Skylights	over	3/2/29	3/8/29	5 days	146FF+5 day	152
149	Build CMU FP riser room ON LAND	over	2/16/29	3/8/29	15 days	147FF	152
150	Finishes / Sealants	over	3/2/29	3/8/29	5 days	146FF+5 day	152
151	Reinstall Utilities Above Floor	over	3/2/29	3/8/29	5 days	146FF+5 day	152
152	Clean Area	over	3/9/29	3/12/29	2 days	146,150,151	153
153	Final Inspection	over	3/13/29	3/14/29	2 days	152	84
154	**Dock B**		**9/11/29**	**4/9/30**	**151 days**		
155	delay start until Fall 2029		9/11/29	9/11/29	1 day	60SS-14 day	156
156	Project Re-Mobilization		9/12/29	9/25/29	10 days	155	157
157	Mobilize for Dock B		9/26/29	10/2/29	5 days	156	158FF
158	Review Safety and Work Conditions		10/2/29	10/2/29	1 day	157FF	159FF
159	Haz Mat / Safety Inspections		10/2/29	10/2/29	1 day	158FF	160FF
160	Not Incl - Haz Mat Remediation		10/2/29	10/2/29	1 day	159FF	161FF
161	Install Debris Containment Boom 5x10	IN	10/2/29	10/2/29	1 day	160FF	162FF
162	De-energize / Disable Utilities	land	10/1/29	10/2/29	2 days	161FF	172
163	Haul Away B-1 Shore Debris	land	10/12/29	11/15/29	25 days	176SS+5 day	
164	Haul Away B-2 Shore Debris	land	11/13/29	12/17/29	25 days	198SS+5 day	
165	Haul Away B-3 Shore Debris	land	12/13/29	1/16/30	25 days	221SS+5 day	
166	Haul Away B-4 Shore Debris	land	1/15/30	2/11/30	20 days	243SS+5 day	
167	Re-energize / Re-enable Utilities	land	4/3/30	4/9/30	5 days	190,213,23	168FF
168	Remove Debris Containment Boom 5x10	IN	4/9/30	4/9/30	1 day	167FF	169
169	Dock B Construction Complete		4/9/30	4/9/30	0 days	168	388
170	**Roof B-1**		**10/3/29**	**1/22/30**	**80 days**		
171	**Demolition**		**10/3/29**	**10/31/29**	**21 days**		
172	Remove Disconnected Utilities	IN / ov	10/3/29	10/4/29	2 days	162	173
173	Remove Roof 5x10	over	10/5/29	10/16/29	8 days	172	174
174	Remove Structure / Walls 5x10	over	10/17/29	10/25/29	7 days	173	175
175	Remove Decking / Supports 5x10	over	10/26/29	10/31/29	4 days	174	178,176FF
176	Remove Debris to Shore 5x10	over	10/5/29	10/31/29	19 days	175FF	163SS+5 day
177	**Piles**		**11/1/29**	**11/28/29**	**20 days**		
178	Remove Piles	IN	11/1/29	11/14/29	10 days	175	179
179	Install New Piles	IN	11/15/29	11/28/29	10 days	178	181
180	**Rebuild**		**11/29/29**	**1/22/30**	**39 days**		
181	Install New Floor Structure	IN	11/29/29	12/12/29	10 days	179	183,182SS+3
182	Reinstall Utilities Under Floor	IN	12/4/29	12/10/29	5 days	181SS+3 day	183FF
183	Install New Decking	over	12/13/29	12/19/29	5 days	181,182FF	184
184	Install New Roof	over	12/20/29	1/9/30	15 days	183	189,186FF+5
185	Install New Fire Sprinkler Piping	over	1/3/30	1/16/30	10 days	184FF+5 day	189
186	Install New Skylights	over	1/3/30	1/16/30	10 days	184FF+5 day	189
187	Finishes / Sealants	over	1/10/30	1/16/30	5 days	184FF+5 day	189
188	Reinstall Utilities Above Floor	over	1/10/30	1/16/30	5 days	184FF+5 day	189
189	Clean Area	over	1/17/30	1/18/30	2 days	187,188,184	190
190	Final Inspection	over	1/21/30	1/22/30	2 days	189	167
191	**Roof B-2**		**11/1/29**	**2/21/30**	**81 days**		
192	**Demolition**		**11/1/29**	**11/30/29**	**22 days**		
193	Mobilize for Roof B-2		11/1/29	11/1/29	1 day	176	194
194	Remove Disconnected Utilities	IN / ov	11/2/29	11/5/29	2 days	193	195



Calendar is working days, simple 5 day 8 hours / day = 40 hour work week, with basic holidays

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
195	Remove Roof 5x10	over	11/6/29	11/15/29	8 days	194	196
196	Remove Structure / Walls 5x10	over	11/16/29	11/26/29	7 days	195	197
197	Remove Decking / Supports 5x10	over	11/27/29	11/30/29	4 days	196	200,198FF
198	Remove Debris to Shore 5x10	over	11/6/29	11/30/29	19 days	197FF	164SS+5 day
199	**Piles**		**12/3/29**	**12/28/29**	**20 days**		
200	Remove Piles	IN	12/3/29	12/14/29	10 days	197	201
201	Install New Piles	IN	12/17/29	12/28/29	10 days	200	203
202	**Rebuild**		**12/31/29**	**2/21/30**	**39 days**		
203	Install New Floor Structure	IN	12/31/29	1/11/30	10 days	201	205,204SS+3
204	Reinstall Utilities Under Floor	IN	1/3/30	1/9/30	5 days	203SS+3 day	205FF
205	Install New Decking	over	1/14/30	1/18/30	5 days	203,204FF	209,206
206	Install New Roof	over	1/21/30	2/8/30	15 days	205	212,208FF+5
207	Install New Fire Sprinkler Piping	over	2/4/30	2/15/30	10 days	206FF+5 day	212
208	Install New Skylights	over	2/4/30	2/15/30	10 days	206FF+5 day	212
209	Install new Transformer PLATFORM	over	1/21/30	2/1/30	10 days	205	212
210	Finishes / Sealants	over	2/11/30	2/15/30	5 days	206FF+5 day	212
211	Reinstall Utilities Above Floor	over	2/11/30	2/15/30	5 days	206FF+5 day	212
212	Clean Area	over	2/18/30	2/19/30	2 days	206,211,210	213
213	Final Inspection	over	2/20/30	2/21/30	2 days	212	167
214	**Roof B-3**		**12/3/29**	**4/1/30**	**86 days**		
215	**Demolition**		**12/3/29**	**1/1/30**	**22 days**		
216	Mobilize for Roof B-3		12/3/29	12/3/29	1 day	198	217
217	Remove Disconnected Utilities	IN / ov	12/4/29	12/5/29	2 days	216	218
218	Remove Roof 5x10	over	12/6/29	12/17/29	8 days	217	219
219	Remove Structure / Walls 5x10	over	12/18/29	12/26/29	7 days	218	220
220	Remove Decking / Supports 5x10	over	12/27/29	1/1/30	4 days	219	223,221FF
221	Remove Debris to Shore 5x10	over	12/6/29	1/1/30	19 days	220FF	165SS+5 day
222	**Piles**		**1/2/30**	**1/29/30**	**20 days**		
223	Remove Piles	IN	1/2/30	1/15/30	10 days	220	224
224	Install New Piles	IN	1/16/30	1/29/30	10 days	223	226
225	**Rebuild**		**1/30/30**	**4/1/30**	**44 days**		
226	Install New Floor Structure	IN	1/30/30	2/12/30	10 days	224	228,227SS+3
227	Reinstall Utilities Under Floor	IN	2/4/30	2/8/30	5 days	226SS+3 day	228FF
228	Install New Decking	over	2/13/30	2/19/30	5 days	226,227FF	229
229	Install New Roof	over	2/20/30	3/12/30	15 days	228	234,231FF+5
230	Install New Fire Sprinkler Piping	over	3/6/30	3/19/30	10 days	229FF+5 day	234
231	Install New Skylights	over	3/6/30	3/19/30	10 days	229FF+5 day	234
232	Finishes / Sealants	over	3/13/30	3/19/30	5 days	229FF+5 day	234
233	Reinstall Utilities Above Floor	over	3/20/30	3/26/30	5 days	229FF+10 da	234
234	Clean Area	over	3/27/30	3/28/30	2 days	233,232,229	235
235	Final Inspection	over	3/29/30	4/1/30	2 days	234	167
236	**Roof B-4**		**1/2/30**	**4/2/30**	**65 days**		
237	**Demolition**		**1/2/30**	**1/30/30**	**21 days**		
238	Mobilize for Roof B-4		1/2/30	1/3/30	2 days	221	239
239	Remove Disconnected Utilities	IN / ov	1/4/30	1/7/30	2 days	238	240
240	Remove Roof 5x10	over	1/8/30	1/17/30	8 days	239	241
241	Remove Structure / Walls 5x10	over	1/18/30	1/24/30	5 days	240	242
242	Remove Decking / Supports 5x10	over	1/25/30	1/30/30	4 days	241	245,243FF
243	Remove Debris to Shore 5x10	over	1/8/30	1/30/30	17 days	242FF	166SS+5 day
244	**Piles**		**1/31/30**	**2/20/30**	**15 days**		
245	Remove Piles	IN	1/31/30	2/6/30	5 days	242	246



