SUNSHINE COAST REGIONAL DISTRICT
Hopkins Landing, Gibsons, BC

April 14, 2023

Prepared for:

Sunshine Coast Regional District
1975 Field Road
Sechelt, BC
V0N 3A1

Attention: Kelly Koper, Capital Projects Coordinator [Ports]

Prepared by:

Herold Engineering Limited
Unit 7, 1920 Lyche Road
Ucluelet, BC
V0R 3A0

HEROLD ENGINEERING

PORTS CONDITION ASSESSMENT

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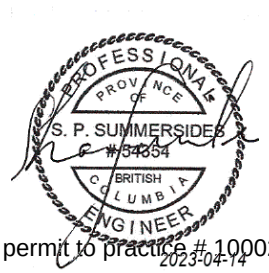
Submittal Date: April 14, 2023

Herold Project No.: 4551-012

Prepared by:



permit to practice # 1000201

Shannon Summersides, P. Eng.
Project Engineer

Reviewed by:

Permit No. 1000201

Craig Work, P. Eng., FEC
Principal

Executive Summary

The scope of the assignment includes above and below water assessment of the Hopkins Landing port facility followed by preparation of a site-specific condition assessment report. The report includes health and safety considerations and load rated capacities for the overall structure, as well as residual life estimates for individual members. A brief gap analysis between the existing structure and locally accepted Best Management Practices (BMPs) for marine facilities was completed using cited reference material (see Section 1.3). The BMPs utilized for the analysis were generated for the Howe Sound, Pender Island and the Sunshine Coast region (by others).

The assessment was conducted on December 1, 2022. The purpose of the assessment was to document the overall physical condition of the facility through review of provided reference material (previous reports/drawings) and visual and tactile assessment of accessible elements from above and below water. The above water assessment was conducted by Herold Engineering and the underwater portion of the work was completed by Westcoast Diving Contractors Limited under direct audio and visual communication with Herold Engineering.

The port facility is no longer in serviceable condition. Assessment results indicate that major upgrades are required at the facility, and that is currently considered structurally unreliable for public assembly. There are several areas where ongoing remedial work has been done. The main concern is the corbel repairs completed throughout the fixed structure(s). Piles that have more than one corbel installed and/or are missing connection between the pile, corbel and pile cap are considered structurally unreliable when resisting nominal lateral loads.

It is also to be noted that the topside items (handrails, guard and decking) are all in fair condition with signs of moderate damage due to abrasion and weathering, as well as moisture ingress and biological damage. The topside items are recommended to be replaced in their entirety within the next six years.

There are a significant number of items identified to be repaired/replaced within the next year as follows:

- Ten timber guards and one riser to be replaced
- Sixteen bearing piles to be replaced
- Eight bearing piles require repairs – strapping
- One corbel requires connection
- Two concrete piles require connection brackets
- Two cross braces are to be replaced and ten braces require remediation
- Two serrated aluminum decking sections are to be replaced on gangway
- Two float flanges require replacement
- All flange splice connection hardware require replacement
- Three mooring piles require replacement

Due to the condition of the fixed structure(s) and the number of repairs required, it is recommended that the facility be closed to public use until upgrades can be completed.

The gap analysis identified minor items which could be completed at the facility to bring it closer to adherence with BMPs. The following could be considered during the next maintenance cycle/upgrade:

- Consideration should be given to prohibiting vessel moorage in the winter season.

The following recommendations pertain to Health and Safety at the facility. As a legacy facility, these items are typically not in conformance with health and safety regulations and are considered at the discretion of the client to upgrade:

- Safety ladder spacing and signage does not conform to WorkSafe BC regulations.
- Handrails do not conform to OH&S standards.

The load rating was established using The Canadian Highway Bridge Code (CAN/CSA S16-19), and assumes that all repairs identified to qualify the rating have been completed. The fixed structure(s) have been retrofitted and the existing configuration, in good condition, can accommodate a maximum area load of 0.6kPa. This load is significantly less than a typical assembly design load for a structure of this form (4.0kPa). No public assemblies or vehicle use is permitted at the facility due to the significantly reduced live load capacity. A traffic bollard is recommended to limit types of live loads able to access the structure(s).

The repairs noted in this report are considered outside anticipated maintenance requirements for a facility of this age and function, due to the recommended replacement of several structural elements on the fixed structures. The repairs are estimated to Class C standard in 2023 Canadian dollars and rounded to the nearest thousand dollars. For Hopkins Landing, the repairs are estimated to be $381,000.00.

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1.0 INTRODUCTION

Facility: Hopkins Landing, Gibsons, BC

Assessment by: Shannon Summersides, P. Eng. (Herold Engineering Ltd.)
Westcoast Diving Contractors Ltd. (3-man crew)

Date: December 1, 2022

1.1 Purpose of Assignment

The assessment was conducted to identify members either requiring repairs or showing signs of deterioration. The following report will provide information regarding maintenance, repair, replacement and health and safety on a 10-year forecasted time period, allowing for a prioritized repair and maintenance program to be implemented. Other items noticed during the assessment will be reported only in terms of general overall condition.

