Salmon Bay Marina Docks A, B, C Closure FAQ

What is happening?

Salmon Bay Marina, which was built in 1961, is closing docks A, B, and C to all customers by **March 18, 2026**. Those docks are nearing the end of their usable lifetime, due to updated building standards and 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. Therefore, Port Engineering 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. For all vessels under covered moorage, including those with liveaboard status, **no overnight stays will be permitted on or after November 18, 2025**. Emergency and severe weather protocols will be shared and remain active throughout the 180-day term.

Is this facility safe?

The safety of our customers and Port staff is our highest priority. Port Engineering teams, in close consultation with our Health and Safety team, have determined that for the immediate time being and, barring any severe weather or vessel impacts, typical marina use can continue into early fall.

Beyond that timeframe, trends anticipate worsening weather, including potential for high winds and accumulation of snow or freezing rain. In those conditions, docks A, B, and C can no longer be maintained to an acceptable level of safety for overnight stays under covered moorage. For that reason, no overnight stays will be permitted on or after November 18, 2025 for any vessels under covered moorage, regardless of liveaboard status.

Short term access to docks A, B and C is safe unless the conditions outlined in the Operational Safety Plan occur. We will post an Operational Safety Plan for the transition period that balances the needs of customers to access their vessels with protecting customers and Port Staff from specific safety hazards through active mitigation measures.

What is the timeline for closure?

September 18, 2025. Marks the start of a 180-day timeline for closure to customers. All moorage agreements for customers on docks A, B, and C will be terminated effective March 18, 2025, including vessels with liveaboard status.

November 18, 2025. Overnight stays are no longer permitted for any vessels under covered moorage on docks A, B, or C. Vessels or FOWR customers not under covered moorage, regardless of liveaboard status, may continue overnight stays on the vessels, provided they adhere to all Port of Seattle all emergency and severe weather protocols.

March 18, 2026. All moorage agreements for customers on docks A, B, and C will be terminated by Salmon Bay Marina and all vessels must be removed from the marina by their owner(s).

What happens to the vessels currently moored at Salmon Bay?

The Port is making several resources available for customers from docks A, B, and C.

For non-FOWR vessels with liveaboard status, we may be able to offer moorage slips at Shilshole Bay Marina and will honor existing Salmon Bay Marina tariff rates until March 17, 2026. Salmon Bay Marina will pro-rate billing for customers who vacate the marina mid-month, any time during the 180-day timeframe. If a vessel can be placed on a trailer, Salmon Bay Marina may be able offer temporary uplands storage on a month-to-month lease.

We have also assigned a dedicated team to support Salmon Bay customers in answering questions and facilitating contact with other marinas, working with customers to assign exit dates, ensuring completion of paperwork, and properly closing moorage accounts. This person also is prioritizing reaching out to those with liveaboard status due to the additional challenges posed by the closure of docks A, B, and C. You will hear from them soon. In general, questions or requests should be shared to salmonbay@portseattle.org.

Do customers have to pay during the 180-day timeframe?

Yes. All Salmon Bay Marina customers are currently on month-to-month moorage agreements and must pay for their slip, including all applicable charges such as moorage fees, utilities, and taxes, as long as it is under contract, for the full 180-day timeframe or the duration through the termination of the moorage agreement and vessel removal, whichever is sooner.

Customers who vacate the marina and terminate their moorage agreements mid-month will be pro-rated for that month's fees.

What is the plan for the marina?

A detailed plan for docks A, B, and C, as well as the overall Salmon Bay Marina, has not yet been fully determined by Port of Seattle leadership and Port Commission. However, docks A, B, and C must close because of irreversible and worsening safety concerns and infrastructure degradation. While these plans only apply to Docks A, B and C, the Port is also reviewing conditions at docks D and E and may take future measures there to ensure the continued safety of our customers and staff.

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

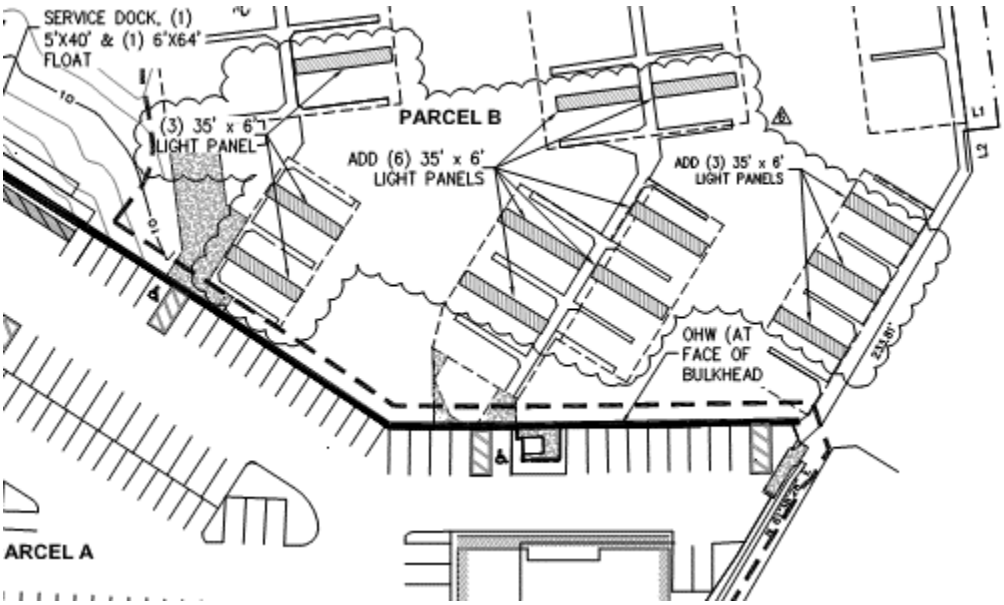


Diagram 1

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:

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

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

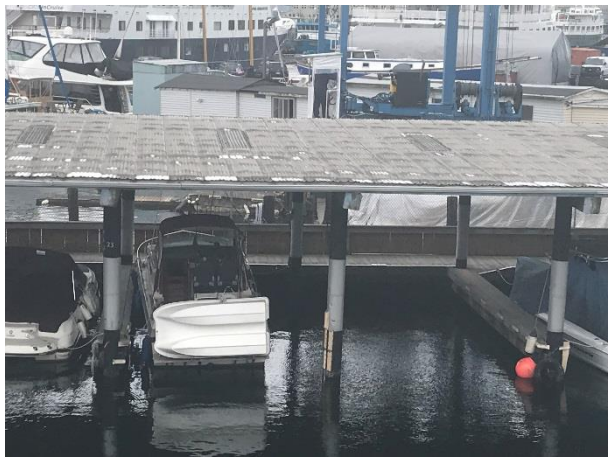


Photo 9: Partial view of Roof A

Budget Estimates and Scope of Work

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

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

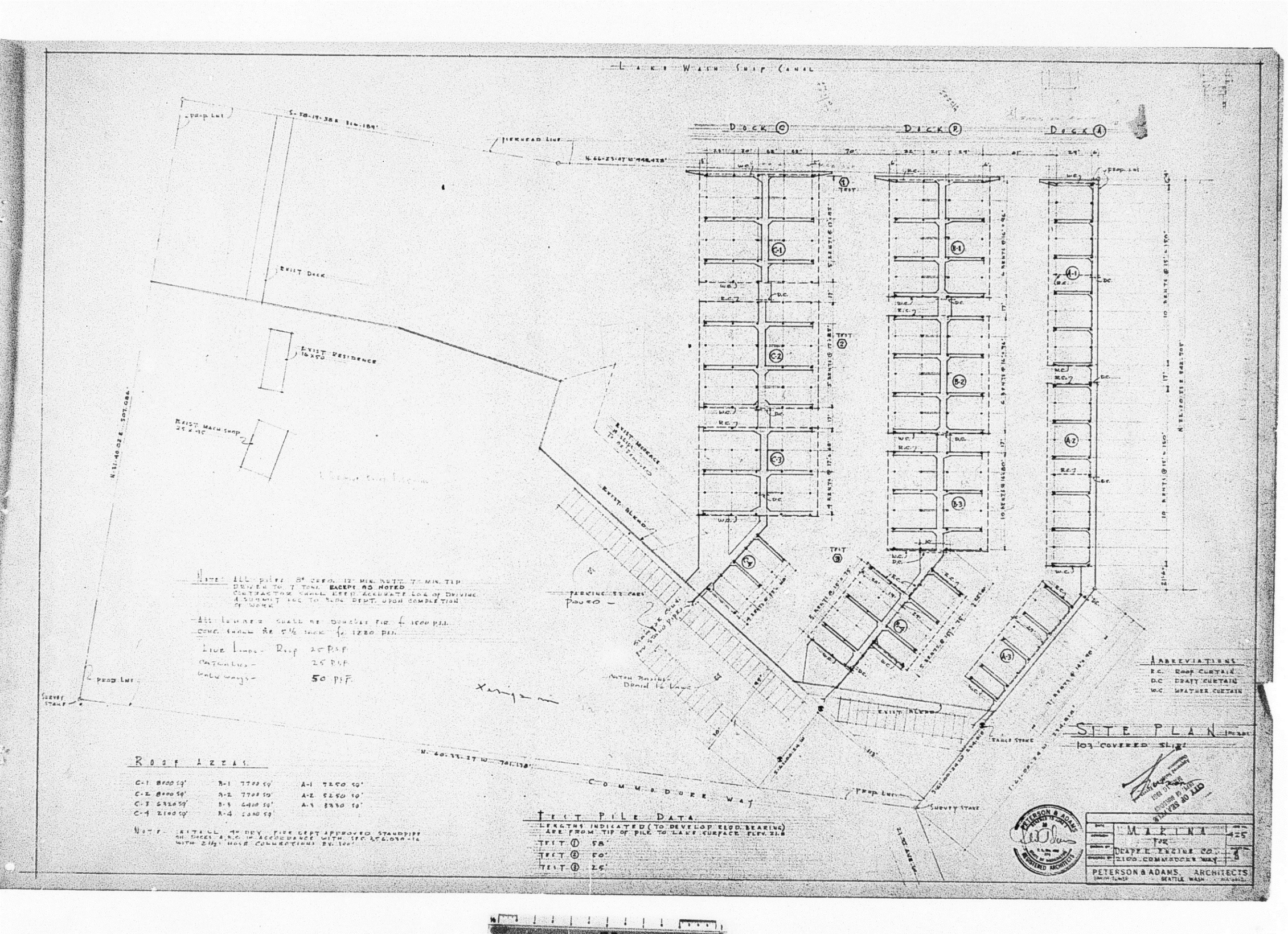
Budget Estimate 2: Based on the review of the 5 roofs for the installation of the skylights and extrapolating for the rest of the marina, our Preliminary estimate is as follows:

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
EXIST. DOCK
EXIST. RESIDENCE
EXIST. MACH. SHOP
EXIST. BLKHD.
PROP. LINE
SURVEY STAKE
COMMODORE WAY
TEST PILE DATA
LENGTHS INDICATED (TO DEVELOP ELOD. BEARING) ARE FROM TIP OF PILE TO LAKE SURFACE ELEV. 21.8
TEST ① 58'
TEST ② 50'
TEST ③ 25'
ROOF AREAS
C-1 8600 SQ' B-1 7700 SQ' A-1 7250 SQ'
C-2 8600 SQ' B-2 7700 SQ' A-2 5250 SQ'
C-3 6320 SQ' B-3 6400 SQ' A-3 8330 SQ'
C-4 2100 SQ' B-4 2340 SQ'
ABBREVIATIONS
R.C. ROOF CURTAIN
D.C. DRAFT CURTAIN
W.C. WEATHER CURTAIN
SITE PLAN
103' COVERED SLIP
MARINA
FOR
DEEPER ENGINE CO.
2100 COMMODORE WAY
PETERSON & ADAMS, ARCHITECTS
SEATTLE WASH

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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)

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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."

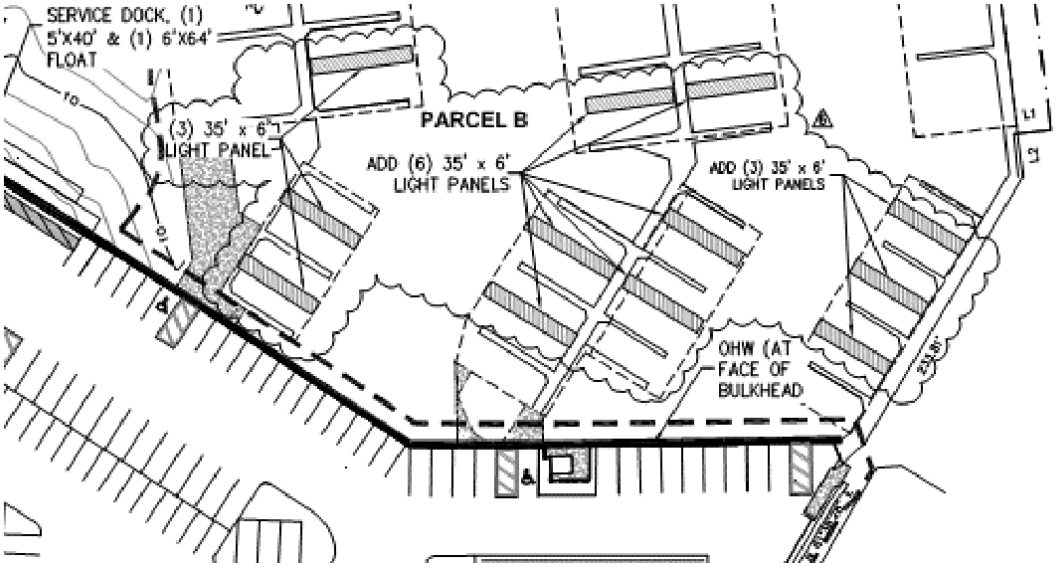

Figure 2 – Extent of Cornerstone's Visual Assessment at Docks A, B, & C (clouded area)

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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

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Fig 7 – Mechanical Equipment and Girder Connection Retrofit

Fig 8 – Girder to Pile Retrofit

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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)

LK. WASHINGTON SHIP CANAL

"A" DOCK

"B" DOCK

"C" DOCK

ROOF RIDGE, TYP

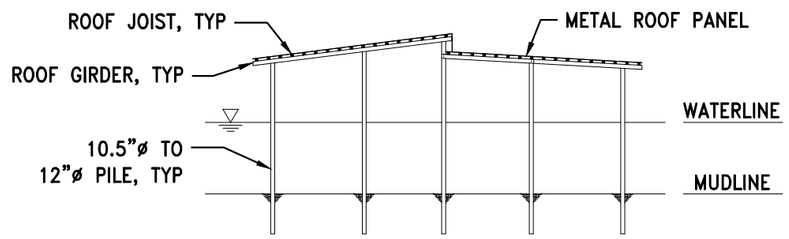
3x OR 4x SPAN JOISTS, TYP

(2) 6x GIRDERS, TYP

10x OR 12x GIRDER, TYP

A

A



SECTION A-A
NOT TO SCALE

SALMON BAY

LEGEND:

- DCR < 1.0
- 1.0 ≤ DCR < 1.3
- 1.3 ≤ DCR < 1.5
- 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