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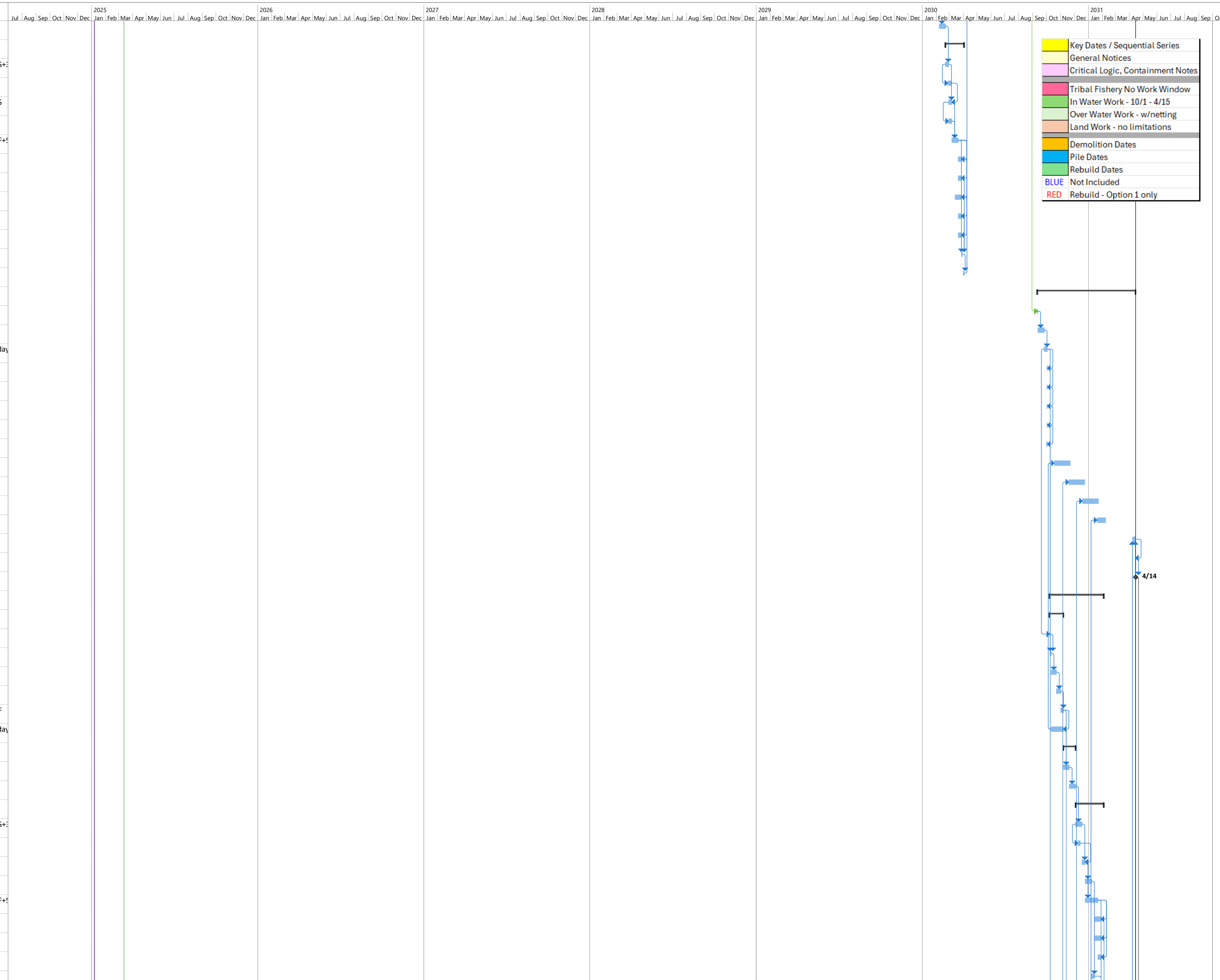
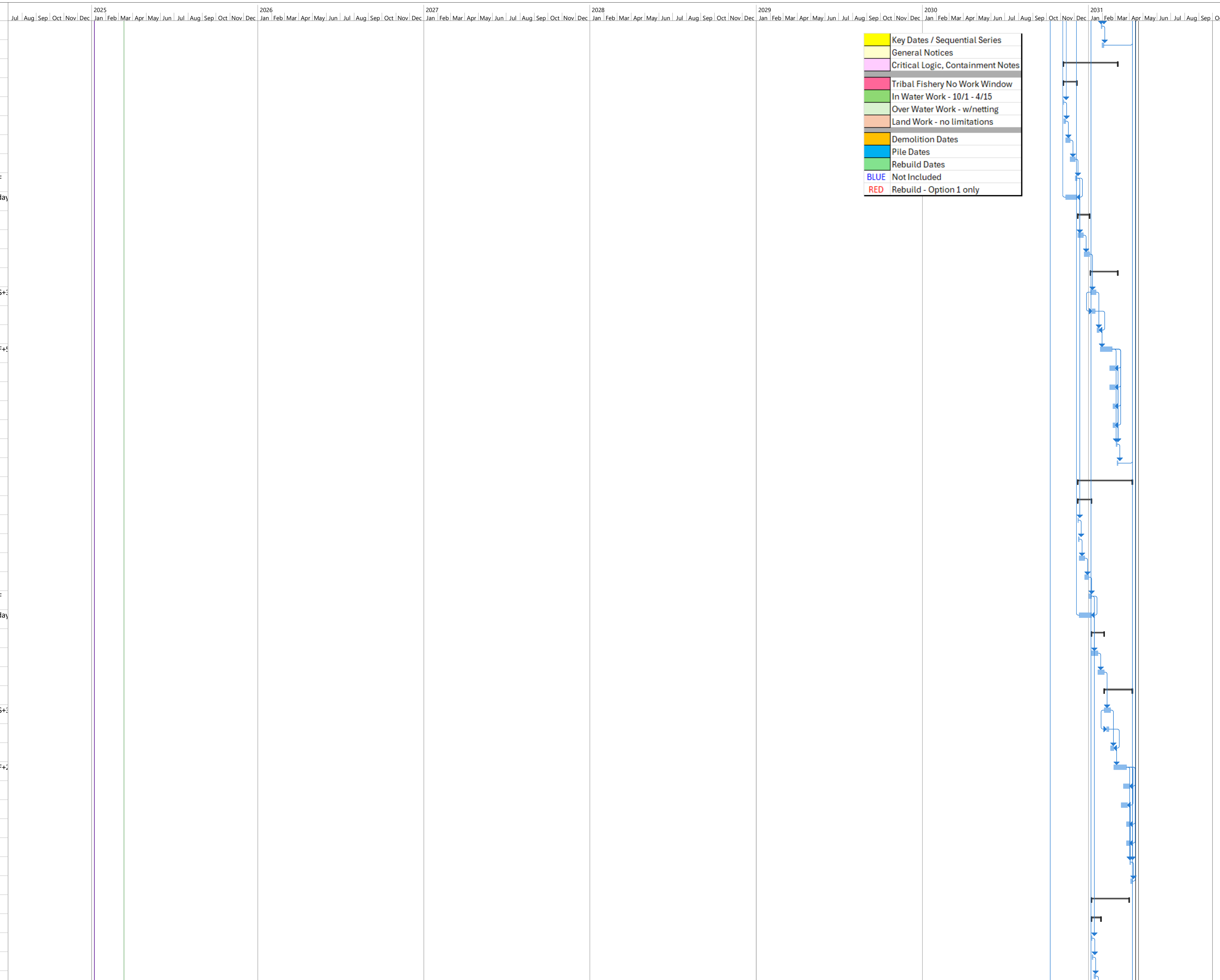
PORT OF SEATTLE - Salmon Bay - Option #1 - REMOVE / REPLACE - ROOF, STRUCTURE, WALLS, DECKING, PILES

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
246	Install New Piles	IN	2/7/30	2/20/30	10 days	245	248
247	**Rebuild**		**2/21/30**	**4/2/30**	**29 days**		
248	Install New Floor Structure	IN	2/21/30	2/27/30	5 days	246	250,249SS+
249	Reinstall Utilities Under Floor	IN	2/26/30	3/4/30	5 days	248SS+3 day	250FF
250	Install New Decking	over	2/28/30	3/6/30	5 days	248,249FF	252,251SS
251	Install New ADA Decking - B-4	over	2/28/30	3/6/30	5 days	250SS	252
252	Install New Roof	over	3/7/30	3/20/30	10 days	250,251	258,254FF+
253	Install New Fire Sprinkler Piping	over	3/21/30	3/27/30	5 days	252FF+5 day	255FF
254	Install New Skylights	over	3/21/30	3/27/30	5 days	252FF+5 day	258
255	Build CMU FP riser room ON LAND	land	3/14/30	3/27/30	10 days	253FF	257FF
256	Finishes / Sealants	over	3/21/30	3/27/30	5 days	252FF+5 day	258
257	Reinstall Utilities Above Floor	over	3/21/30	3/27/30	5 days	252FF+5 day	258
258	Clean Area	over	3/28/30	3/29/30	2 days	257,256,252	259
259	Final Inspection	over	4/1/30	4/2/30	2 days	258	167
260	**Dock C**		**9/11/30**	**4/14/31**	**154 days**		
261	delay start until Fall 2030		9/11/30	9/11/30	1 day	64SS-14 day	262
262	Project Re-Mobilization		9/12/30	9/25/30	10 days	261	263
263	Mobilize for Dock C		9/26/30	10/2/30	5 days	262	278SS+8 day
264	Review Safety and Work Conditions		10/2/30	10/2/30	1 day	263FF	265FF
265	Haz Mat / Safety Inspections		10/2/30	10/2/30	1 day	264FF	266FF
266	Not Incl - Haz Mat Remediation		10/2/30	10/2/30	1 day	265FF	267FF
267	Install Debris Containment Boom 5x10	IN	10/2/30	10/2/30	1 day	266FF	268FF
268	De-energize / Disable Utilities	land	10/1/30	10/2/30	2 days	267FF	279
269	Haul Away C-1 Shore Debris	land	10/18/30	11/21/30	25 days	283SS+5 day	
270	Haul Away C-2 Shore Debris	land	11/19/30	12/23/30	25 days	306SS+5 day	
271	Haul Away C-3 Shore Debris	land	12/19/30	1/22/31	25 days	328SS+5 day	
272	Haul Away C-4 Shore Debris	land	1/20/31	2/7/31	15 days	350SS+5 day	
273	Re-energize / Re-enable Utilities	land	4/8/31	4/14/31	5 days	298,320,342	274FF
274	Remove Debris Containment Boom 5x10	IN	4/14/31	4/14/31	1 day	273FF	275
275	Dock C Construction Complete		4/14/31	4/14/31	0 days	274	388
276	**Roof C-1**		**10/8/30**	**2/3/31**	**85 days**		
277	**Demolition**		**10/8/30**	**11/6/30**	**22 days**		
278	Mobilize for Roof C-1		10/8/30	10/8/30	1 day	263SS+8 day	279
279	Remove Disconnected Utilities	IN / ov	10/9/30	10/10/30	2 days	278,268	280
280	Remove Roof 5x10	over	10/11/30	10/22/30	8 days	279	281
281	Remove Structure / Walls 5x10	over	10/23/30	10/31/30	7 days	280	282
282	Remove Decking / Supports 5x10	over	11/1/30	11/6/30	4 days	281	285,283FF
283	Remove Debris to Shore 5x10	over	10/11/30	11/6/30	19 days	282FF	269SS+5 day
284	**Piles**		**11/7/30**	**12/3/30**	**19 days**		
285	Remove Piles	IN	11/7/30	11/19/30	9 days	282	286
286	Install New Piles	IN	11/20/30	12/3/30	10 days	285	288
287	**Rebuild**		**12/4/30**	**2/3/31**	**44 days**		
288	Install New Floor Structure	IN	12/4/30	12/17/30	10 days	286	290,289SS+
289	Reinstall Utilities Under Floor	IN	12/9/30	12/13/30	5 days	288SS+3 day	290FF
290	Install New Decking	over	12/18/30	12/24/30	5 days	288,289FF	291,292
291	Install New Transformer PLATFORM	over	12/25/30	1/7/31	10 days	290	296
292	Install New Roof	over	12/25/30	1/21/31	20 days	290	297,294FF+
293	Install New Fire Sprinkler Piping	over	1/15/31	1/28/31	10 days	292FF+5 day	297
294	Install New Skylights	over	1/15/31	1/28/31	10 days	292FF+5 day	297
295	Finishes / Sealants	over	1/22/31	1/28/31	5 days	292FF+5 day	297
296	Reinstall Utilities Above Floor	over	1/8/31	1/14/31	5 days	291	297