The assessment included detailed above water visual / tactile assessment of the following facility components:

- Abutment headwall
- Handrails
- Vehicle Guard
- Cleats
- Safety Ladders
- Deck Planks
- Stringers
- Pile Caps
- Cross Bracing
- Piles

Items assessed specific to floats:

- Gangways and connections
- Bull rails & risers
- Rub boards
- Decking
- Flanges & cross ties
- Floatation
- Mooring system (piles, anchor chains)

The facility was previously reviewed from above water by Herold Engineering in December 2018, and below water in 2009 by Pelagic Technologies Inc. (Pelagic). Reference drawings indicating noted bearing pile condition, as well as the chain and anchor mooring layout were provided to Herold Engineering. It is assumed that this reporting was conducted via underwater assessment.

1.2 Scope of Work

The assessment of the facility components was completed to the standards set out below. The work included facility components noted in Section 1.1.

The condition assessment and residual life estimates were based on previous experience, as well as the reference material noted below.

The load rating and capacity calculations were executed following the recommendations in the reference material noted below and best engineering practice.

All recommendations related to occupational health and safety were provided based upon current WorkSafe BC regulations, as well as our experience with facilities similar in form and function.

A gap analysis was conducted for the facility to evaluate compliance with several best management practices documents. The documents were prepared by municipalities and First Nations groups along the coast of Vancouver Island and the Coastal Mainland for the maintenance and construction of marine infrastructure. All documents were provided by The Sunshine Coast Regional District and are reference in Section 1.3 below.

1.3 Reference Material

- Procedures for Inspection and Assessment of Fixed Timber Docks – 1994 September – 4th Edition by R.G. Sexsmith Ltd.
- Standard Practice Manual for Underwater Investigations by the American Society of Civil Engineers, Ports and Harbors Committee, May 2000.
- Canadian Highway Bridge Design Code CAN/CSA S6-19.
- WorkSafeBC Occupation Health and Safety Regulations for Wharves, Docks and Mooring Floats
- Pender Harbour Dock Management Plan. Ministry of Forests, Lands, Natural Resource Operations and Rural Development. March 2021.
- Shisha'Ih Nation Best Management Practices for Marine Docks. Version 20180605.
- Atl'ka7tsem/Howe Sound Biosphere Region Best Management Practices for Marine Docks. Draft 10. June 13, 2021.
- Canadian Navigable Waters Act. R.S.C, 1985, c.N-22. Canadian Minister of Justice. December 12, 2022.

1.4 Methodology

The facility was reviewed from above water by Herold Engineering Limited (Herold Engineering) and below water by Westcoast Diving Contractors Ltd (WDC) under direct audio and visual supervision of Herold Engineering.

The assessment involved a visual and tactile assessment of the structural elements, and select hammer soundings of timber elements. Refer to Section 5 for assessment results, as well as Appendix D for detailed remediation recommendations. Although these assessments are able to verify much of the visible and tactile damage, they are somewhat limited in assessing the severity and extent of internal damage, especially damage as a result of marine borer activity.

Load capacity calculations were completed using CAN/CSA S6-19. Residual life estimates for various elements were completed using guidelines provided in the reference material noted in Section 1.3. The findings are based on "as found" conditions at the time of the assessment.

2.0 DESCRIPTION

2.1 Location

Gambier Harbour Port Facility is located on the southern aspect of Gambier Island, approximately 30 kilometers northwest of Vancouver, B.C across the Strait of Georgia. Refer to the following aerial figure (Figure 2.1) for port location.

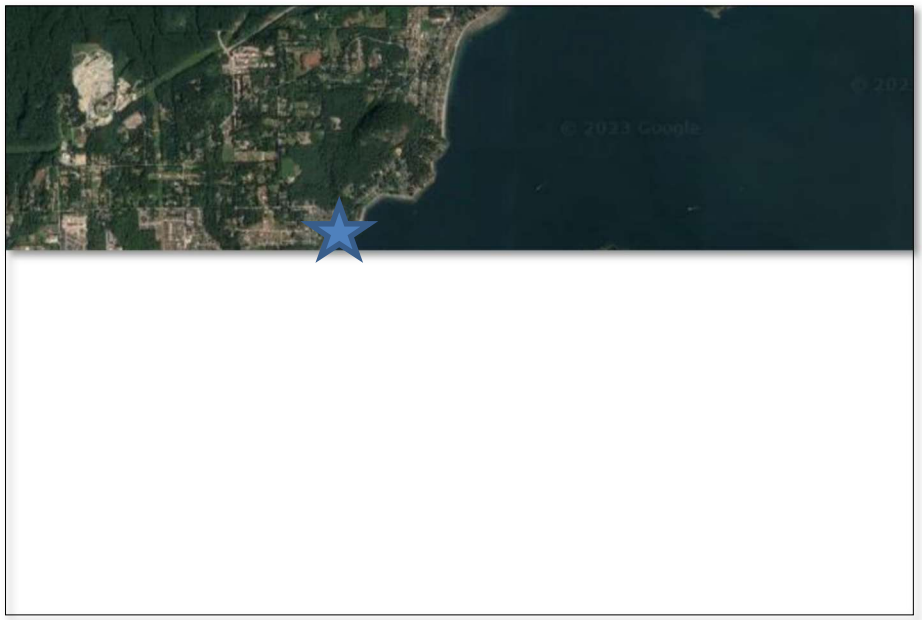


Figure 2.1: Hopkins Landing Site Location (Gambier Island)

2.2 Geometry

The overall geometry of the facility's main components is as follows:

Approach	-	1.83m x 130m
Wharfhead	-	1.83m x 9.1m
Gangway	-	1.83m x 18.6m
Float	-	4.3m x 17.4m

The general layout of the facility is as per the Herold Engineering Drawings 4551-012 S01 and S02 located in Appendix C.