N

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

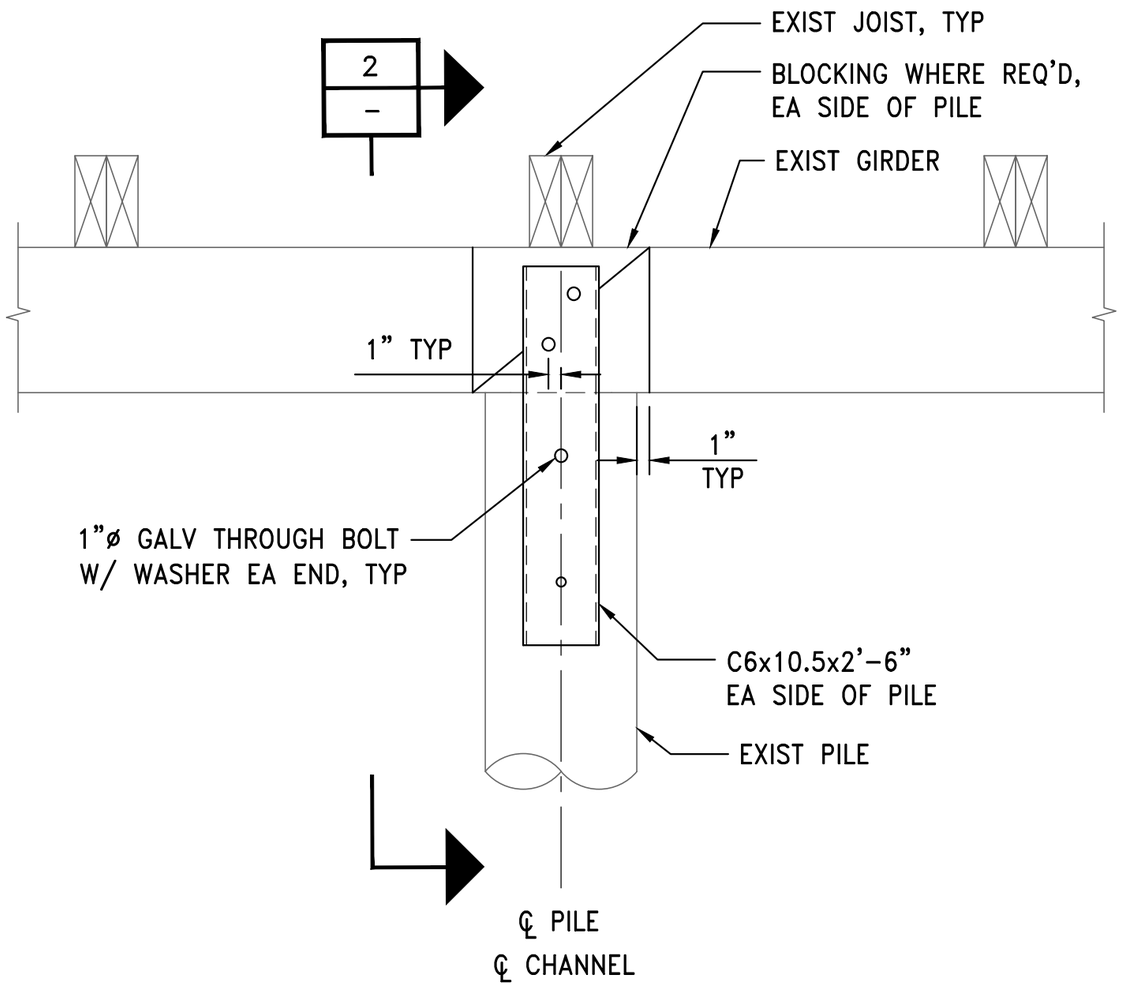
SHEET TITLE: GIRDER/JOIST DCR HEAT MAP

WORK PROJECT NO.

CONSULTANT'S NO.

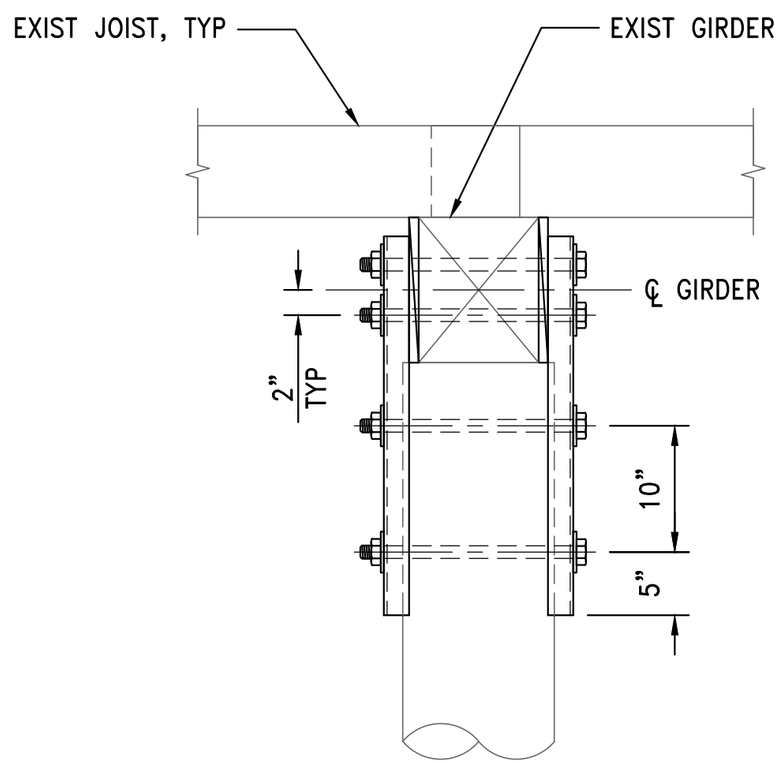
PORT OF SEATTLE NO.

HEAT MAP



DETAIL 1

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



SECTION 2

SINGLE GIRDER CHANNEL CONNECTION
FOR GIRDER WIDTH < OR = 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

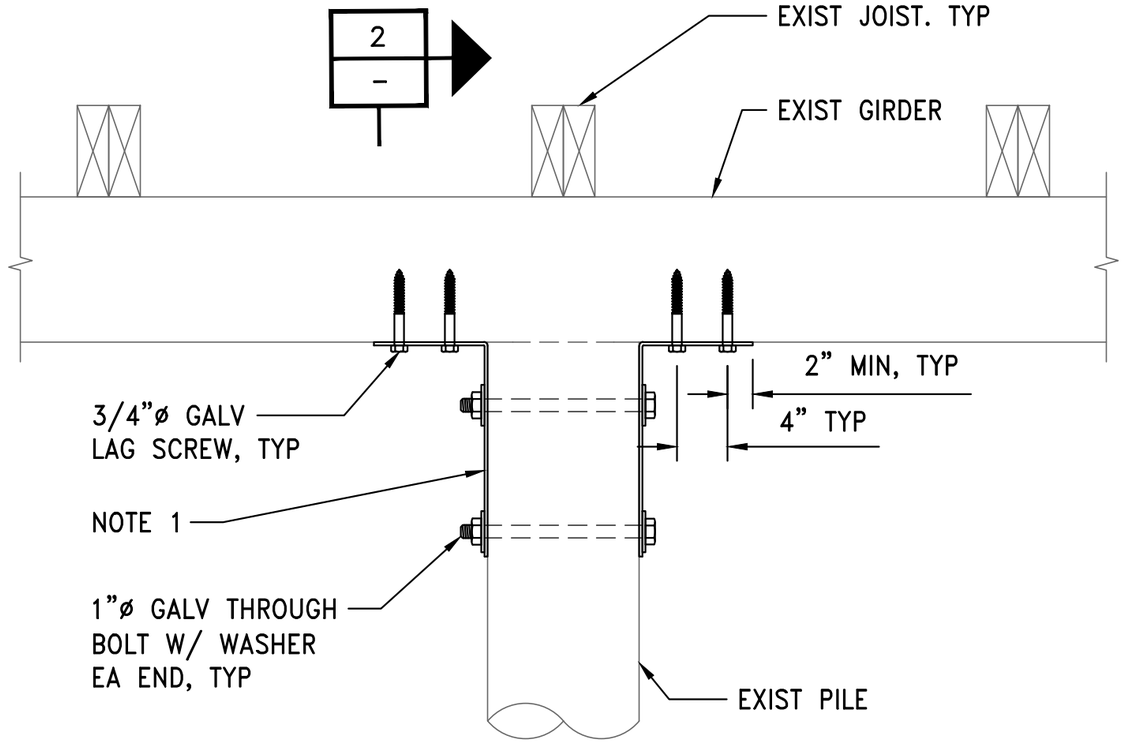
SHEET TITLE: CONNECTION REPAIR DETAILS

WORK PROJECT NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO.