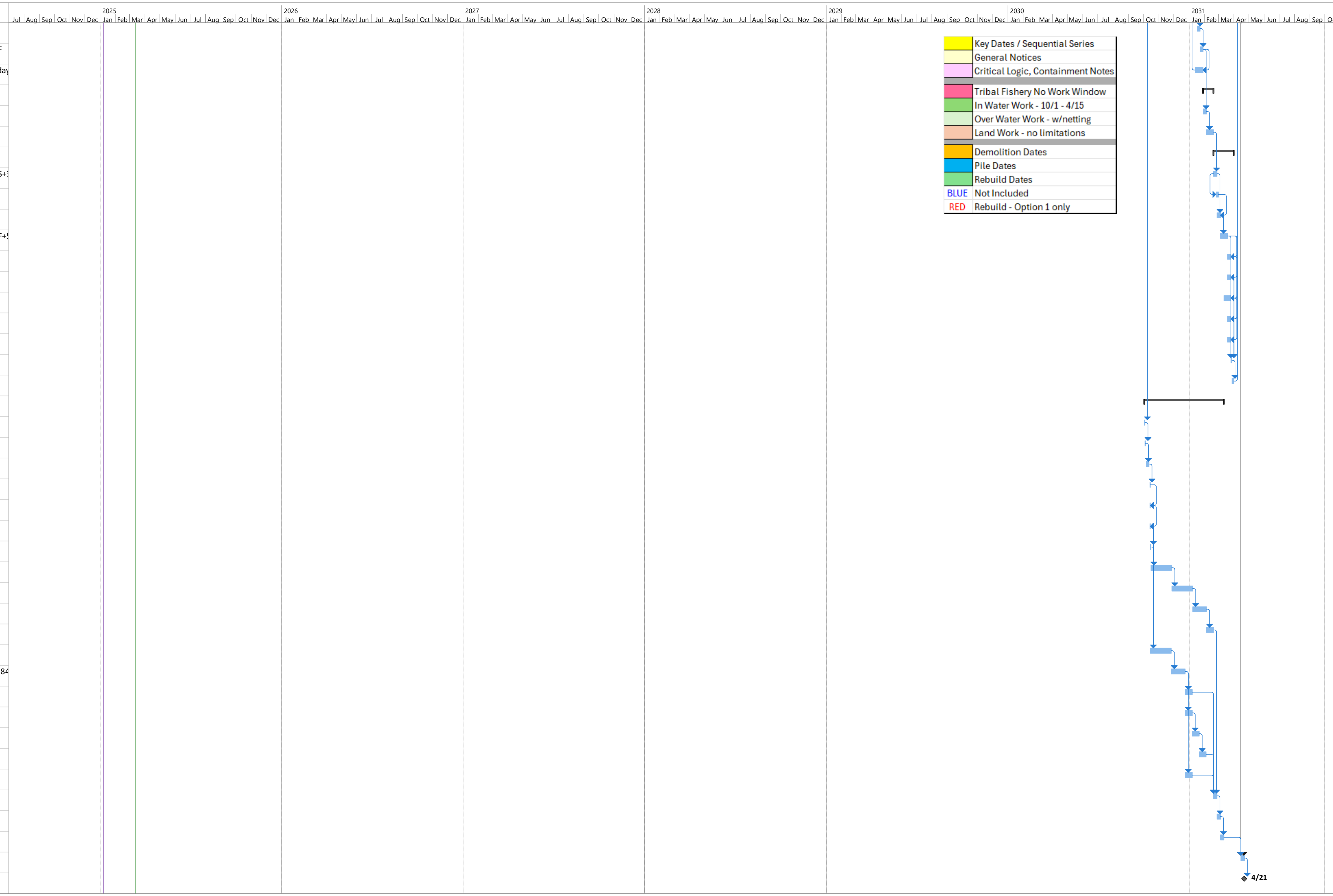


PORT OF SEATTLE - Salmon Bay - Option #1 - REMOVE / REPLACE - ROOF, STRUCTURE, WALLS, DECKING, PILES

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
297	Clean Area	over	1/29/31	1/30/31	2 days	296,295,292	298
298	Final Inspection	over	1/31/31	2/3/31	2 days	297	273
299	**Roof C-2**		**11/7/30**	**3/6/31**	**86 days**		
300	**Demolition**		**11/7/30**	**12/6/30**	**22 days**		
301	Mobilize for Roof C-2		11/7/30	11/7/30	1 day	283	302
302	Remove Disconnected Utilities	IN / ov	11/8/30	11/11/30	2 days	301	303
303	Remove Roof 5x10	over	11/12/30	11/21/30	8 days	302	304
304	Remove Structure / Walls 5x10	over	11/22/30	12/2/30	7 days	303	305
305	Remove Decking / Supports 5x10	over	12/3/30	12/6/30	4 days	304	308,306FF
306	Remove Debris to Shore 5x10	over	11/12/30	12/6/30	19 days	305FF	270SS+5 day
307	**Piles**		**12/9/30**	**1/3/31**	**20 days**		
308	Remove Piles	IN	12/9/30	12/20/30	10 days	305	309
309	Install New Piles	IN	12/23/30	1/3/31	10 days	308	311
310	**Rebuild**		**1/6/31**	**3/6/31**	**44 days**		
311	Install New Floor Structure	IN	1/6/31	1/17/31	10 days	309	313,312SS+3
312	Reinstall Utilities Under Floor	IN	1/9/31	1/15/31	5 days	311SS+3 day	313FF
313	Install New Decking	over	1/20/31	1/24/31	5 days	311,312FF	314
314	Install New Roof	over	1/27/31	2/21/31	20 days	313	319,316FF+5
315	Install New Fire Sprinkler Piping	over	2/17/31	2/28/31	10 days	314FF+5 day	319
316	Install New Skylights	over	2/17/31	2/28/31	10 days	314FF+5 day	319
317	Finishes / Sealants	over	2/24/31	2/28/31	5 days	314FF+5 day	319
318	Reinstall Utilities Above Floor	over	2/24/31	2/28/31	5 days	314FF+5 day	319
319	Clean Area	over	3/3/31	3/4/31	2 days	318,317,314	320
320	Final Inspection	over	3/5/31	3/6/31	2 days	319	273
321	**Roof C-3**		**12/9/30**	**4/7/31**	**86 days**		
322	**Demolition**		**12/9/30**	**1/7/31**	**22 days**		
323	Mobilize for Roof C-3		12/9/30	12/9/30	1 day	306	324
324	Remove Disconnected Utilities	IN / ov	12/10/30	12/11/30	2 days	323	325
325	Remove Roof 5x10	over	12/12/30	12/23/30	8 days	324	326
326	Remove Structure / Walls 5x10	over	12/24/30	1/1/31	7 days	325	327
327	Remove Decking / Supports 5x10	over	1/2/31	1/7/31	4 days	326	330,328FF
328	Remove Debris to Shore 5x10	over	12/12/30	1/7/31	19 days	327FF	271SS+5 day
329	**Piles**		**1/8/31**	**2/4/31**	**20 days**		
330	Remove Piles	IN	1/8/31	1/21/31	10 days	327	331
331	Install New Piles	IN	1/22/31	2/4/31	10 days	330	333
332	**Rebuild**		**2/5/31**	**4/7/31**	**44 days**		
333	Install New Floor Structure	IN	2/5/31	2/18/31	10 days	331	335,334SS+3
334	Reinstall Utilities Under Floor	IN	2/10/31	2/14/31	5 days	333SS+3 day	335FF
335	Install New Decking	over	2/19/31	2/25/31	5 days	333,334FF	336
336	Install New Roof	over	2/26/31	3/25/31	20 days	335	341,338FF+2
337	Install New Fire Sprinkler Piping	over	3/19/31	4/1/31	10 days	336FF+5 day	341
338	Install New Skylights	over	3/14/31	3/27/31	10 days	336FF+2 day	341
339	Finishes / Sealants	over	3/26/31	4/1/31	5 days	336FF+5 day	341
340	Reinstall Utilities Above Floor	over	3/26/31	4/1/31	5 days	336FF+5 day	341
341	Clean Area	over	4/2/31	4/3/31	2 days	340,339,336	342
342	Final Inspection	over	4/4/31	4/7/31	2 days	341	273
343	**Roof C-4**		**1/8/31**	**3/31/31**	**59 days**		
344	**Demolition**		**1/8/31**	**1/28/31**	**15 days**		
345	Mobilize for Roof C-4		1/8/31	1/8/31	1 day	328	346
346	Remove Disconnected Utilities	IN / ov	1/9/31	1/10/31	2 days	345	347
347	Remove Roof 5x10	over	1/13/31	1/16/31	4 days	346	348

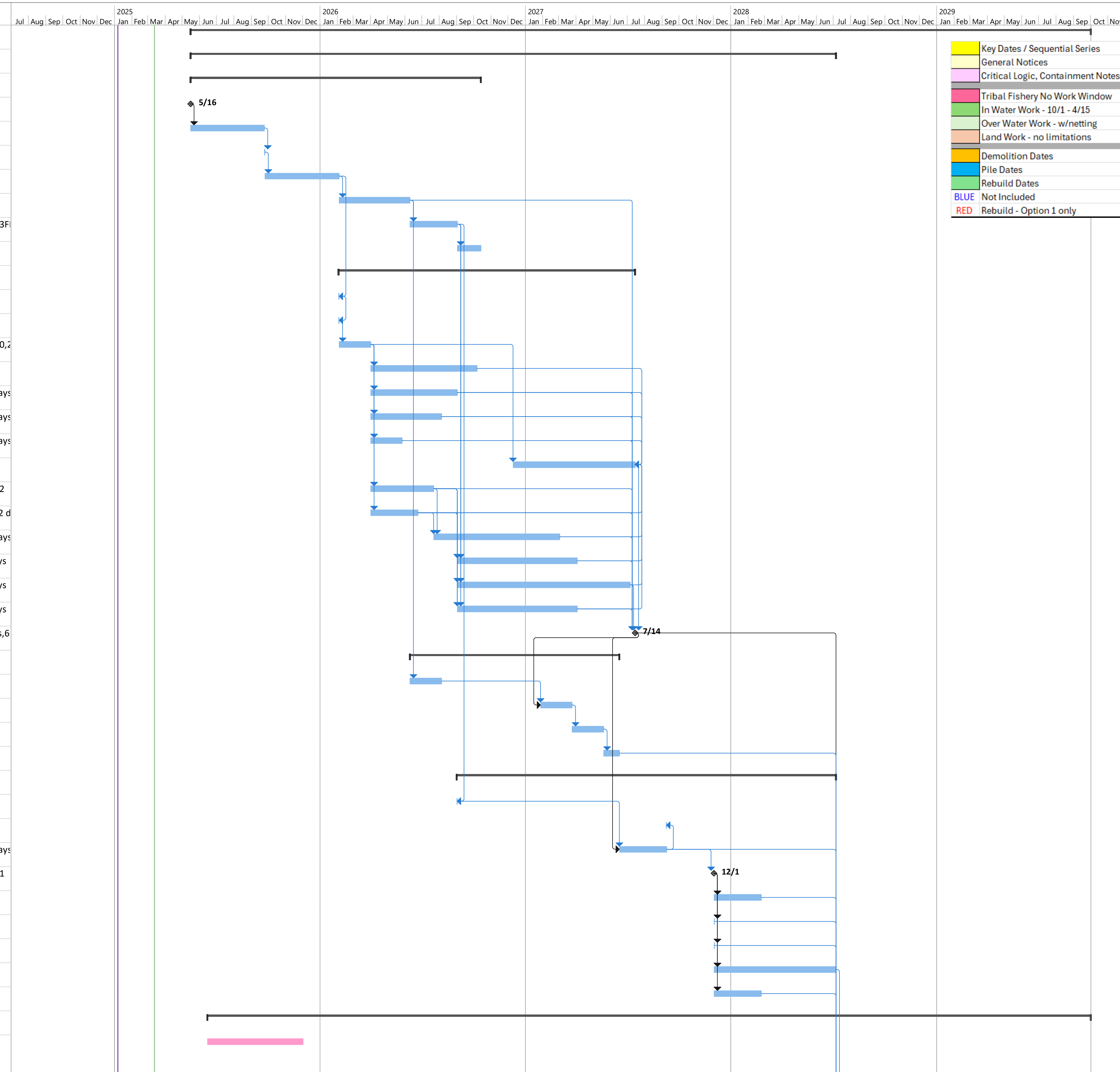


ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
348	Remove Structure / Walls 5x10	over	1/17/31	1/22/31	4 days	347	349
349	Remove Decking / Supports 5x10	over	1/23/31	1/28/31	4 days	348	352,350FF
350	Remove Debris to Shore 5x10	over	1/13/31	1/28/31	12 days	349FF	272SS+5 day
351	**Piles**		**1/29/31**	**2/18/31**	**15 days**		
352	Remove Piles	IN	1/29/31	2/4/31	5 days	349	353
353	Install New Piles	IN	2/5/31	2/18/31	10 days	352	355
354	**Rebuild**		**2/19/31**	**3/31/31**	**29 days**		
355	Install New Floor Structure	IN	2/19/31	2/25/31	5 days	353	357,356SS+3
356	Reinstall Utilities Under Floor	IN	2/24/31	2/28/31	5 days	355SS+3 day	357FF
357	Install New Decking	over	2/26/31	3/4/31	5 days	355,356FF	358
358	Install New Roof	over	3/5/31	3/18/31	10 days	357	364,360FF+5
359	Install New Fire Sprinkler Piping	over	3/19/31	3/25/31	5 days	358FF+5 day	361FF
360	Install New Skylights	over	3/19/31	3/25/31	5 days	358FF+5 day	364
361	Build CMU FP riser room ON LAND	over	3/12/31	3/25/31	10 days	359FF	363FF
362	Finishes / Sealants	over	3/19/31	3/25/31	5 days	358FF+5 day	364
363	Reinstall Utilities Above Floor	over	3/19/31	3/25/31	5 days	361FF	364
364	Clean Area	over	3/26/31	3/27/31	2 days	363,362,358	365
365	Final Inspection	over	3/28/31	3/31/31	2 days	364	273
366	**Land Side Work**		**10/3/30**	**3/11/31**	**114 days**		
367	Not limited by Fish Windows	land	10/3/30	10/3/30	1 day	263	368
368	Start work with Dock C. (not required)	land	10/4/30	10/4/30	1 day	367	369
369	Mobilize for Land Side Work	land	10/7/30	10/11/30	5 days	368	370
370	Review Safety and Work Conditions	land	10/14/30	10/14/30	1 day	369	371FF
371	Haz Mat / Safety Inspections	land	10/14/30	10/14/30	1 day	370FF	372FF
372	Not Incl - Haz Mat Remediation	land	10/14/30	10/14/30	1 day	371FF	373,378
373	De-energize / Disable Utilities	land	10/15/30	10/15/30	1 day	372	374
374	Build New Electrical Equipment Bldg	land	10/16/30	11/26/30	30 days	373	375
375	Install Electrical Equipment in Building	land	11/27/30	1/7/31	30 days	374	376
376	Electrical Infrastructure Work	land	1/8/31	2/4/31	20 days	375	377
377	Install New Lighting / bollards	land	2/5/31	2/18/31	10 days	376	385
378	Build New Pump Room	land	10/15/30	11/25/30	30 days	372	379
379	Install Equipment in New Pump Room	land	11/26/30	12/23/30	20 days	378	380,381,384
380	Install New Piping from Water Main	land	12/24/30	1/6/31	10 days	379	385
381	Install New Fire Riser Piping - Dock A	land	12/24/30	1/6/31	10 days	379	382
382	Install New Fire Riser Piping - Dock B	land	1/7/31	1/20/31	10 days	381	383
383	Install New Fire Riser Piping - Dock C	land	1/21/31	2/3/31	10 days	382	385
384	Replace Potable Water system	land	12/24/30	1/6/31	10 days	379	385
385	Testing / Inspections	land	2/19/31	2/25/31	5 days	377,384,383	386
386	Re-energize / Re-enable Utilities	land	2/26/31	3/4/31	5 days	385	387
387	Land Side Construction Complete	land	3/5/31	3/11/31	5 days	386	388
388	City Inspection for Occupation	land	4/15/31	4/21/31	5 days	86,169,275,	389
389	Approval to Re-Occupy A,B,C Docks	land	4/21/31	4/21/31	0 days	388	