2.3 Reference System

The reference system used for this report is as per the drawings found in Appendix C. For the purpose of this report, the approach, wharfhead, gangway, and float all generally run north to south

Along the approach and wharfhead the pile bents are numbered from the abutment (Bent 0) to the wharf face (Bent 27). The pile rows are lettered from east to west as Gridlines A through to F.

There is one float at the facility, accessed by an aluminum gangway. The float is moored by treated timber mooring pile groups at the north and south ends of the float.

The general arrangement of the facility is shown in Photograph 1 & 2, located in Appendix A.

2.4 Approach & Wharfhead

The facility is a typical legacy Transport Canada facility. The approach and wharfhead are primarily treated timber construction. Topside elements include handrails and guards along either side of the approach, as well as a guard around the wharfhead perimeter. Timber decking provides a walking surface along the approach and wharfhead. There is a life ring, and safety mounted along the seaward edge of the wharfhead.

The substructure is comprised of treated timber stringers, pile caps and bearing piles. It is understood that the superstructure (handrails, guard, decking and stringers have been replaced within the last five years. The approach has intermittent lateral and longitudinal bracing and wale timbers.

The approach appears to be retro-actively placed on an existing timber substructure (pile caps and bearing piles). The existing approach is not as wide as the original approach, and the edge stringer lands along the pile cap span, rather than bearing directly onto the pile cap at the bearing pile location. This updated configuration increases the loading in the pile caps, and distributes the loading to the bearing piles unevenly.

The abutment (Bent 0) appears to be a buried timber construction. The arrangement was not accessible for review at the time of the assessment.

Typical member sizes and spans are as follows:

Handrails	-	38mm x 140mm handrail
	-	38mm x 89mm top-rail
	-	38mm x 140mm mid-rail
	-	89mm x 89mm x 1.5m posts spaced at 2.4m (±)
Timber Decking	-	75mm x 305mm treated, spanning approx. 610mm
Vehicle guard	-	89mm x 140mm (approach)
Risers	-	38mm x 140mm
Stringers	-	140mm x 279mm creosote treated
Pile caps	-	216mm x 254mm creosote treated
Cross Bracing	-	152mm x 203mm
All Piles	-	Size 36 (305Ø) creosoted treated/concrete
Wale Timbers	-	152mm x 203mm
Fender Chocks	-	152mm x 203mm

2.5 Gangway

An aluminum gangway is located on the seaward edge of the wharfhead. The gangway provides access to a timber float. Truss member sizes are as follows:

Top Chord	-	HSS76x76
Bottom Chord	-	HSS76x76
Verticals	-	HSS76x76
Cross Beams	-	HSS76x76
Decking	-	51mm thick serrated aluminum sections

2.6 Float

Topsides of the float include timber bull rails and risers and treated timber decking. There is a timber landing pad with guide angles secured to the float deck.

The float substructure is a timber construction consisting of treated timber cross-ties, joists, stringers, and flanges. The float is moored by a spread dolphin comprised of four mooring piles stiffened with a header beam at the north end, and a compact dolphin comprised of six timber mooring piles at the south end. The floatation is a mixture of fiberglass pontoon and polystyrene floatation.

Typical component sizes and spans are as follows:

Decking	-	51mm x 305mm
Bull Rails	-	152mm x 152mm
Risers	-	152mm x 152mm x 305mm long
Rubboards	-	38mm x 292mm

Pelagic has reported the float substructure as follows:

Edge stringer	-	140mm x 290mm
Joists	-	mixture of 89mm x 140mm and 140mm x 290mm
Cross-tie	-	290mm x 290mm
Flange	-	140mm x 290mm
Flange Splice Block	-	140mm x 140mm

3.0 HEALTH & SAFETY BACKGROUND

Legacy Transport Canada marine facilities of this kind have a similar construction and arrangement which is somewhat typical within the Pacific region. The majority of marine facilities are not able to meet areas of governing regulations for health and safety. It is at the discretion of the owners of the facility as to the stringency with which the following requirements are followed.

3.1 OH&S Requirements

3.1.1 Ladders

Fixed ladders must be provided at every dock for access to and egress from the water and should:

- Be spaced at intervals not exceeding 30 meters.
- Extend from the top of the float or fixed wharf structure deck to at least 1 meter below the lowest water level.
- Be maintained free of barnacles and marine growth, and
- Have their location identified by high visibility paint on the curb or bull rail.

3.1.2 Lifesaving Equipment

Appropriate lifesaving equipment must:

- Be provided and maintained for the rescue of any worker/users in danger of drowning, and
- Be positioned at intervals not exceeding 50 meters in conspicuous locations as near as practicable to the danger area.
- Throwing lines fitted to lifebuoys or similar equipment must be of suitable size and length and made of buoyant material.
- Lifesaving equipment includes lifebuoys, throwing bags, grapples, boat hooks or other equipment appropriate to the circumstances.

3.1.3 Curbs, Bull Rails, Guardrails, and Barriers

A curb or bull rail must be installed along the open sides of each float, dock, wharf, pier and similar other area where mobile equipment might be used.