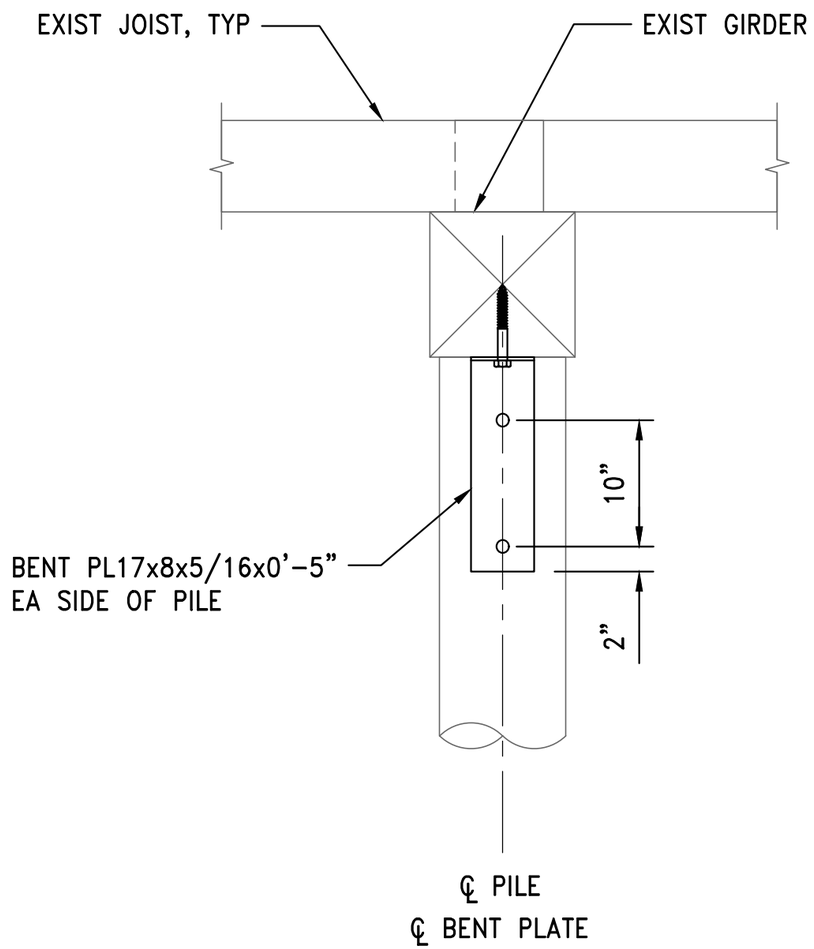
SK1



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

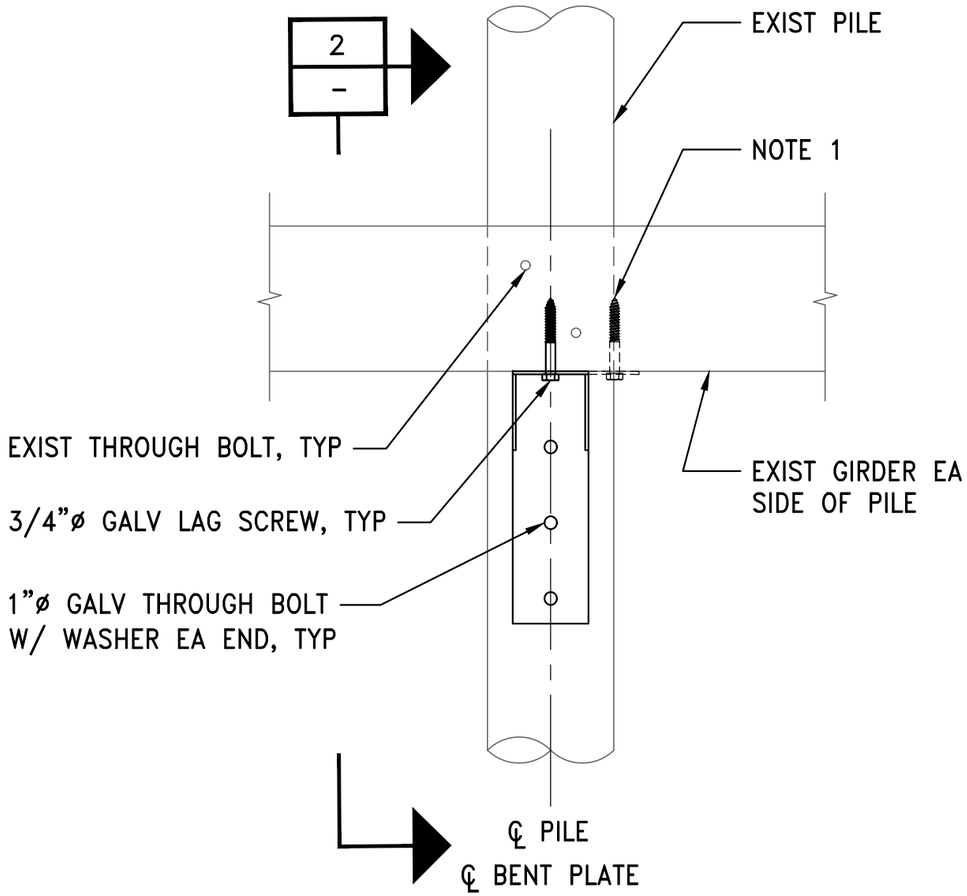
SHEET TITLE: CONNECTION REPAIR DETAILS

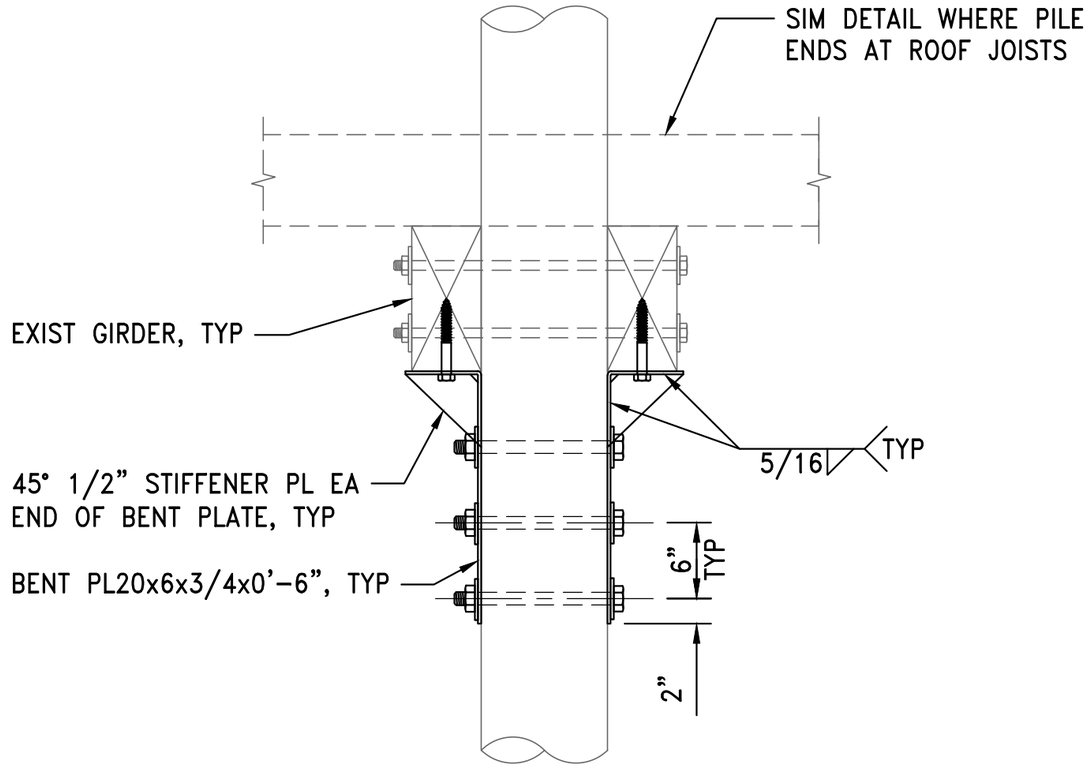
WORK PROJECT NO.