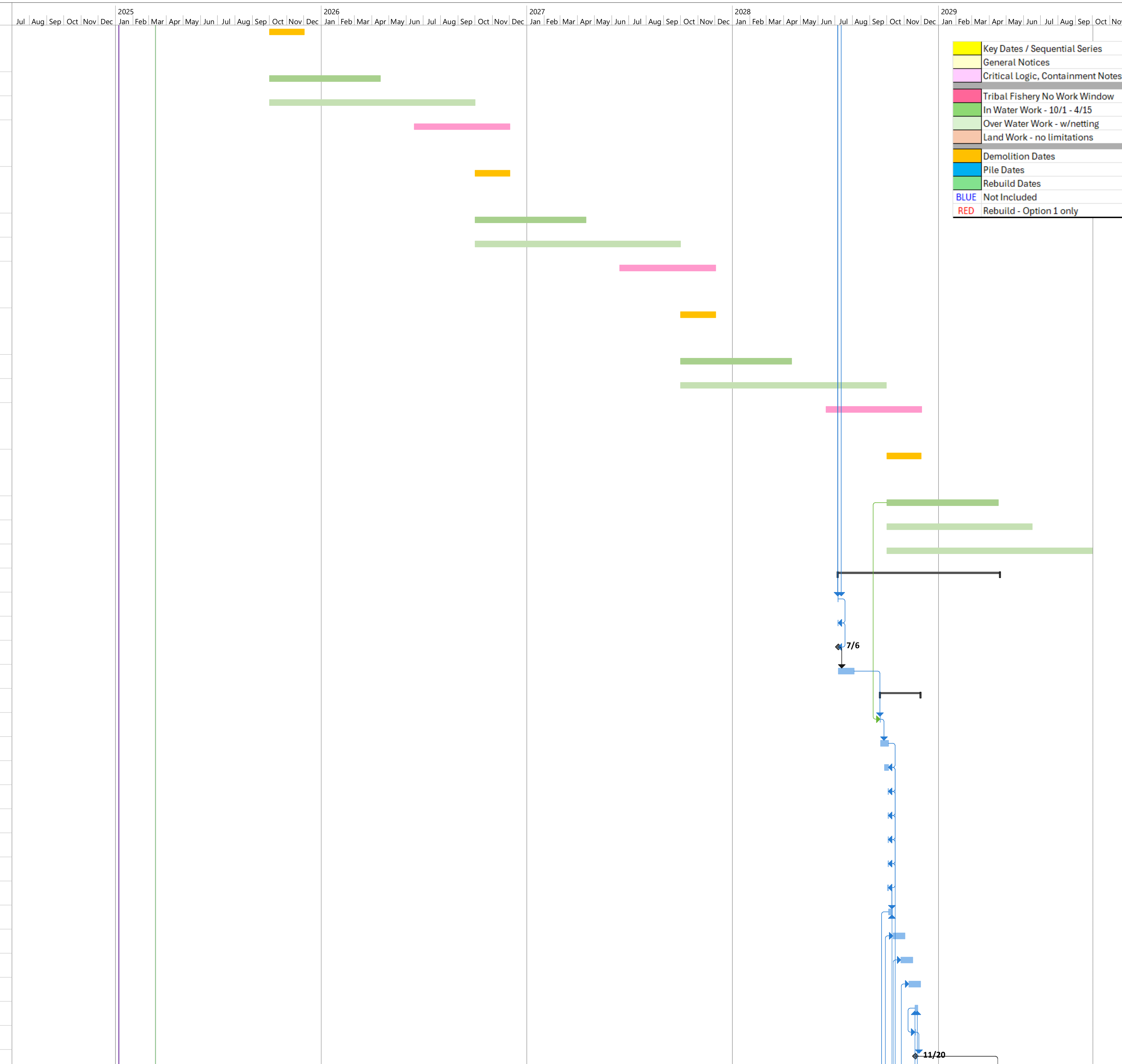
PORT OF SEATTLE - Salmon Bay - Option #2 - REMOVE - ROOF, STRUCTURE, WALLS

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
1	**SALMON BAY - Option 2 - REMOVE Roof, Walls**		**5/16/25**	**10/1/29**	**1135 days**		
2	**PROJECT PLANNING**		**5/16/25**	**7/5/28**	**812 days**		
3	**Design**		**5/16/25**	**10/13/26**	**361 days**		
4	Start Project		5/16/25	5/16/25	0 days		5
5	Bid / Award Designer		5/16/25	9/23/25	90 days	4	6
6	design dates are approximate		9/24/25	9/24/25	1 day	5	7
7	30% Design For Permitting & Surveys		9/25/25	2/3/26	90 days	6	8,12FF
8	60% Design Progress		2/4/26	6/9/26	90 days	7	9,28,26
9	90% Design Progress		6/10/26	9/1/26	60 days	8	10,25,24,23,33F
10	100% Design Progress		9/2/26	10/13/26	30 days	9	
11	**Port Permits**		**2/3/26**	**7/14/27**	**377 days**		
12	permit dates are approximate		2/3/26	2/3/26	1 day	7FF	13FF
13	start permits after 30% design		2/3/26	2/3/26	1 day	12FF	14
14	Prepare JARPA Based on 30% Design		2/4/26	3/31/26	40 days	13	15,16,17,18,20,2
15	Section 10		4/1/26	10/6/26	135 days	14	19FF+22 days
16	Section 7		4/1/26	9/1/26	110 days	14	26,19FF+22 days
17	Section 106		4/1/26	8/4/26	90 days	14	26,19FF+22 days
18	HPA		4/1/26	5/26/26	40 days	14	26,19FF+22 days
19	DNR Waterway Use Authorization		12/10/26	7/14/27	155 days	15FF+22 days,14,16FF+22 days,17FF+22 day	26
20	Preliminary Aplication and Preparation		4/1/26	7/21/26	80 days	14	26,25,24,23,22
21	SEPA		4/1/26	6/23/26	60 days	14	22,26,19FF+22 d
22	Master Use Permit (SDP) or exemption		7/22/26	3/2/27	160 days	21,20	26,19FF+22 days
23	Demolition Permit (7 months)		9/2/26	4/2/27	153 days	9,20,21	26,19FF+7 days
24	Construction Permit (10 months)		9/2/26	7/5/27	219 days	9,20,21	26,19FF+7 days
25	Grading Permit (7 months)		9/2/26	4/2/27	153 days	9,20,21	26,19FF+7 days
26	All Port Obtained Permits Ready		7/14/27	7/14/27	0 days	8,16,17,18,19,20,21,22,23,24,25	29FS-120 days,6
27	**Moorage Customer / External Relations**		**6/10/26**	**6/16/27**	**266 days**		
28	Public Meetings		6/10/26	8/4/26	40 days	8	29
29	Initial Notice to Vacate		1/28/27	3/24/27	40 days	26FS-120 days,28	30
30	Final Notice to Vacate		3/25/27	5/19/27	40 days	29	31
31	Last Day to Occupy		5/20/27	6/16/27	20 days	30	61
32	**Contractor Preparation**		**9/1/26**	**7/5/28**	**482 days**		
33	after 90% design		9/1/26	9/1/26	1 day	9FF	35
34	after DNR and all permits		9/8/27	9/8/27	1 day	35FF	
35	Contractor Bid / Award		6/17/27	9/8/27	60 days	26FS-20 days,33	61,36FS+60 days
36	Notice to Proceed - Planning / Prep		12/1/27	12/1/27	0 days	35FS+60 days	37,38,39,40,41
37	Contractor Obtained Permits - Elect		12/2/27	2/23/28	60 days	36	61
38	Not needed - Permits - Mech		12/2/27	12/2/27	1 day	36	61
39	Not needed - Permits - Plumb		12/2/27	12/2/27	1 day	36	61
40	Contractor Obtained Permits - NPDES		12/2/27	7/5/28	155 days	36	61
41	Materials & Equip demo 40 ... build 60		12/2/27	2/23/28	60 days	36	61
42	**ALLOWED WORK WINDOWS**		**6/15/25**	**10/1/29**	**1115 days**		
43	Tribal Fishery No Work 06/16 to 12/01 - NA as assumes Tribal Fishery Agreement		6/15/25	12/1/25	117 days		



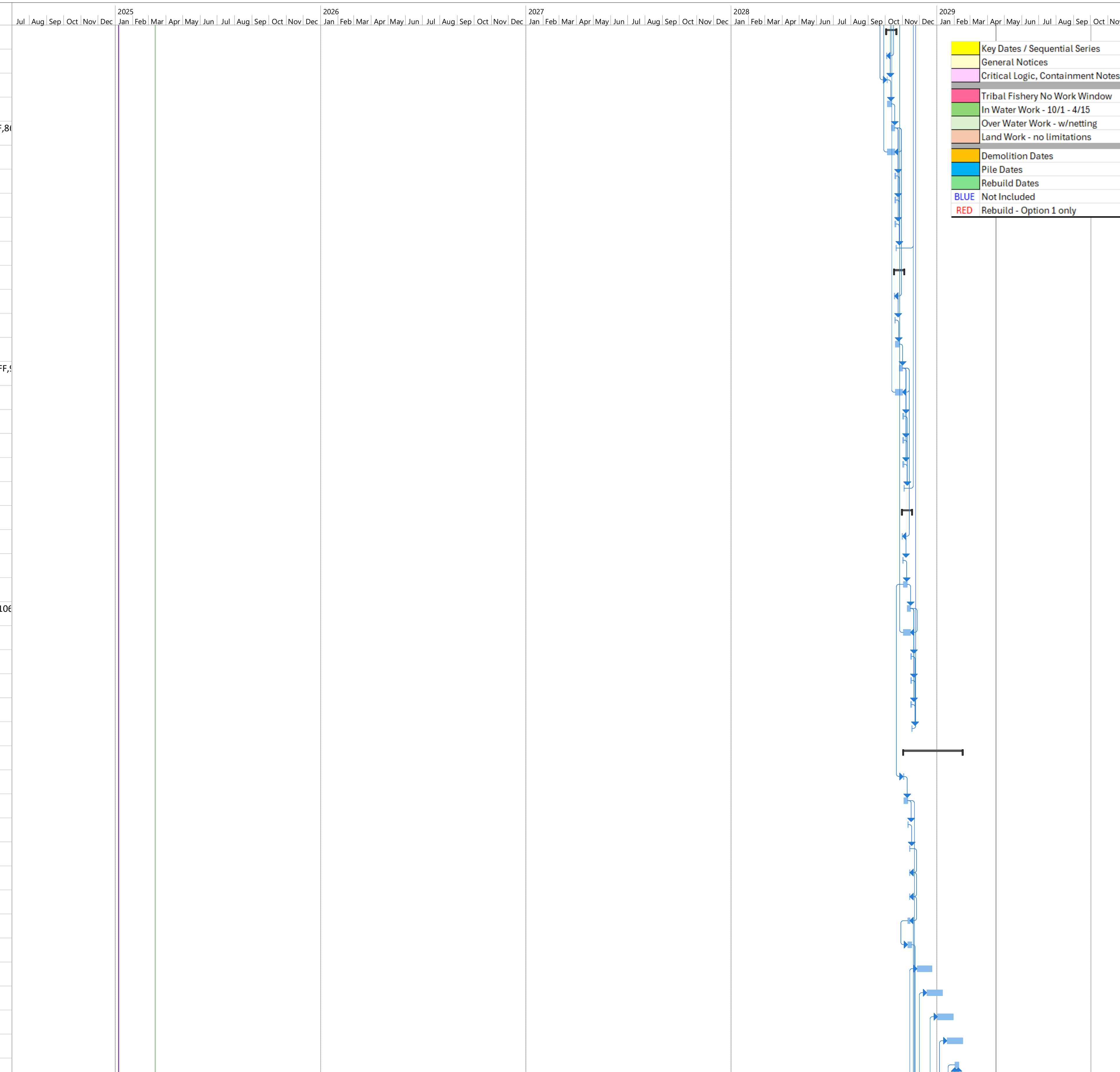
PORT OF SEATTLE - Salmon Bay - Option #2 - REMOVE - ROOF, STRUCTURE, WALLS