Each curb and bull rail must be of substantial construction and be at least 250mm high.
Where practicable, guardrails meeting the requirements of Part 4 (General Conditions)
must be installed at:

- Dangerous breaks in the continuity of the wharf, dock or pier and
- Dangerous corners, edges and other parts of a wharf, dock, or pier.
- See section 3.1.5 for Part 4 (General Conditions) requirements (below).

Moveable warning barriers may be used where the use of standard guardrails is impracticable.

3.1.4 Markings

Where circumstances require, curbs, bull rails, guardrails, and barriers must be painted solid yellow, yellow and black stripes or checkers, or yellow against a suitable contrasting background.

Retroreflective paint or patches must be applied to curbs, bull rails, guardrails, and barriers where mobile equipment is operated at night.

3.1.5 Fall Protection (OH&S Part 4 – General Conditions)

An area accessible to workers must have guards or guardrails installed in any of the following circumstances:

- If a raised floor, open-sided floor, mezzanine, gallery, balcony, work platform, ramp, walkway, or runway is 1.22 meters or more above the adjacent floor or grade level;
- On both sides of any walkway over or adjacent to any substance which is a hazard if a worker fell in, or on it, or which is over machinery or work areas;
- Around the perimeter of any open container or containment area such as an open vat, bin, tank or pit which is 1.22 meters or more in depth and which has sides that do not extend at least as high as required for a guardrail above the adjacent grade or work surface;

It is to be noted that these requirements pertain to workers and may not be relevant for the use of a port facility.

3.2 Fire Protection

The placement of fire-extinguishing equipment shall be planned in cooperation with the authority having jurisdiction and the local responding fire departments at least annually in order to accommodate changing conditions and personnel responsible for fire control in the facility.

The placement of portable fire extinguishers on piers and along bulkheads where vessels are moored or are permitted to be moored shall meet the following criteria:

- Extinguishers listed for Class A, B, and C fires shall be installed at the pier/land intersection on a pier that exceeds 7.62m in length.
- Additional fire extinguishers shall be placed such that the maximum travel distance to an extinguisher does not exceed 22.86 meters.
- All portable fire extinguishers shall be maintained in accordance with Chapter 6 of NFPA 10, Standard for Portable Fire Extinguishers, and shall be clearly visible and marked.

4.0 BEST MANAGEMENT PRACTICES GAP ANALYSIS

Pacific coastal municipalities and First Nations groups are beginning to provide regulations and guidelines for marine dock construction, management and remediation in attempts to ensure infrastructure is adhering as best as is practicable to Fisheries and Oceans Canada guidelines and best management practices.

A gap analysis has been conducted for the facility to identify items which may fall short of new regulations/guidelines and to identify items which the SCRD may want to use in the future to develop their own permitting requirements, regulations and best management practices for floating docks within their jurisdiction.

The following Best Management Practices (BMP) documents have been used in the gap analysis as provided by the SCRD:

- Pender Harbour Dock Management Plan. Ministry of Forests, Lands, Natural Resource Operations and Rural Development. March 2021.

- Shisha'lh Nation Best Management Practices for Marine Docks. Version 20180605.
- Atl'ka7tsem/Howe Sound Biosphere Region Best Management Practices for Marine Docks. Draft 10. June 13, 2021.

All three documents have very similar requirements/recommendations. Some items are specific to new construction; however, several items can be incorporated into existing facilities during regular service, repair, renovation and/or decommission activities to improve environmental and societal impacts.

It is to be understood that the water body surrounding Gambier Island and the Sunshine Coast Mainland is deemed by DFO and the Canadian Species at Risk Act to be a habitat for extirpated, endangered of threatened marine species. For this reason, new construction and any major maintenance activities involving in water works are required to be reviewed, at minimum, by DFO to ensure that all habitat and species are kept safe during the associated activities. For this reason, the best management practices noted above heavily emphasize DFO regulations and mitigation measures for marine facilities and construction. Some of the items do not apply to this port facility.

Hopkins Landing is a legacy port facility that was constructed as appropriate for its time. Since the facility is existing, and no reports of negative interactions with marine life have been reported during its current service life (i.e.: as a public facility), we can say that the infrastructure has now likely become part of the marine habitat and there is no known reason to believe the facility poses any threat to marine life.

The following checklist details the gap analysis between the West Bay Port Facility as found during the condition assessment and the BMP's outlined in the above documents.

Table 4.1 Gap Analysis Checklist

BEST MANAGEMENT PRACTICE	2022	REMARKS
Dock Facility that facilitate numerous upland owners	✓	*Facilities service large(r) communities with several people utilizing the facility*
No critical habitats are impacted per Canadian Species at Risk Act (SC 2022, c.29)	✓	*Not directly applicable to the structure in service, but it is considered during upgrades and maintenance activities.*
Do not block the free movement of water along the shoreline	✓	*Piled structures allow for this requirement to be met*
All building codes and bylaws administered by all levels of government must be adhered to for all structures	✓	*No service shed on structure(s)*
Clearance to underside of float is minimum 1.5 meters	✓	
Aligned in a North to South direction	✓	*N/A*
Access ramps/walkways are minimum 1.0 meters above HHWLT	✓	*At high tide this facility is very close to this minimum. Consideration should be given to sea level rise during any changes to the walkway structures*
Access ramps/walkways 1.2 meters wide maximum	✓	
Decking material allows (43%) light penetration	✗	*Timber decking does not allow through the minimum 43% light penetration. This*