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

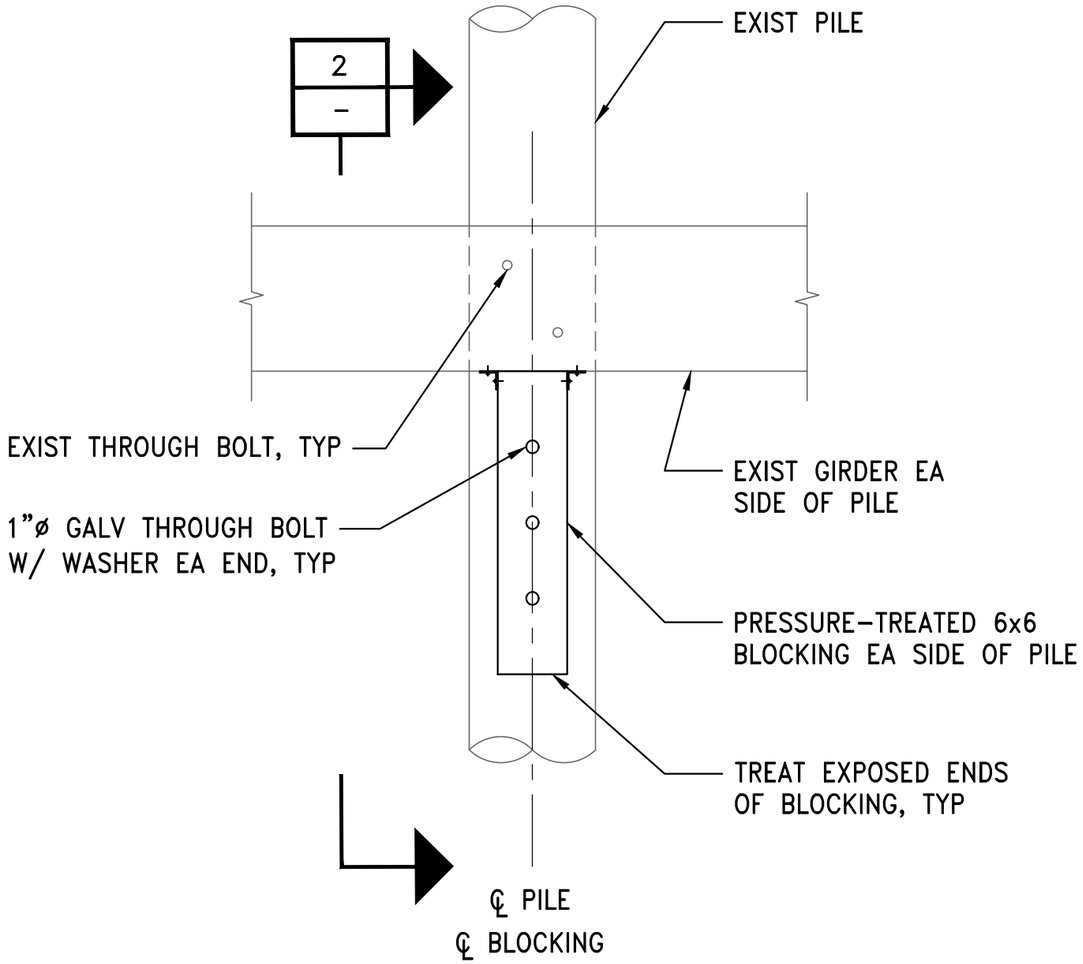
SECTION 2 / –
DOUBLE GIRDER BEARING CONNECTION
OPTION A

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

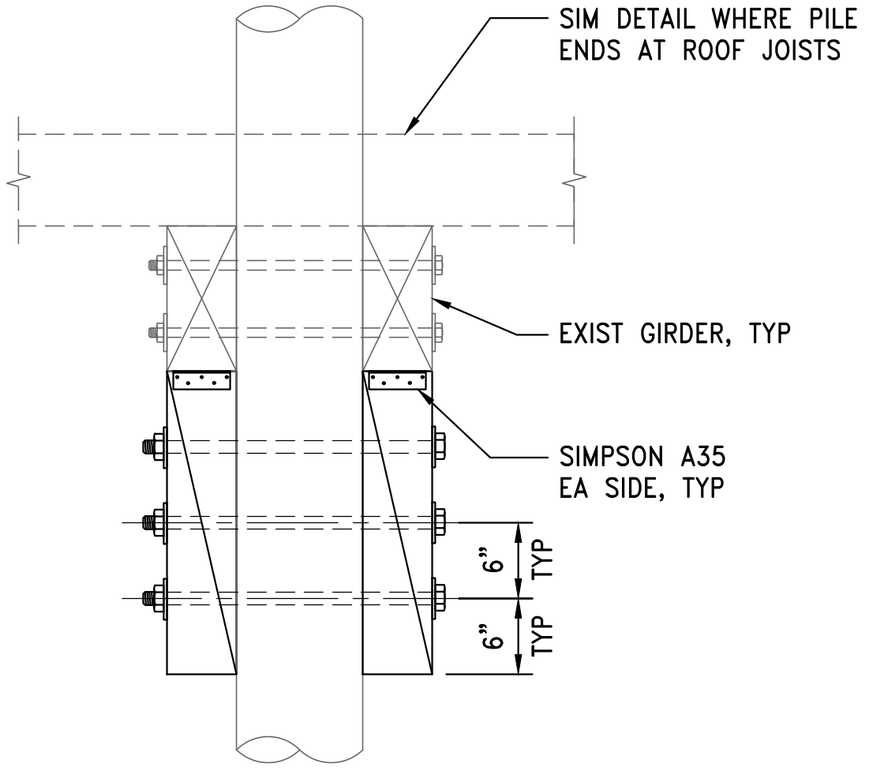
Port of Seattle
SALMON BAY MARINA
PROJECT: SALMON BAY MOORAGE ROOF CONDITION ASSESSMENT
SHEET TITLE: CONNECTION REPAIR DETAILS

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

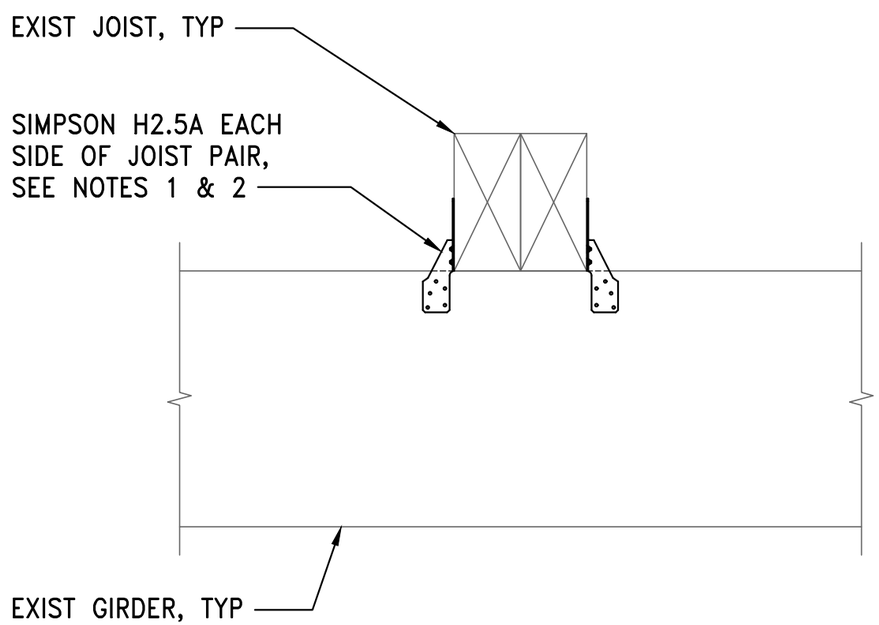
SHEET TITLE: CONNECTION REPAIR DETAILS

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 1/–
JOIST TO GIRDER CONNECTION

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

Salmon Bay Marina

Routine Pile Inspection Report

Seattle, Washington

Document Number: W3Y17302-TNE-01

March 2024

PORT OF SEATTLE.