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
44	Tribal Fishery Agreement (assumed based on in water work window)		10/1/25	12/1/25	42 days		
45	IN WATER Work #1 - Oct 1 to Apr 15 2026		10/1/25	4/15/26	137 days		
46	OVER WATER #1 - all year (with netting)		10/1/25	9/30/26	257 days		
47	Tribal Fishery No Work 06/16 to 12/01 - NA as assumes Tribal Fishery Agreement		6/15/26	12/1/26	122 days		
48	Tribal Fishery Agreement (assumed based on in water work window)		10/1/26	12/1/26	44 days		
49	IN WATER Work #2 - Oct 1 to Apr 15 2027		10/1/26	4/15/27	141 days		
50	OVER WATER #2 - all year (with netting)		10/1/26	9/30/27	261 days		
51	Tribal Fishery No Work 06/16 to 12/01 - NA as assumes Tribal Fishery Agreement		6/15/27	12/1/27	122 days		
52	Tribal Fishery Agreement (assumed based on in water work window)		10/1/27	12/1/27	44 days		
53	IN WATER Work #3 - Oct 1 to Apr 15 2028		10/1/27	4/14/28	141 days		
54	OVER WATER #3 - all year (with netting)		10/1/27	9/29/28	261 days		
55	Tribal Fishery No Work 06/16 to 12/01 - NA as assumes Tribal Fishery Agreement		6/15/28	12/1/28	122 days		
56	Tribal Fishery Agreement (assumed based on in water work window)		10/1/28	11/30/28	44 days		
57	IN WATER Work #4 - Oct 1 to Apr 15 2029		10/1/28	4/16/29	141 days		66SS-9 days
58	OVER WATER #4 - Oct 1 to June 15 2029		10/1/28	6/15/29	185 days		
59	OVER WATER #4 - with over water netting		10/1/28	10/1/29	261 days		
60	**CONSTRUCTION (Roof Removal)**		**7/6/28**	**4/19/29**	**206 days**		
61	after all permits ready		7/6/28	7/6/28	1 day	31,35,37,38,39,40,26,41	62FF
62	3 crews, work in parallel, with 2 week offset		7/6/28	7/6/28	1 day	61FF	63FF
63	Notice To Proceed - Construction		7/6/28	7/6/28	0 days	62FF	64
64	Contractor Preparation		7/7/28	8/3/28	20 days	63	66
65	**Dock A**		**9/19/28**	**11/29/28**	**52 days**		
66	moved out to 9/19		9/19/28	9/19/28	1 day	64,57SS-9 days	67
67	Initial Project Mobilization		9/20/28	10/3/28	10 days	66	68FF
68	Mobilize for Dock A		9/27/28	10/3/28	5 days	67FF	82FF,69FF
69	Review Safety and Work Conditions		10/3/28	10/3/28	1 day	68FF	70FF
70	Haz Mat / Safety Inspections		10/3/28	10/3/28	1 day	69FF	71FF
71	Not Incl - Haz Mat Remediation		10/3/28	10/3/28	1 day	70FF	72FF
72	Install Debris Containment Boom 5x10	IN	10/3/28	10/3/28	1 day	71FF	73FF
73	De-energize / Disable Utilities	land	10/2/28	10/3/28	2 days	72FF	83,74
74	Remove / Remount - Panels / Disconnects	over	10/4/28	10/10/28	5 days	73,82	83SS
75	Haul Away A-1 Shore Debris	land	10/12/28	11/1/28	15 days	86SS+5 days	
76	Haul Away A-2 Shore Debris	land	10/26/28	11/15/28	15 days	96SS+5 days	
77	Haul Away A-3 Shore Debris	land	11/9/28	11/29/28	15 days	106SS+5 days	
78	Re-energize / Re-enable Utilities	land	11/20/28	11/24/28	5 days	90,100,110	79SS
79	Remove Debris Containment Boom 5x10	IN	11/20/28	11/20/28	1 day	78SS	80
80	Dock A Construction Complete		11/20/28	11/20/28	0 days	79	245

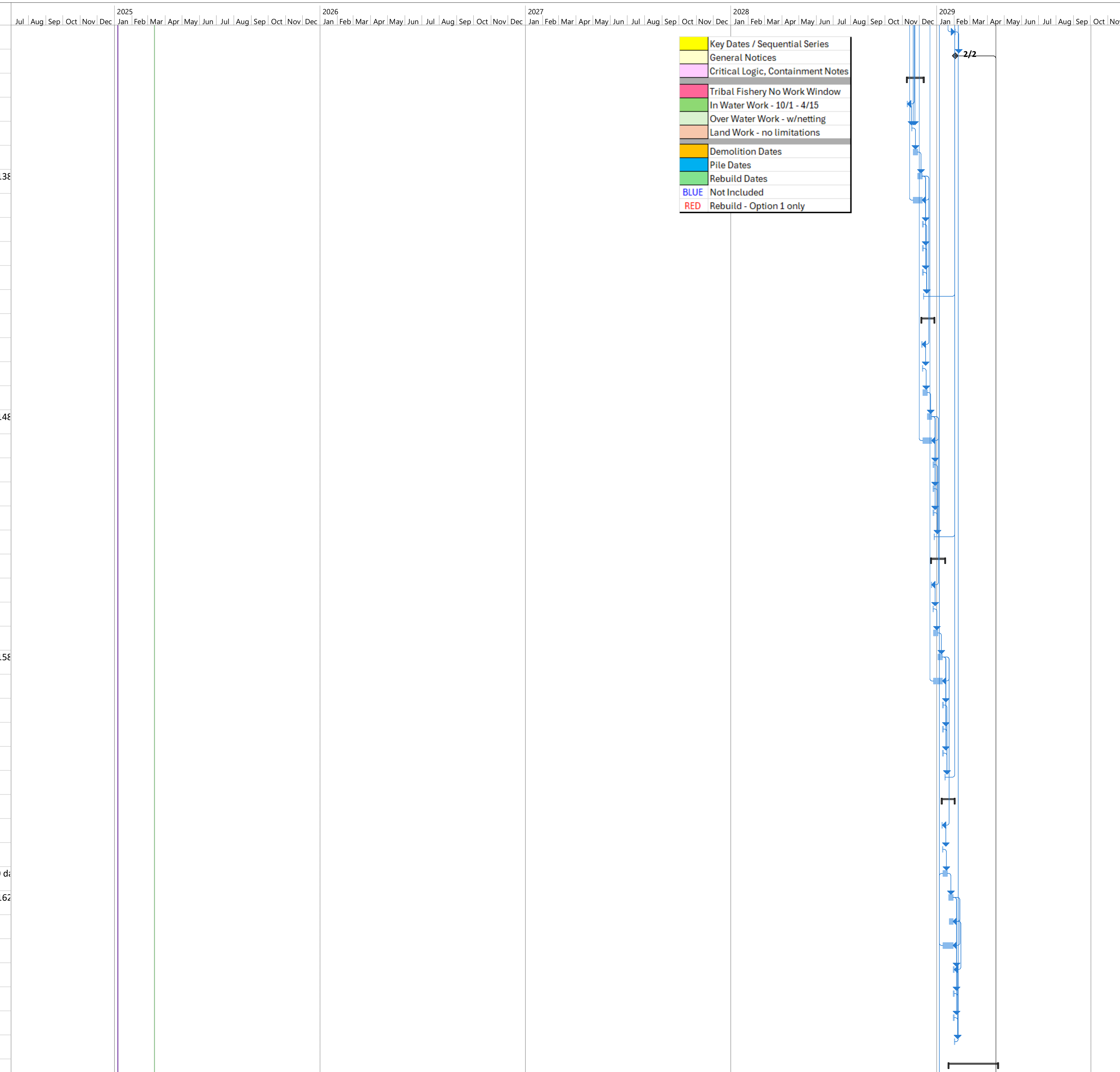


PORT OF SEATTLE - Salmon Bay - Option #2 - REMOVE - ROOF, STRUCTURE, WALLS

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
81	**Roof A-1**		**10/3/28**	**10/20/28**	**14 days**		
82	Mobilize for Roof A-1		10/3/28	10/3/28	1 day	68FF	74,83
83	Remove Disconnected Roof Utilities	**over**	10/4/28	10/4/28	1 day	74SS,73,82	84
84	Remove Roof 5x10	**over**	10/5/28	10/11/28	5 days	83	85
85	Remove Structure / Walls 5x10	**over**	10/12/28	10/17/28	4 days	84	87,88,89,92FF,8
86	Remove Debris to Shore 5x10	**over**	10/5/28	10/17/28	9 days	85FF	75SS+5 days
87	Finishes / Sealants	**over**	10/18/28	10/19/28	2 days	85	90
88	Reinstall Utilities	**over**	10/18/28	10/19/28	2 days	85	90
89	Clean Area	**over**	10/18/28	10/19/28	2 days	85	90
90	Final Inspection	**over**	10/20/28	10/20/28	1 day	89,87,88	78
91	**Roof A-2**		**10/17/28**	**11/3/28**	**14 days**		
92	Mobilize for Roof A-2		10/17/28	10/17/28	1 day	85FF	93
93	Remove Disconnected Roof Utilities	**over**	10/18/28	10/18/28	1 day	92	94
94	Remove Roof 5x10	**over**	10/19/28	10/25/28	5 days	93	95
95	Remove Structure / Walls 5x10	**over**	10/26/28	10/31/28	4 days	94	97,98,99,102FF,
96	Remove Debris to Shore 5x10	**over**	10/19/28	10/31/28	9 days	95FF	76SS+5 days
97	Finishes / Sealants	**over**	11/1/28	11/2/28	2 days	95	100
98	Reinstall Utilities	**over**	11/1/28	11/2/28	2 days	95	100
99	Clean Area	**over**	11/1/28	11/2/28	2 days	95	100
100	Final Inspection	**over**	11/3/28	11/3/28	1 day	99,98,97	78
101	**Roof A-3**		**10/31/28**	**11/17/28**	**14 days**		
102	Mobilize for Roof A-3		10/31/28	10/31/28	1 day	95FF	103
103	Remove Disconnected Roof Utilities	**over**	11/1/28	11/1/28	1 day	102	104
104	Remove Roof 5x10	**over**	11/2/28	11/8/28	5 days	103	105,112SS
105	Remove Structure / Walls 5x10	**over**	11/9/28	11/14/28	4 days	104	107,108,109,106
106	Remove Debris to Shore 5x10	**over**	11/2/28	11/14/28	9 days	105FF	77SS+5 days
107	Finishes / Sealants	**over**	11/15/28	11/16/28	2 days	105	110
108	Reinstall Utilities	**over**	11/15/28	11/16/28	2 days	105	110
109	Clean Area	**over**	11/15/28	11/16/28	2 days	105	110
110	Final Inspection	**over**	11/17/28	11/17/28	1 day	109,108,107	78
111	**Dock B**		**11/2/28**	**2/15/29**	**76 days**		
112	mob at Dock A-3 roof removal		11/2/28	11/2/28	1 day	104SS	113
113	Mobilize for Dock B		11/3/28	11/9/28	5 days	112	128FF,114
114	Review Safety and Work Conditions		11/10/28	11/10/28	1 day	113	115
115	Haz Mat / Safety Inspections		11/13/28	11/13/28	1 day	114	116FF
116	Not Incl - Haz Mat Remediation		11/13/28	11/13/28	1 day	115FF	117FF
117	Install Debris Containment Boom 5x10	IN	11/13/28	11/13/28	1 day	116FF	118FF
118	De-energize / Disable Utilities	land	11/10/28	11/13/28	2 days	117FF	129,119SS
119	Remove / Remount - Panels / Disconnects	**over**	11/10/28	11/16/28	5 days	118SS	129
120	Haul Away B-1 Shore Debris	land	11/27/28	12/22/28	20 days	132SS+5 days	
121	Haul Away B-2 Shore Debris	land	12/14/28	1/10/29	20 days	142SS+5 days	
122	Haul Away B-3 Shore Debris	land	1/2/29	1/29/29	20 days	152SS+5 days	
123	Haul Away B-4 Shore Debris	**land**	1/19/29	2/15/29	20 days	163SS+5 days	
124	Re-energize / Re-enable Utilities	land	2/2/29	2/8/29	5 days	136,146,156,167	125SS