BEST MANAGEMENT PRACTICE	2022	REMARKS
		is typical along the fixed structures and float.
Use of encased, wrapped or uncovered polystyrene products	✗	*Floatation is not as recommended in the BMPs*
Using preferred materials	✓	*Structure(s) are constructed from preferred materials, but are not the BMP specified "best" material, which is steel.*
Upland dock elements (including anchor points) do not disturb the riparian area	✓	*N/A*
Maintenance and construction activities take place in appropriate DFO timing windows	✓	*N/A*
Consultation with appropriate First Nations stakeholders prior to construction, with specific sensitivity to archeological significance of site	✗	*Unsure if this is part of the SCRD process during upgrades/maintenance activities.*
Allow access to shoreline for First Nations harvesting of marine resources FN	✓	*N/A*
Seasonal floats	✗	*Not seasonal*
No vessel moorage during winter	✗	*Temporary vessel moorage permitted all year round*
Construction does not include native materials	✓	*N/A*
Adhere to Canadian Navigable Waters Protection Act	✓	*No navigation hazards identified within site boundary at time of assessment*
Ongoing maintenance is in accordance with appropriate BMPs	✓	*N/A*

The facility adheres to several of the BMPs set out in the reference material. The majority of nonconformance is a result of the facility being existing at the time of BMP implementation.

There are items which currently do not adhere to the BMPs, but could be remediated during major upgrades/maintenance or changes to the service requirements as follows:

- Construct any future buildings on the structure to the most current edition of The British Columbia Building Code.
- Consideration should be given to prohibiting vessel moorage in the winter season.

5.0 ASSESSMENT RESULTS

The results of the on-site assessment are based mainly on visual review, probing and sounding timber with a hammer. While all the piles were reviewed, these assessments are somewhat limited in detection of the severity and extent of the damage particularly damage due to marine borers.

The general condition of the various elements is as indicated below. For information on specific components, see Appendix B.

The following is an explanation of the rating scale used in Section 5 as it relates to the estimated time before the next required repair to a specific item.

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. Repairs may need to be carried out on a very high priority basis with strong 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
Poor:	Advanced deterioration or overstressing is observed on widespread portions of the structure but does not significantly reduce the load-bearing capacity of the structure. Repairs may need to be carried out with moderate urgency.
Fair:	All primary structural elements are sound, but minor to moderate defects or deterioration is 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.
Satisfactory:	Limited minor to moderate defects or deterioration are observed, but no overstressing is observed. No repairs are required.
Good:	No visible damage, or only minor damage is noted. Structural elements may show very minor deterioration, but no overstressing is observed. No repairs are required.

5.1 Approach and Wharfhead

The approach and wharfhead are no longer considered to be in serviceable condition. The existing configuration has several repairs which are considered structurally unreliable and require remediation. The approach is a newer construction than the substructure, and the configuration is not typical of structures of this form/function. Significant upgrades are required and consideration should be given to closing the structure(s) to the public until such time as repairs can be made.

General views of the approach, wharfhead, and floats are shown in Photograph 1 & 2 (Appendix A).

5.1.1 Topsides

Generally, the topside elements (handrails, guard timber, and decking) are in overall fair serviceable condition. There is cracking and cross-sectional loss due to weathering and mechanical damage, as well as evidence of moisture ingress and biological damage. The handrails, guard timbers and decking are recommended for replacement within the next six years.

There are ten sections of timber guard and one riser recommended to be replaced within the next year, and it is recommended that the approach and wharfhead be power-washed to remove debris and biological accumulation.

Their safety ladders require some remediation. The ladder at the end of the wharfhead does not have a complete concrete anchor and requires replacement. Signage is recommended to be installed indicating the ladder location from shore, as well as from water.

5.1.2 Abutment

The abutment is in overall satisfactory condition. Accessibility was limited at the time of the assessment.

Adjacent to the abutment is a timber walkway that extends to the beach. The stairs at the end of this walkway are not typical. The treads have very little depth, and this could be a tripping hazard for the public. Consideration should be given to providing stairs which conform to BCBC 2018.

5.1.3 Stringers

The stringers are in overall good condition.

The splice hardware on the stringers is moderately corroded and appear loose. Several of the splices require new hardware, and consideration should be given to replacing all the stringer hardware at the splice locations.

There are two stringer butt connections missing splice blocks and connection hardware. Splice blocks and appropriate hardware are recommended to be installed.

5.1.4 Pile Caps

Generally, the pile caps are in overall fair to poor condition, with minor to moderate biological and mechanical damage.

The existing approach appears to have been placed on existing pile caps and bearing piles. The new approach is not as wide as the original, and the pile caps are significantly more loaded than if the approach was as wide as the pile caps.

There is one pile cap with moderate splitting and checking and an exposed bolt hole. Strapping the cracking and plugging and patching the hole is recommended.

5.1.5 Bearing Piles

The bearing piles are in overall poor to very poor condition. Several bearing piles have been remediated using corbel repairs. In some areas there are more than one corbel (up to three) between the pile cap and the top of the bearing pile. This configuration is considered structurally unreliable for nominal lateral loads and all of these locations are required to be remediated.

Within the next year, sixteen bearing piles require replacement, three footings are required to be re-cast, and sixteen bearing piles require remedial repairs such as strapping, patching, and/or installation of shims to restore full bearing.

There are an additional six bearing piles recommended to be replaced within the next three years.