SALMON BAY MARINA

SEATTLE, WASHINGTON

ROUTINE PILE INSPECTION REPORT

MARCH 2024

Document Number: W3Y17302-TNE-01

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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 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 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 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.

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.

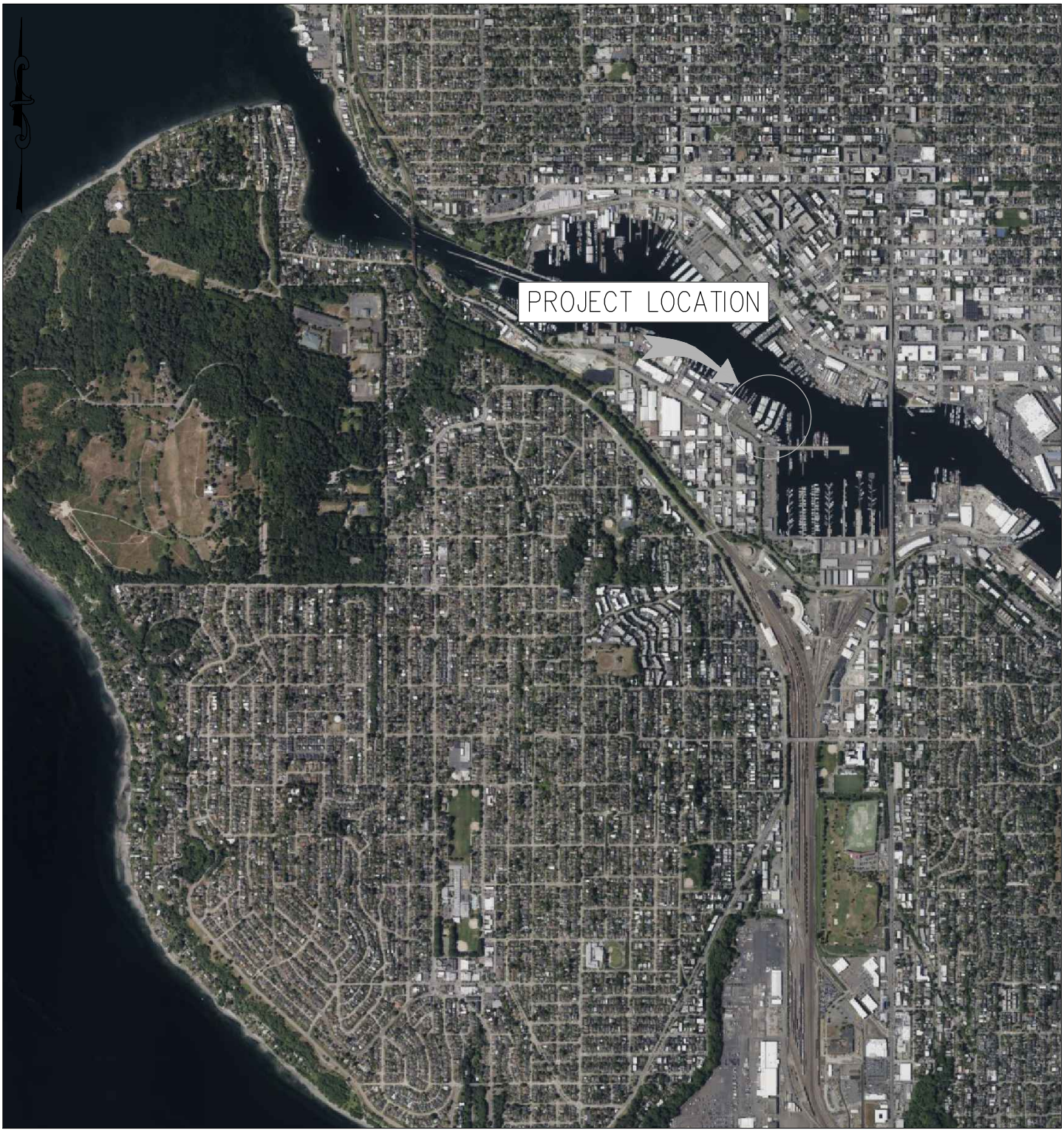
Dock A comprises 114 timber plumb and batter piles arranged into 33 bents. Each bent typically contains 3 to 4 piles, with the eastern-most pile supporting a low-water barrier to protect the berthed vessel from wake produced by ship traffic in the canal. A wave screen supported by an additional nine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

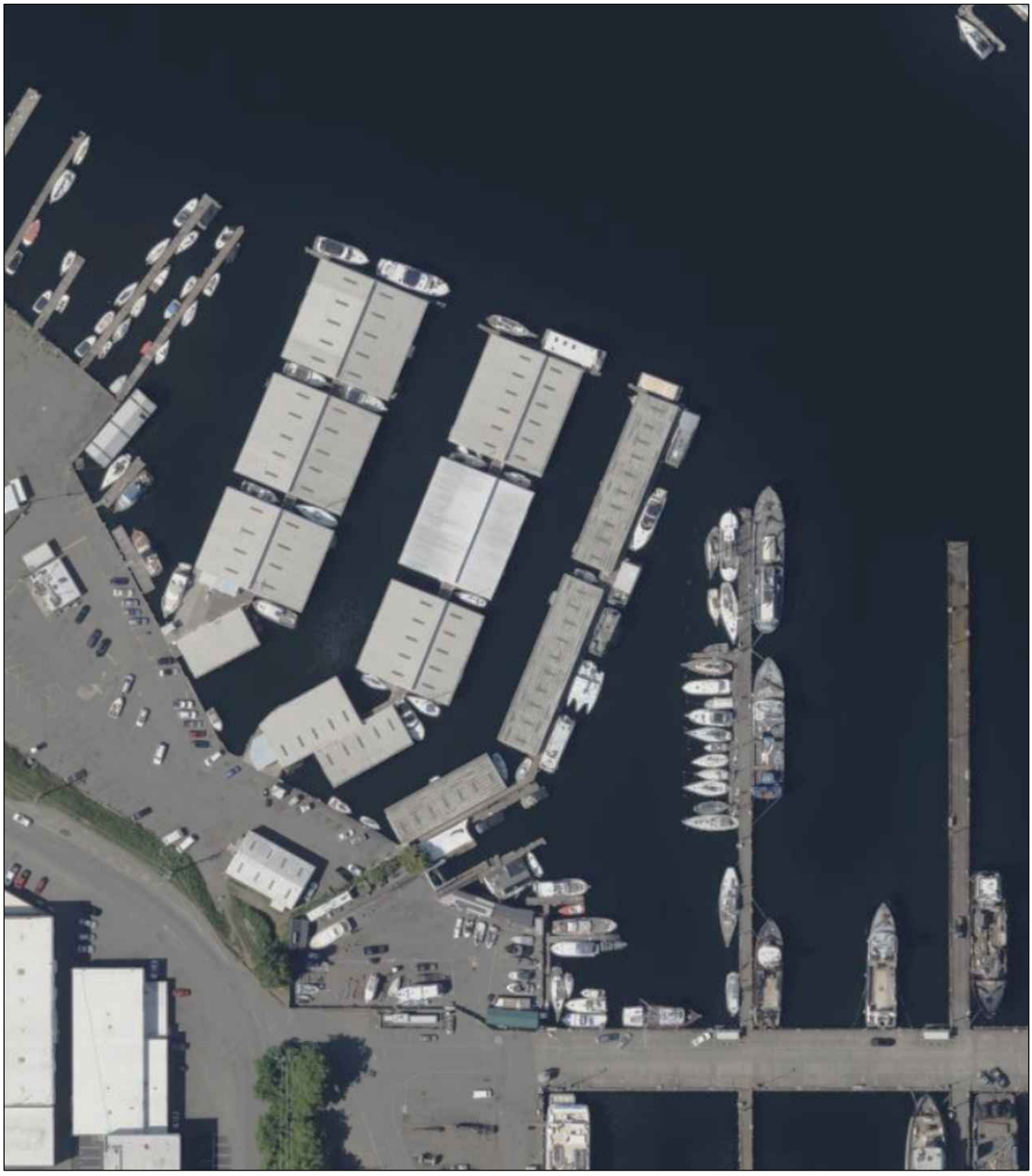
A Vicinity Map and Location Plan of the project site are provided in Figures 2-1 and 2-2, respectively.