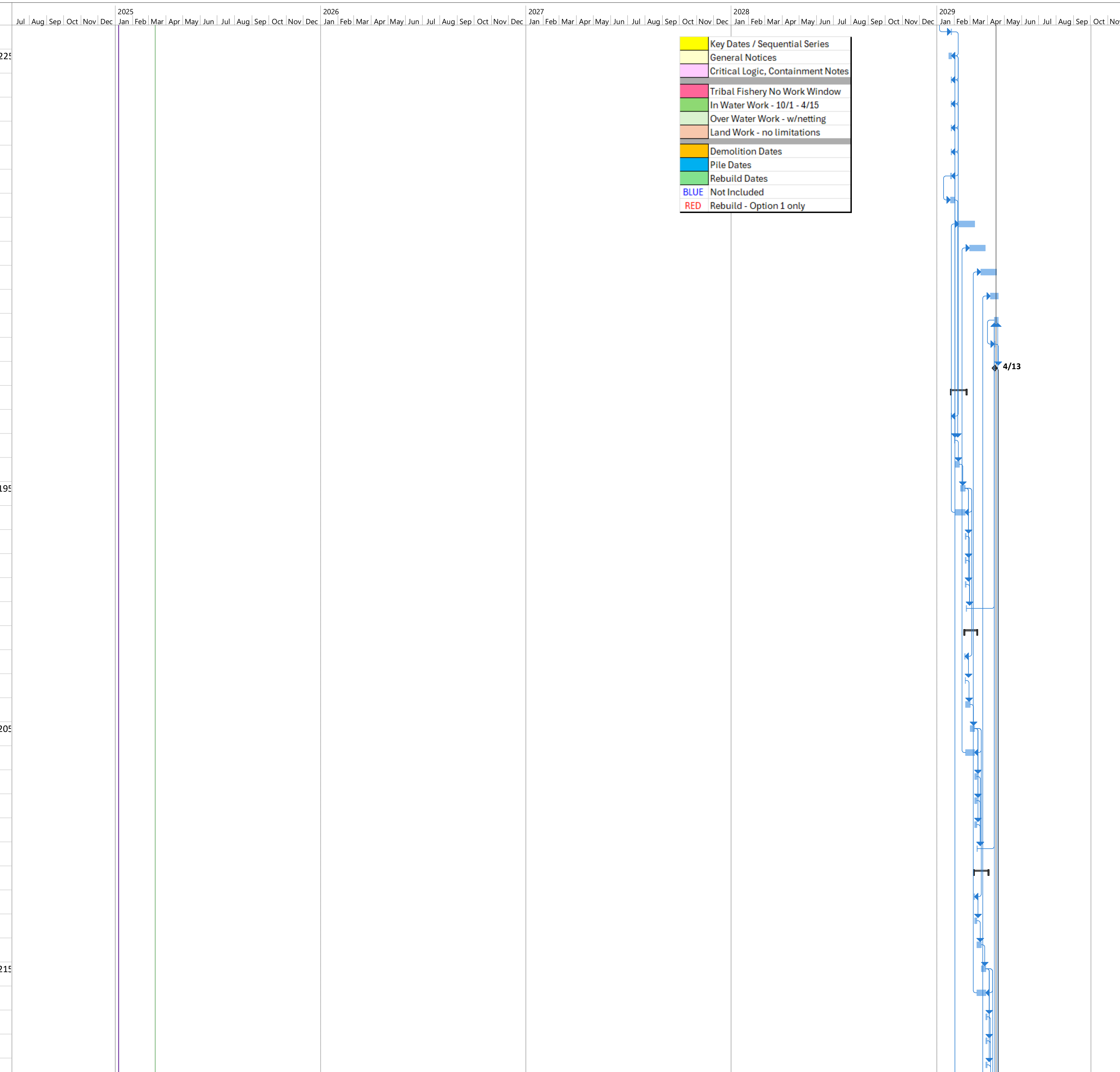


ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
125	Remove Debris Containment Boom 5x10	IN	2/2/29	2/2/29	1 day	124SS	126
126	Dock B Construction Complete		2/2/29	2/2/29	0 days	125	245
127	**Roof B-1**		**11/9/28**	**12/8/28**	**22 days**		
128	Mobilize for Roof B-1		11/9/28	11/9/28	1 day	113FF	129
129	Remove Disconnected Roof Utilities	over	11/17/28	11/17/28	1 day	128,118,119	130
130	Remove Roof 5x10	over	11/20/28	11/27/28	6 days	129	131
131	Remove Structure / Walls 5x10	over	11/28/28	12/5/28	6 days	130	133,134,135,138
132	Remove Debris to Shore 5x10	over	11/20/28	12/5/28	12 days	131FF	120SS+5 days
133	Finishes / Sealants	over	12/6/28	12/7/28	2 days	131	136
134	Reinstall Utilities	over	12/6/28	12/7/28	2 days	131	136
135	Clean Area	over	12/6/28	12/7/28	2 days	131	136
136	Final Inspection	over	12/8/28	12/8/28	1 day	135,134,133	124
137	**Roof B-2**		**12/5/28**	**12/27/28**	**17 days**		
138	Mobilize for Roof B-2		12/5/28	12/5/28	1 day	131FF	139
139	Remove Disconnected Roof Utilities	over	12/6/28	12/6/28	1 day	138	140
140	Remove Roof 5x10	over	12/7/28	12/14/28	6 days	139	141
141	Remove Structure / Walls 5x10	over	12/15/28	12/22/28	6 days	140	143,144,145,148
142	Remove Debris to Shore 5x10	over	12/7/28	12/22/28	12 days	141FF	121SS+5 days
143	Finishes / Sealants	over	12/25/28	12/26/28	2 days	141	146
144	Reinstall Utilities	over	12/25/28	12/26/28	2 days	141	146
145	Clean Area	over	12/25/28	12/26/28	2 days	141	146
146	Final Inspection	over	12/27/28	12/27/28	1 day	145,144,143	124
147	**Roof B-3**		**12/22/28**	**1/15/29**	**17 days**		
148	Mobilize for Roof B-3		12/22/28	12/22/28	1 day	141FF	149
149	Remove Disconnected Roof Utilities	over	12/25/28	12/25/28	1 day	148	150
150	Remove Roof 5x10	over	12/26/28	1/2/29	6 days	149	151
151	Remove Structure / Walls 5x10	over	1/3/29	1/10/29	6 days	150	153,154,155,158
152	Remove Debris to Shore 5x10	over	12/26/28	1/10/29	12 days	151FF	122SS+5 days
153	Finishes / Sealants	over	1/11/29	1/12/29	2 days	151	156
154	Reinstall Utilities	over	1/11/29	1/12/29	2 days	151	156
155	Clean Area	over	1/11/29	1/12/29	2 days	151	156
156	Final Inspection	over	1/15/29	1/15/29	1 day	155,154,153	124
157	**Roof B-4**		**1/10/29**	**2/1/29**	**17 days**		
158	Mobilize for Roof B-4		1/10/29	1/10/29	1 day	151FF	159
159	Remove Disconnected Roof Utilities	over	1/11/29	1/11/29	1 day	158	160
160	Remove Roof 5x10	over	1/12/29	1/19/29	6 days	159	161,169SS+10 da
161	Remove Structure / Walls 5x10	over	1/22/29	1/29/29	6 days	160	164,165,166,162
162	Install New ADA Decking - B-4	IN	1/23/29	1/29/29	5 days	161FF	164FF
163	Remove Debris to Shore 5x10	over	1/12/29	1/29/29	12 days	161FF	123SS+5 days
164	Finishes / Sealants	over	1/30/29	1/31/29	2 days	161,162FF	167
165	Reinstall Utilities	over	1/30/29	1/31/29	2 days	161	167
166	Clean Area	over	1/30/29	1/31/29	2 days	161	167
167	Final Inspection	over	2/1/29	2/1/29	1 day	166,165,164	124
168	**Dock C**		**1/22/29**	**4/19/29**	**64 days**		



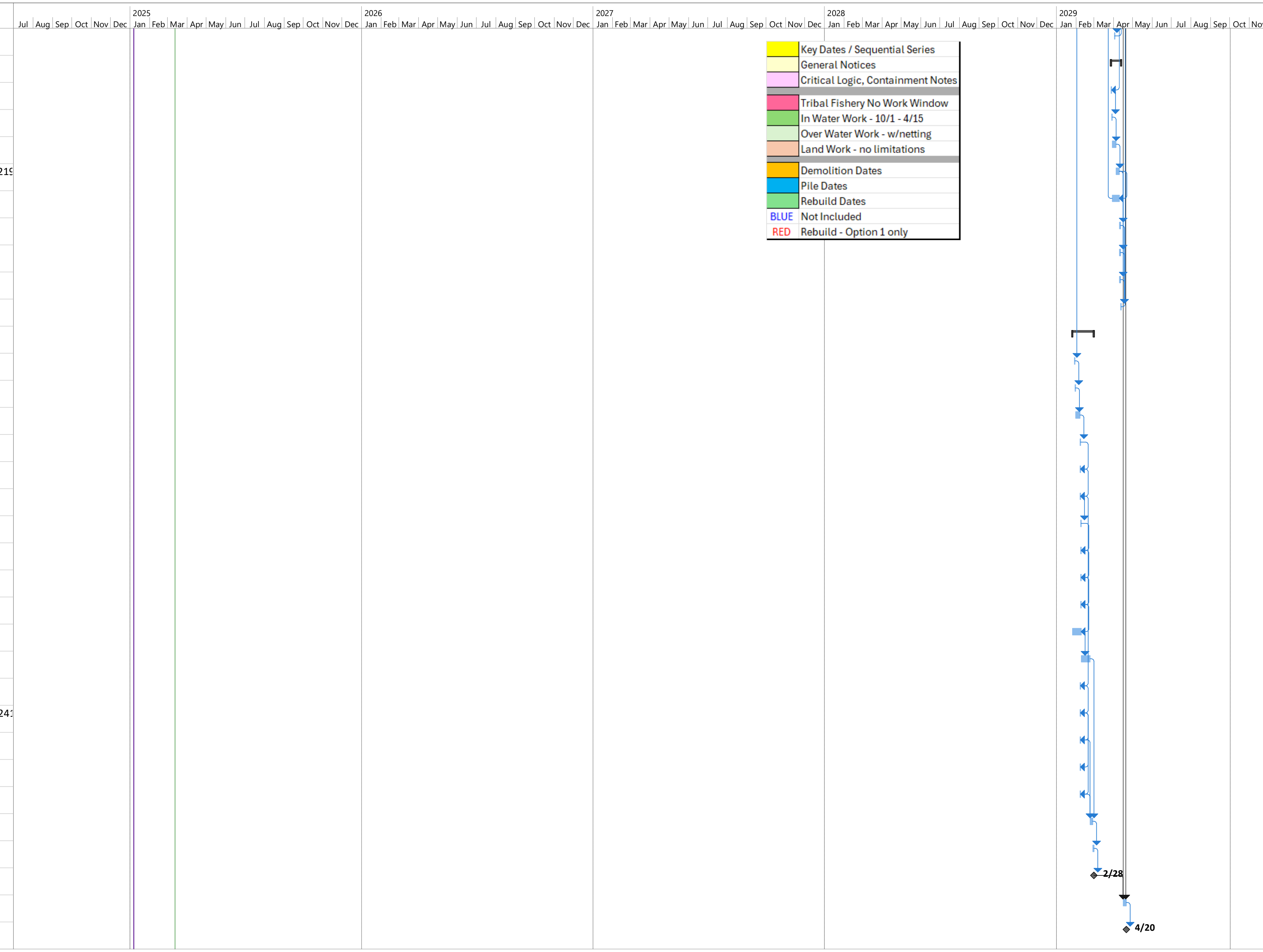
PORT OF SEATTLE - Salmon Bay - Option #2 - REMOVE - ROOF, STRUCTURE, WALLS