5.1.6 Cross-Bracing and Wale Timbers

The cross bracing at the facility is in good to fair condition. There are two braces which require replacement, as well as ten braces that require remedial repairs such as strapping, tightening of the connections and/or replacement of the connection hardware.

5.2 Soundings

Soundings were taken around the wharfhead and approach perimeter. The soundings may be used to identify any scouring, undermining, and/or sediment transport that may be happening at the facility. It is recommended that sounding measurements be taken during scheduled maintenance and periodic condition assessments to monitor variations in the seabed and/or listing of the structure(s).

Table 5.2.1 Wharf and Approach Sounding (m)
**All measurements were taken from top of deck to mudline.*

Location	2018	2022
10E	6.1m	5.7m
19E	8.0m	8.0m
16A	7.0m	7.0m
27A	10.4m	10.5m
27G	10.1m	10.4m

5.3 Gangway

The gangway is in overall good condition. There are two sections of serrated aluminum decking which require replacement.

5.4 Main Float

The float is in generally serviceable condition with isolated members requiring repair. The topsides are in fair condition. The decking and bull rails are moderately deteriorated due to weathering and abrasion.

The substructure is in poor to very poor condition. There are two flanges that have failed and are hanging down below the underside of the float. The failed flanges have resulted in a significant list in the float freeboard (see below). The flanges are recommended to be replaced, as well as all the flange splice block hardware as is considered best practice.

The mooring system is in overall poor condition. Three mooring piles are significantly abraded with areas of greater than 50% cross sectional loss. It is recommended that four mooring piles be replaced.

The floatation is in overall poor condition. There are raw polystyrene billets which are not considered to adhere to currently accepted environmental best practices. Some of the polystyrene is loose and floating within the float footprint.

Table 5.4.1 Main Float Freeboard Measurements (mm)
**All measurement from waterline to top of float deck*

Location	2018	2022
Northwest	356	483
Northeast	432	330
Southwest	457	508
Southeast	457	508

The freeboard around the float perimeter is inconsistent and deviates from acceptable design heights and tolerances. This is likely due to the deterioration within the substructure, as well as the condition of the polystyrene floatation.

5.5 Dolphins

The three mooring dolphins around the wharfhead are in overall good condition. It is understood that the structure(s) are utilized by the public to climb and jump off of during the summer months. These structures are not considered safe for public usage; they are coated in creosote and often installed at a batter below the water surface. It is possible for a person jumping from the top of the structure to land on the battered pilings below water which could result in injury. Further, there is one pile which is broken below the water and requires removal.

Consideration should be given to decommissioning of the mooring dolphins.

5.6 Miscellaneous

An eel grass bed was noted below the fixed structure from Bent 14 to Bent 17 (approximately). DFO has defined eel grass as a species at risk. This bed must be reported to DFO prior to any construction activities.

5.7 Health and Safety

The following health and safety items were noted during the assessment.

5.7.1 Ladders

- Ladders along the float and the approach and wharfhead are spaced at intervals exceeding 30 meters.
- The ladder location is not identified with signage and/or high visibility paint on either side of the guard on the wharfhead.

5.7.2 Lifesaving Equipment

- The life ring is mounted to the wharfhead handrails, and is clearly identifiable when at the facility.

5.7.3 Curbs, Bull Rails, Guardrails, and Barriers

- The guard timber along the approach, as well as the float bull rail/riser arrangements do not meet minimum height requirements of 250mm consistently at the facility. This requirement is typically not met at facilities of this nature.

5.7.4 Fall Protection

The existing handrails are climbable, and have openings larger than 102mm at a deck elevation that exceeds 610mm.

5.7.5 Lighting

There is lighting at the facility. The light post brackets are significantly corroded and require replacement. There are localized areas where the insulation around the service wires has failed and there are exposed wires below the structure.

It is recommended that the brackets be replaced and the services be inspected by a registered professional.

5.7.6 Fire Protection

No observed portable fire extinguishers and/or fire protocols at the facility.

5.7.7 Navigation

Mooring Dolphin #2 has a broken pile below the water surface. It is recommended to be removed as it could be a potential navigation hazard.

6.0 LOAD RATING & RESIDUAL LIFE ESTIMATES

6.1 Load Rating

There is a no posted load rating for the approach and wharf head; however, a load rating was generated for the structure(s) by Herold Engineering in 2019.

6.1.1 Approach, Wharfhead and Gangway

The approach width at Hopkins Landing is less than 3.0 meters wide, and vehicle loads are not considered to access facilities with this approach width. A steel traffic bollard is recommended to limit to pedestrian access only.

Bending, shear and compressive capacities were determined using methods prescribed in Sections 3 and 9 of CAN/CSA S6-19. Member sizes and spacing were determined by field measurements. The analysis was done based on "as-new" condition of the structural elements and structural capacities assume that the recommended repairs have been completed (see Appendix B).

A maximum uniform load (in kilopascals (kPa), as well as a maximum point load (in kilonewtons (kN)), was determined for the structure, as well as for the gangway in accordance with CAN/CSA S6-19.