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

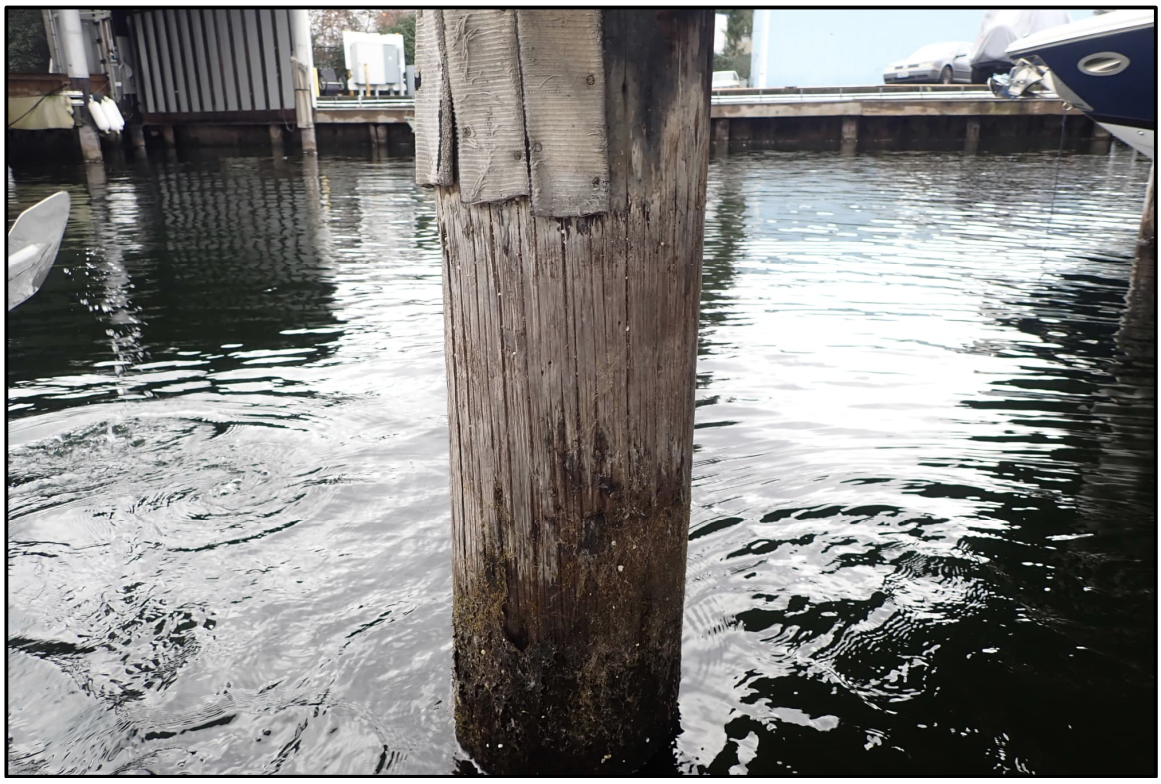


Photo 2-1: Typical timber pile ranging between 9 in. and 12 in. wide, along Docks A, B, and C.

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 wavescreen.

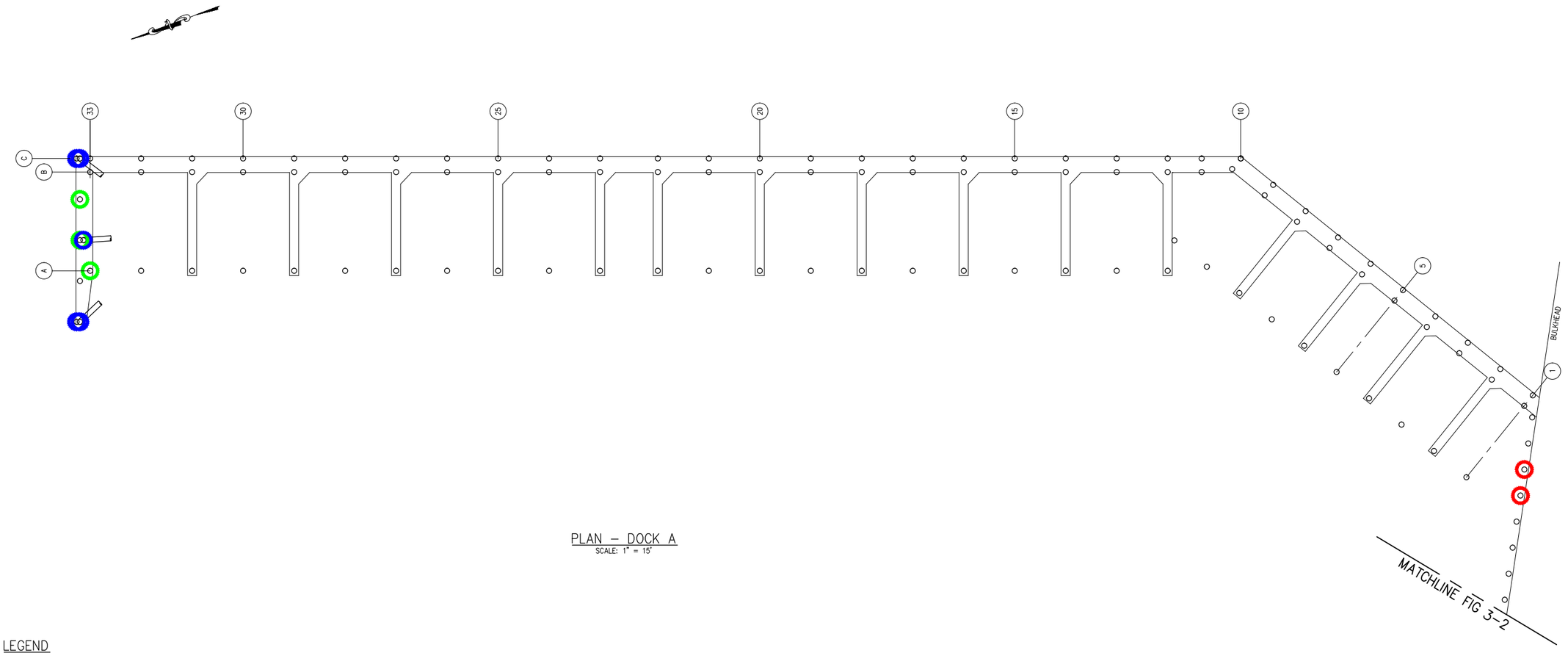
Photo 3-4: Timber pile with major section loss due to fungal rot at top of pile.