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
169	mob at Dock B-4 roof removal		1/26/29	1/26/29	1 day	160SS+10 days	170FF
170	Mobilize for Dock C		1/22/29	1/26/29	5 days	169FF	185FF,171FF,22
171	Review Safety and Work Conditions		1/26/29	1/26/29	1 day	170FF	172FF
172	Haz Mat / Safety Inspections		1/26/29	1/26/29	1 day	171FF	173FF
173	Not Incl - Haz Mat Remediation		1/26/29	1/26/29	1 day	172FF	174FF
174	Install Debris Containment Boom 5x10	IN	1/26/29	1/26/29	1 day	173FF	175FF
175	De-energize / Disable Utilities	land	1/25/29	1/26/29	2 days	174FF	186,176SS
176	Remove / Remount - Panels / Disconnects	over	1/25/29	1/31/29	5 days	175SS	186
177	Haul Away C-1 Shore Debris	land	2/9/29	3/8/29	20 days	189SS+5 days	
178	Haul Away C-2 Shore Debris	land	2/28/29	3/27/29	20 days	199SS+5 days	
179	Haul Away C-3 Shore Debris	land	3/20/29	4/16/29	20 days	209SS+5 days	
180	Haul Away C-4 Shore Debris	land	4/6/29	4/19/29	10 days	219SS+5 days	
181	Re-energize / Re-enable Utilities	land	4/13/29	4/19/29	5 days	193,203,213,223	182SS
182	Remove Debris Containment Boom 5x10	IN	4/13/29	4/13/29	1 day	181SS	183
183	Dock C Construction Complete		4/13/29	4/13/29	0 days	182	245
184	**Roof C-1**		**1/26/29**	**2/22/29**	**20 days**		
185	Mobilize for Roof C-1		1/26/29	1/26/29	1 day	170FF	186
186	Remove Disconnected Roof Utilities	over	2/1/29	2/1/29	1 day	185,175,176	187
187	Remove Roof 5x10	over	2/2/29	2/9/29	6 days	186	188
188	Remove Structure / Walls 5x10	over	2/12/29	2/19/29	6 days	187	190,191,192,19
189	Remove Debris to Shore 5x10	over	2/2/29	2/19/29	12 days	188FF	177SS+5 days
190	Finishes / Sealants	over	2/20/29	2/21/29	2 days	188	193
191	Reinstall Utilities	over	2/20/29	2/21/29	2 days	188	193
192	Clean Area	over	2/20/29	2/21/29	2 days	188	193
193	Final Inspection	over	2/22/29	2/22/29	1 day	192,191,190	181
194	**Roof C-2**		**2/19/29**	**3/13/29**	**17 days**		
195	Mobilize for Roof C-2		2/19/29	2/19/29	1 day	188FF	196
196	Remove Disconnected Roof Utilities	over	2/20/29	2/20/29	1 day	195	197
197	Remove Roof 5x10	over	2/21/29	2/28/29	6 days	196	198
198	Remove Structure / Walls 5x10	over	3/1/29	3/8/29	6 days	197	200,201,202,20
199	Remove Debris to Shore 5x10	over	2/21/29	3/8/29	12 days	198FF	178SS+5 days
200	Finishes / Sealants	over	3/9/29	3/12/29	2 days	198	203
201	Reinstall Utilities	over	3/9/29	3/12/29	2 days	198	203
202	Clean Area	over	3/9/29	3/12/29	2 days	198	203
203	Final Inspection	over	3/13/29	3/13/29	1 day	202,201,200	181
204	**Roof C-3**		**3/8/29**	**4/2/29**	**18 days**		
205	Mobilize for Roof C-3		3/8/29	3/8/29	1 day	198FF	206
206	Remove Disconnected Roof Utilities	over	3/9/29	3/12/29	2 days	205	207
207	Remove Roof 5x10	over	3/13/29	3/20/29	6 days	206	208
208	Remove Structure / Walls 5x10	over	3/21/29	3/28/29	6 days	207	210,211,212,21
209	Remove Debris to Shore 5x10	over	3/13/29	3/28/29	12 days	208FF	179SS+5 days
210	Finishes / Sealants	over	3/29/29	3/30/29	2 days	208	213
211	Reinstall Utilities	over	3/29/29	3/30/29	2 days	208	213
212	Clean Area	over	3/29/29	3/30/29	2 days	208	213



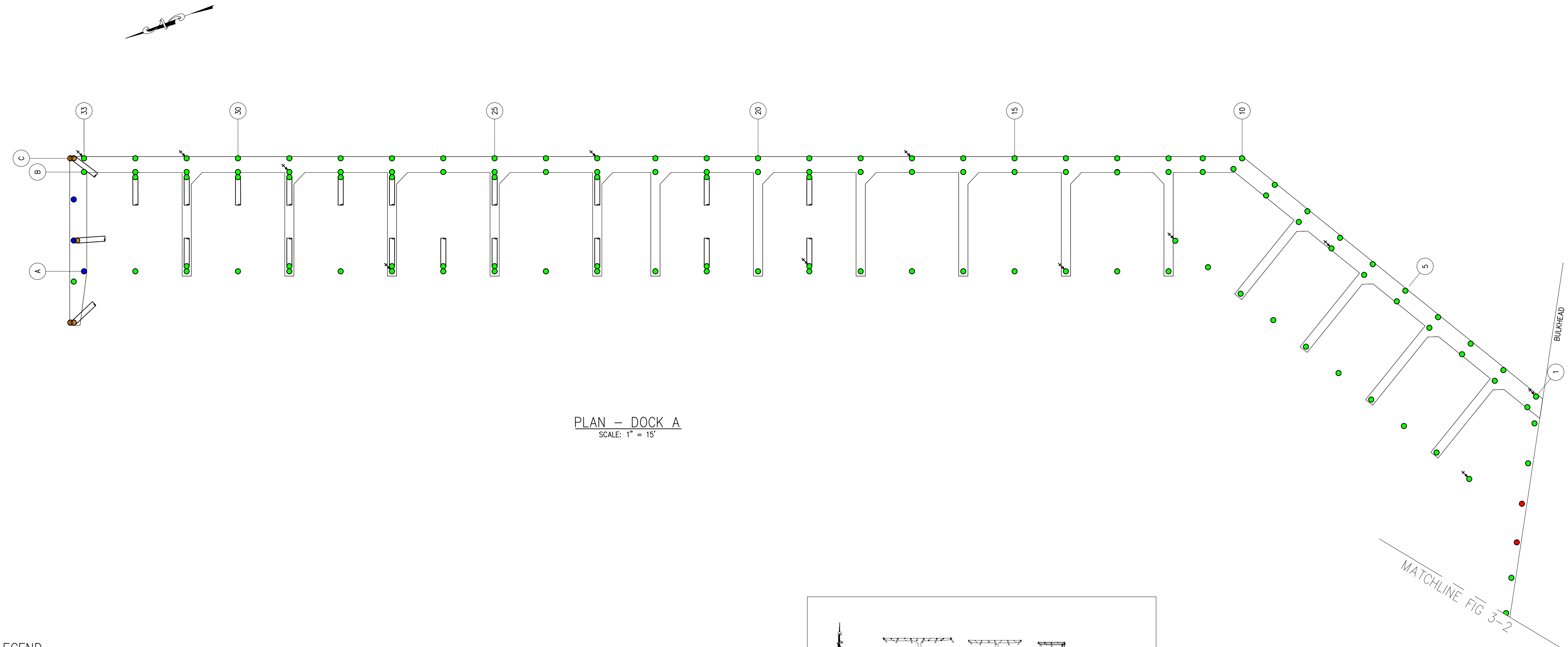
PORT OF SEATTLE - Salmon Bay - Option #2 - REMOVE - ROOF, STRUCTURE, WALLS

ID	Task Name	Cat.	Start	Finish	Duration	Predecessors	Successors
213	Final Inspection	over	4/2/29	4/2/29	1 day	212,211,210	181
214	**Roof C-4**		**3/28/29**	**4/12/29**	**12 days**		
215	Mobilize for Roof C-4		3/28/29	3/28/29	1 day	208FF	216
216	Remove Disconnected Roof Utilities	over	3/29/29	3/29/29	1 day	215	217
217	Remove Roof 5x10	over	3/30/29	4/4/29	4 days	216	218
218	Remove Structure / Walls 5x10	over	4/5/29	4/9/29	3 days	217	220,221,222,21
219	Remove Debris to Shore 5x10	over	3/30/29	4/9/29	7 days	218FF	180SS+5 days
220	Finishes / Sealants	over	4/10/29	4/11/29	2 days	218	223
221	Reinstall Utilities	over	4/10/29	4/11/29	2 days	218	223
222	Clean Area	over	4/10/29	4/11/29	2 days	218	223
223	Final Inspection	over	4/12/29	4/12/29	1 day	222,221,220	181
224	**Land Side Work**		**1/26/29**	**2/28/29**	**24 days**		
225	Not limited by Fish Windows	land	1/29/29	1/29/29	1 day	170	226
226	Start work with Dock C. (not required)	land	1/30/29	1/30/29	1 day	225	227
227	Mobilize for Land Side Work	land	1/31/29	2/6/29	5 days	226	228
228	Review Safety and Work Conditions	land	2/7/29	2/7/29	1 day	227	229FF
229	Haz Mat / Safety Inspections	land	2/7/29	2/7/29	1 day	228FF	230FF
230	Not Incl - Haz Mat Remediation	land	2/7/29	2/7/29	1 day	229FF	231,237FF
231	De-energize / Disable Utilities	land	2/8/29	2/8/29	1 day	230	232FF
232	Not incl - New Electrical Equipment Bldg		2/8/29	2/8/29	1 day	231FF	233FF
233	Not incl - Electrical Equipment in Building		2/8/29	2/8/29	1 day	232FF	234FF
234	Not incl - Electrical Infrastructure Work		2/8/29	2/8/29	1 day	233FF	235FF
235	Move 2 transformers to shore - B & C Docks	land	1/26/29	2/8/29	10 days	234FF	236
236	Install New Lighting / bollards	land	2/9/29	2/22/29	10 days	235	242
237	Not incl - New Pump Room		2/7/29	2/7/29	1 day	230FF	238FF
238	Not incl - Equipment in New Pump Room		2/7/29	2/7/29	1 day	237FF	239FF,240FF,24
239	Not incl - New Piping from Water Main		2/7/29	2/7/29	1 day	238FF	242
240	Not incl - New Fire Riser Piping		2/7/29	2/7/29	1 day	238FF	
241	Not incl - Potable Water system		2/7/29	2/7/29	1 day	238FF	242
242	Testing / Inspections	land	2/23/29	2/26/29	2 days	236,239,241	243
243	Re-energize / Re-enable Utilities	land	2/27/29	2/28/29	2 days	242	244
244	Land Side Construction Complete	land	2/28/29	2/28/29	0 days	243	245
245	City Inspection for Occupation	land	4/16/29	4/20/29	5 days	80,126,183,244	246
246	Approval to Re-Occupy	land	4/20/29	4/20/29	0 days	245	



Calendar is working days, simple 5 day 8 hours / day = 40 hour work week, with basic holidays

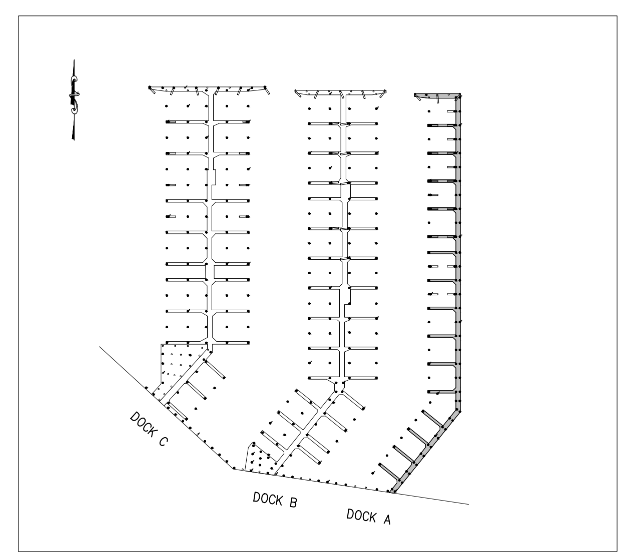
Appendix F. Pile Deficiency Plan



PLAN – DOCK A
SCALE: 1" = 15'