Material resistance factors used for design are as follows:

- Flexure (Φ_R) = 0.9
- Shear (Φ_R) = 0.9
- Compression (Φ_R) = 0.8

Load factors used for the load rating are as follows:

- Dead load factor (a_D) = 1.5 (deck) / 1.2 (other)
- Live load factor (a_L) = 1.7

Table D1 (Appendix D) summarize the results of the load rating and assumes all recommended repairs have been completed. By analyzing each element, an overall governing condition is determined as follows:

Table 6.1.1 Approach and Wharfhead Load Rating Governing Condition

Load Type	Element	Failure Mode	Maximum Load (kPa)
Area Load	Pile Cap	Shear	0.6

Shear in the pile cap on the approach and wharfhead was determined to be the overall governing mode of failure. This maximum allowable live load does not meet the CAN/CSA S6-19 specified live load of 4.0kPa and is considered insufficient for public assemblies of any kind. It is recommended that signage to this effect be installed at the facility.

6.1.2 Gangway

The gangway is an aluminum truss construction. There were no load rating stamps identified at the time of the review. The following assumptions have been made for the load rating analysis:

- Aluminum material type: 6061-T6
- Tube section wall thickness = 3.2mm

Material resistance factors used for design are as follows:

- Flexure (Φ_R) = 0.9
- Shear (Φ_R) = 0.9
- Compression (Φ_R) = 0.8

Load factors used for the load rating are as follows:

- Dead load factor (α_D) = 1.1
- Live load factor (α_L) = 1.7

Table D1 (Appendix D) summarize the results of the load rating and assumes all recommended repairs have been completed. By analyzing each element, an overall governing condition is determined as follows:

Table 6.1.21 Gangway Load Rating Governing Condition

Load Type	Element	Failure Mode	Maximum Load (kPa)
Area Load	Top Chord	Compression	1.5

Compression in the top chord of the truss was determined to be the overall governing mode of failure. This maximum allowable live load is not in accordance with CAN/CSA S6-19 specified live load of 4.0kPa. However, it does exceed the generally accepted design load of 1.2kPa for gangway structures. No load limit signage is recommended at the facility.

6.1.3 Float

The float is a typical Transport Canada construction having a historically rated design load capacity of 1.2kPa.

6.2 Residual Life Estimates

The residual life estimates are based on Section 2.5 of "Procedures for Inspection and Assessment of Fixed Timber Docks, 4th Edition" by R.G. Sexsmith Ltd. These estimates represent the worst-case members inspected in any member group. For this reason, the overall condition of the member group is not necessarily reflected by the following residual life estimates. As noted in the above referenced material, the following applies:

- Where treated wood has been examined for presence of decay, and found sound, a life of 8-10 years is appropriate.
- Where evidence of some decay, but very limited extent was found present, a life of 3-6 years is appropriate.
- Where an element has weakened cross-section due to decay, the life can be presumed to be negligible (i.e., 0 years).

Residual life estimates for sacrificial items, intentionally designed for a shortened life span, have been approximated based on our previous experience with elements of this form and function and are as follow:

- Where element retains greater than 50% of its cross section and is secured to structure as designed, a life of 1-2 years is appropriate.
- Where the element retains less than 50% of its cross section and/or shows signs of fatigue/overstress at the connection points to structure, a life of less than one year is appropriate,
- Where the element retains 0% of its cross section (i.e.: failed) and/or has failed at any of the connection points it is considered to be "missing" and it is appropriate to presume the life of the element is negligible (0 years)

See Appendix B to determine which members the residual life estimate applies to.

6.2.1 Approach and Wharfhead

Topsides*	0 years (based on ten timber guards to be replaced), 3-6 years otherwise
Stringers	8-10 years (based on overall condition of elements)
Pile Caps	3-6 years (based on overall condition of elements)
Piles	0 years (based on sixteen piles to be replaced), 3-6 years otherwise

**Note: topside items include handrails, vehicle guards, decking and any accessories which exist on the topside of the fixed structure(s).*

6.2.2 Gangway

Aluminum	8-10 years with ongoing maintenance
Serrated Aluminum Decking	0 years (based on two sections to be replaced)
Shoreward Transition	8-10 years with ongoing maintenance
Seaward Transition Missing	8-10 years with ongoing maintenance

6.2.3 Float

Bull Rails	1-3 years (based on overall condition of elements)
Timber Decking	1-3 years (based on overall condition of members)
Rub Boards	1-3 years (based on overall condition of members)
Flanges	0 years (based on two failed flanges); 3-6 years otherwise

Cross Ties	3-6 years (based on overall condition of the elements)
Floatation	1-3 years (based on the condition of the uncovered billet floatation)
Mooring Piles	0 years (based on the condition of three piles); 3-6 years otherwise

7.0 COST ESTIMATE

The repairs noted in this report are considered within anticipated maintenance requirements for a facility of this age and function. The repairs are estimated to Class C standard, in 2023 Canadian dollars, and are based on historical data, as well as our experience with projects of this nature.

Please note, the following cost estimate assumes that a construction crew has mobilized for a major upgrade. The mobilization/demobilization assumes that the crew is on-site for repairs at this facility individually. Should the SCRD anticipate completing work on multiple facilities at once, the mobilization/demobilization line item should be amended to reflect a reduction in site specific project costs as the rate is shared between multiple facilities.