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

- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE
- 12"ø TIMBER PILE RATED MAJOR
- 12"ø TIMBER PILE RATED SEVERE

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

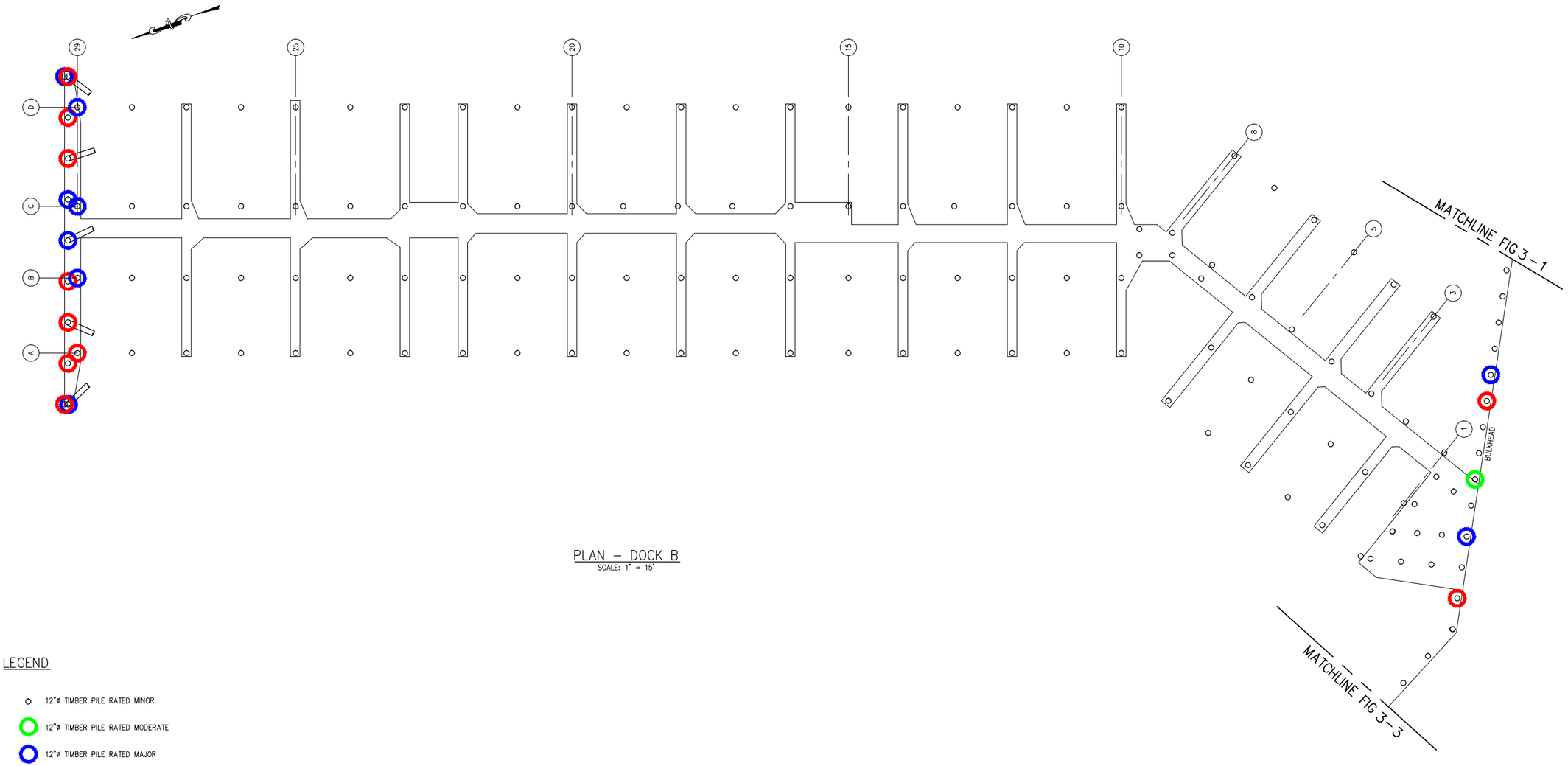
REVISIONS NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

Jacobs

DESIGNED BY G.L.	PORT OF SEATTLE MARINE FACILITIES
DRAWN BY G.L.	
CHECKED BY	SALMON BAY MARINA
PROJECT ENGR	PILE DEFICIENCY PLAN SHEET 1 OF 3

SCALE 1" = 15' | DATE | REVISION

DRAWING NO. FIG 3-1



PLAN – DOCK B
SCALE: 1" = 15'

LEGEND

- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE
- 12"ø TIMBER PILE RATED MAJOR
- 12"ø TIMBER PILE RATED SEVERE

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
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REVISIONS	NO.	DESCRIPTION	DATE	BY	NO.	DESCRIPTION	DATE	BY

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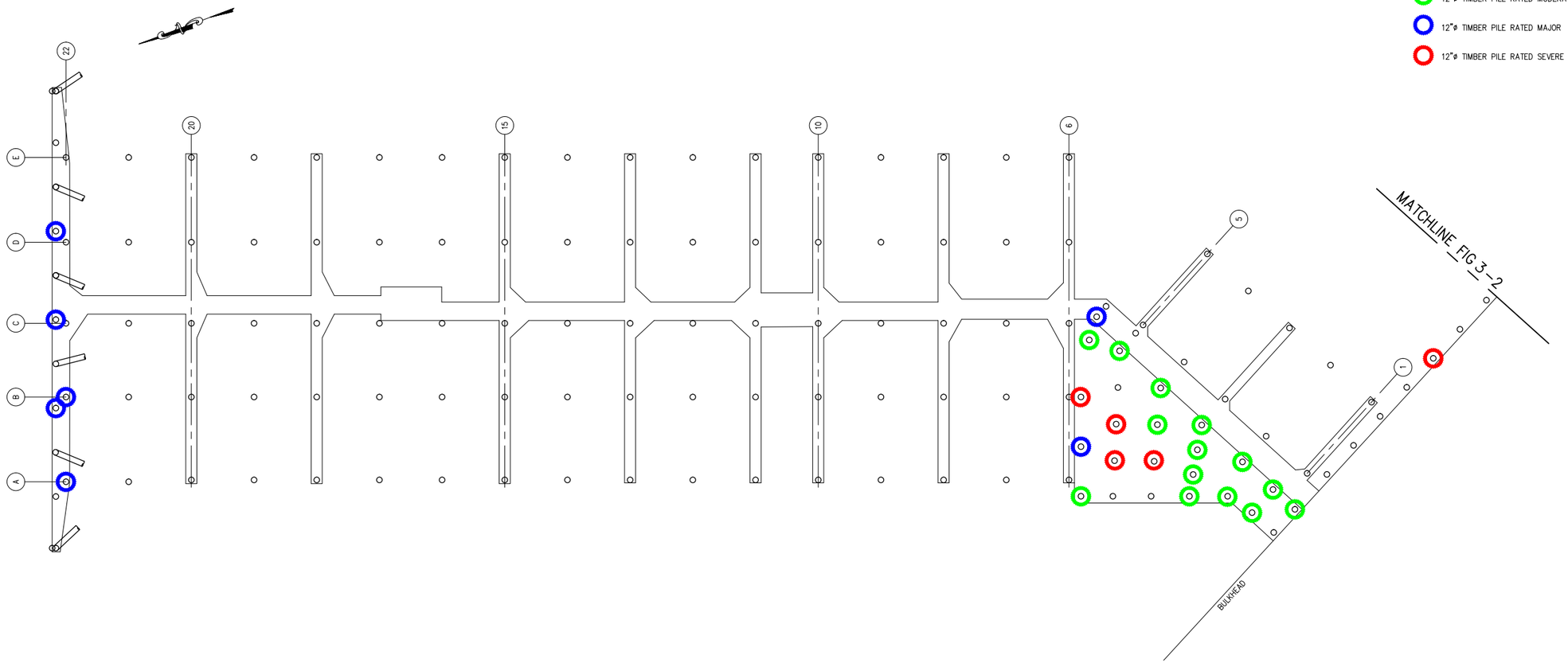
DRAWN BY G.L.	
CHECKED BY	SALMON BAY MARINA
PROJECT ENGR	PILE DEFICIENCY PLAN SHEET 2 OF 3

SCALE 1" = 15' | DATE | REVISION

DRAWING NO. FIG 3–2

LEGEND

- 12"ø TIMBER PILE RATED MINOR
- 12"ø TIMBER PILE RATED MODERATE
- 12"ø TIMBER PILE RATED MAJOR
- 12"ø TIMBER PILE RATED SEVERE



PLAN – DOCK C
SCALE: 1" = 15'

1"=15' 0 15 30 FT.

GRAPHIC SCALES
CHECK BEFORE USE

IF SHEET IS LESS THAN 24" X 36"
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DRAWN BY G.L.	
CHECKED BY	SALMON BAY MARINA
PROJECT ENGR	PILE DEFICIENCY PLAN SHEET 3 OF 3

SCALE 1" = 15' | DATE | REVISION

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.