LEGEND

- 2-4 PHOTO LOCATION
- LEVEL II & III LOCATIONS
- 12"ϕ TIMBER PILE
- 12"ϕ TIMBER BATTER PILE
- 12"ϕ TIMBER PILE RATED MINOR
- 12"ϕ TIMBER PILE RATED MODERATE (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ϕ TIMBER PILE RATED MAJOR (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ϕ TIMBER PILE RATED SEVERE (PRIORITY REPAIR TO BE IMPLEMENTED IN 1 TO 3 YEARS)



KEY PLAN

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

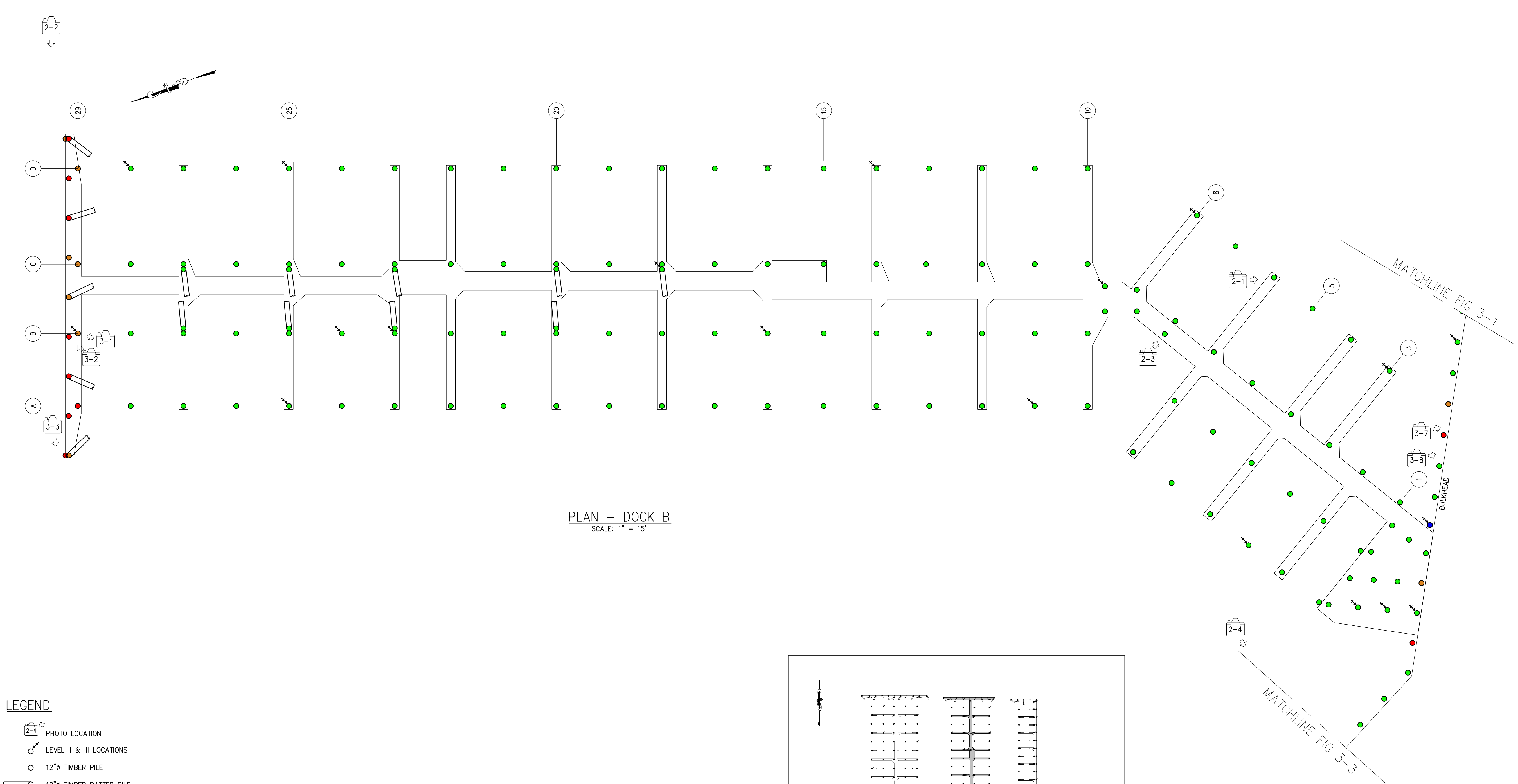
IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

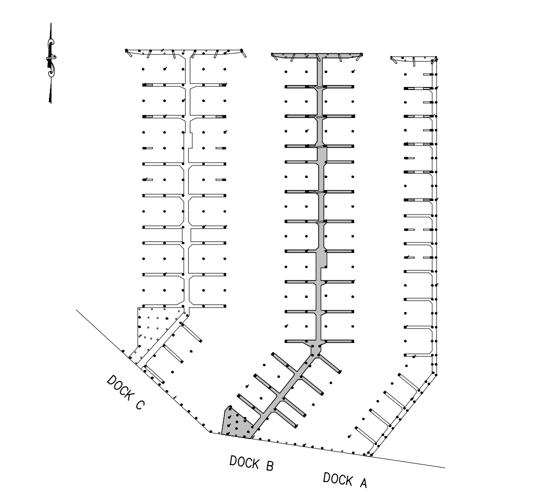
DESIGNED BY G.L.	PORT OF SEATTLE MARINE FACILITIES	SCALE 1" = 15'	REVISION
DRAWN BY G.L.		DATE	
CHECKED BY	SALMON BAY MARINA	DRAWING NO.	
PROJECT ENGR	PILE DEFICIENCY PLAN SHEET 1 OF 3	FIG 3–1	



PLAN – DOCK B
SCALE: 1" = 15'

LEGEND

- PHOTO LOCATION
- LEVEL II & III LOCATIONS
- 12"ø TIMBER PILE
- 12"ø TIMBER BATTER PILE
- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED MAJOR (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED SEVERE (PRIORITY REPAIR TO BE IMPLEMENTED IN 1 TO 3 YEARS)



KEY PLAN

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
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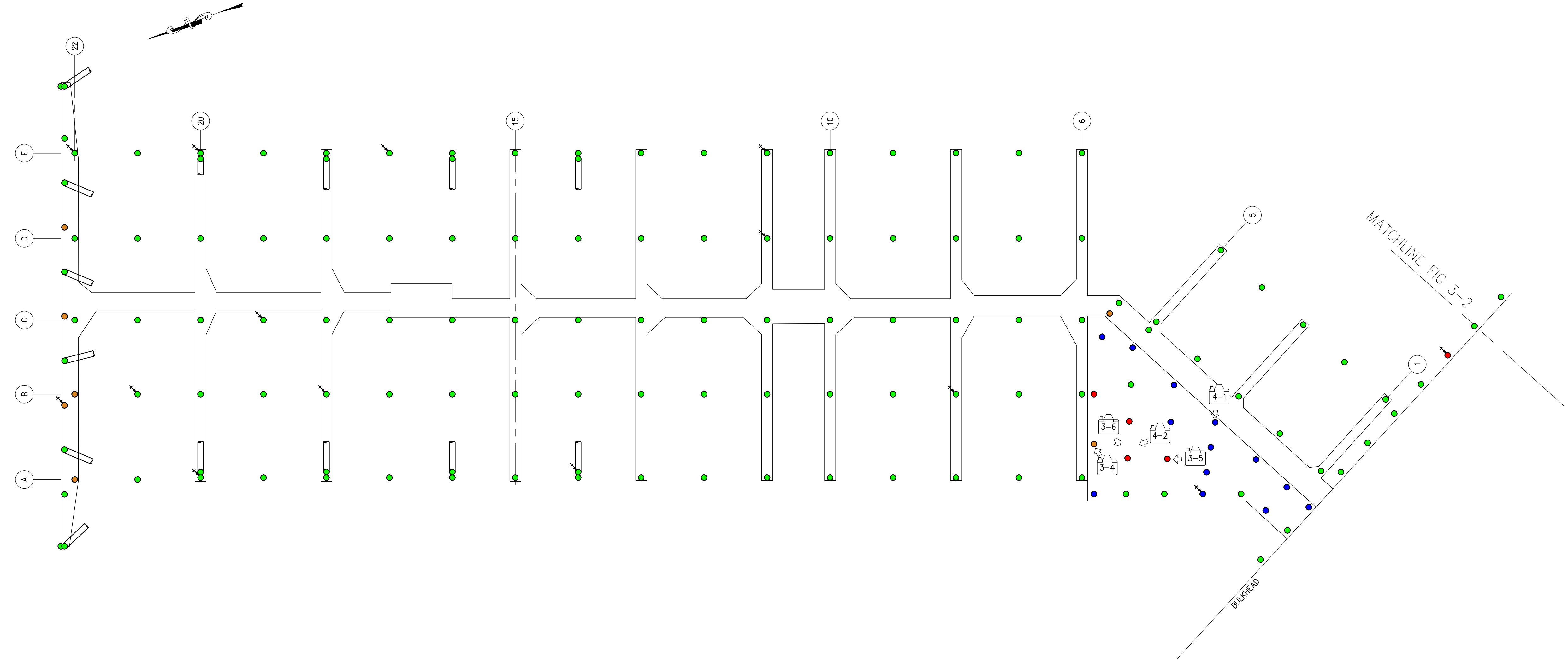
NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

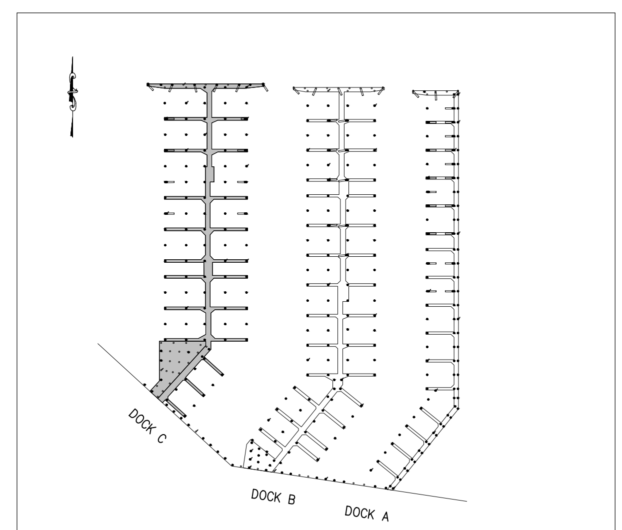
REVISIONS

Jacobs

DESIGNED BY G.L.	PORT OF SEATTLE MARINE FACILITIES	SCALE 1" = 15'	REVISION
DRAWN BY G.L.		DATE	
CHECKED BY	SALMON BAY MARINA	DRAWING NO.	
PROJECT ENGR	PILE DEFICIENCY PLAN SHEET 2 OF 3	FIG 3-2	



PLAN – DOCK C
SCALE: 1" = 15'



KEY PLAN

LEGEND

- PHOTO LOCATION
- LEVEL II & III LOCATIONS
- 12"ø TIMBER PILE
- 12"ø TIMBER BATTER PILE
- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED MAJOR (ROUTINE REPAIR TO BE IMPLEMENTED IN 3 TO 5 YEARS)
- 12"ø TIMBER PILE RATED SEVERE (PRIORITY REPAIR TO BE IMPLEMENTED IN 1 TO 3 YEARS)

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
IT IS A REDUCED PRINT.
SCALE ACCORDINGLY

REVISIONS

NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

DESIGNED BY G.L.
DRAWN BY G.L.
CHECKED BY
PROJECT ENGR

PORT OF SEATTLE
MARINE FACILITIES

SALMON BAY MARINA

PILE DEFICIENCY PLAN
SHEET 3 OF 3

SCALE 1" = 15'
REVISION
DATE
DRAWING NO.
FIG 3–3

Salmon Bay Financial Returns

Salmon Bay

$ in 000's	2021 Actual	2022 Actual	2023 Actual	2024 Actual	2025 Budget
Total Revenue	985	1,056	1,155	1,199	1,315
Expenses					
Total Direct	337	446	487	613	431
Total Support Services	389	469	610	587	602
Total Central Services / Other	329	404	497	482	512
Total Expense	1,055	1,319	1,594	1,682	1,544
NOI Before Depreciation	(70)	(262)	(440)	(484)	(229)
Depreciation	542	543	546	564	550
NOI After Depreciation	(611)	(806)	(986)	(1,048)	(779)