Table 7.1 Cost Estimate for Recommended Repairs

ITEM	LOCATION	RECOMMENDATION	COST ($)
Mobilization/Demobilization			**$30,000.00**
Approach & Wharfhead			
Lighting	Lamp post at Bent 2	Replace bracket	$2,500.00
Traffic Bollard	General	Touch-up coating	$350.00
Safety Ladder	Bent 27	Provide new anchor at safety ladder	$2,500.00
Safety Ladder	Bent 27	Provide signage visible from water and from land	$750.00
Timber Guard	1.22m at Gridline E	Replace timber guard	$1,677.50
Timber Guard	2.2m at Gridline E	Provide timber guard	$1,677.50
Timber Guard	2.44m at Gridline D	Replace timber guard	$1,677.50
Timber Guard	7.9m at Gridline D	Replace timber guard	$1,677.50
Timber Guard	10.7m at E	Replace timber guard	$1,677.50
Timber Guard	25.6m at E	Replace timber guard	$1,677.50
Timber Guard	47.5m at E	Replace timber guard	$1,677.50
Timber Guard	61m at E	Replace timber guard	$1,677.50
Timber Guard	Bent 24 at E	Replace timber guard	$1,677.50
Timber Guard	26E	Replace riser	$75.00

ITEM	LOCATION	RECOMMENDATION	COST ($)
Timber Guard	Bent 15 and 16 (Gridlines A, B, C)	Replace timber guards	$6,462.50
Stringers	Bent 1 & 2	Provide splice block and typical stringer connection	$750.00
Pile Cap	Bent 1	Core pile cap to determine extent of cross section loss. If required, replace pile cap. If pile cap is competent, plug and patch bolt holes	$1,050.00
Bearing Pile	1D	Excavate and establish solid bearing under footing. This may require replacement of the piling	$8,500.00
Bearing Pile	2D	Recast footing	$500.00
Bearing Pile	2E	Recast footing	$500.00
Bearing Pile	4E	Replace bearing pile	$7,500.00
Bearing Pile	5D	Replace bearing pile	$7,500.00
Bearing Pile	5E	Install stainless steel strapping first 1.5m of the pile	$250.00
Bearing Pile	6E	Plug and patch hole	$750.00
Bearing Pile	7E	Plug and patch hole	$750.00
Bearing Pile	8E	Provide steel strap or collar connection to pile cap complete with shims to ensure full bearing	$750.00
Bearing Pile	11D	Install stainless steel strapping first 1.5m of the pile	$250.00
Bearing Pile	11E	Replace bearing pile	$7,500.00
Bearing Pile	12D	Replace bearing pile	$7,500.00
Bearing Pile	12E	Install stainless steel banding along pile length. Install shims and connect pile to pile cap to ensure load transfer and adequate bearing	$500.00
Bearing Pile	13D	Remove corbels and replace bearing pile	$7,500.00
Bearing Pile	13E	Provide steel strap or collar connection to pile cap complete with shims to ensure full bearing	$750.00
Bearing Pile	14D	Replace bearing pile	$7,500.00
Bearing Pile	14E	Install stainless steel banding	$250.00
Bearing Pile	15D	Remove corbels and replace bearing pile	$7,500.00
Bearing Pile	15E	Remove corbels and replace bearing pile	$7,500.00
Bearing Pile	16D	Remove corbels and replace bearing pile	$7,500.00
Bearing Pile	16E	Install stainless steel banding on pile	$250.00
Bearing Pile	17E	Remove corbels and replace bearing pile	$7,500.00

ITEM	LOCATION	RECOMMENDATION	COST ($)
Bearing Pile	18E	Provide strapping between pile, pile cap and corbel. Ensure symmetrical connection that fully connects all three elements. Consider removal of corbels and replace bearing pile within three years	$8,500.00
Bearing Pile	19D	Replace bearing pile	$7,500.00
Bearing Pile	21D	Replace bearing pile	$7,500.00
Bearing Pile	21E	Replace bearing pile	$7,500.00
Bearing Pile	22E	Replace bearing pile	$7,500.00
Bearing Pile	23E	Replace bearing pile	$7,500.00
Bearing Pile	26B	Install stainless steel banding and consider for replacement within three years	$250.00
Bearing Pile	26F	Install stainless steel banding and consider for replacement within three years	$250.00
Bearing Pile	26G	Remove corbels and replace bearing pile	$7,500.00
Bearing Pile	27A	Install stainless steel banding and consider replacing bearing pile within three years	$250.00
Cross Brace	3D	Re-secure brace connection	$250.00
Cross Brace	4E	Replace hardware	$750.00
Cross Brace	5D	Replace hardware	$750.00
Cross Brace	5E	Replace cross brace and mounting hardware	$1,677.50
Cross Brace	6D	Install stainless steel strapping on brace	$250.00
Cross Brace	7D	Replace hardware	$750.00
Cross Brace	8D	Install stainless steel strapping on brace	$250.00
Cross Brace	9E	Install stainless steel strapping on brace	$250.00
Cross Brace	13E	Install stainless steel strapping on brace	$250.00
Cross Brace	18D	Re-instate connection	$750.00
Cross Brace	$20D^{BOT}$ to $20E^{TOP}$	Replace cross brace	$1,677.50
Cross Brace	24E	Replace hardware	$750.00
Gangway			
Chain Guarding	Shoreward End	Re-instate chain guarding	$150.00
Serrated Aluminum Grating	Two sections	Replace two sections of grating	$250.00
Float			
Flange	Northwest edge of float	Replace flange and associated hardware	$4,575.00
Flange	Southeast edge of float	Replace flange and associated hardware	$4,575.00
Floatation	General	Replace all floatation with BMP approved encased floatation	$15,000.00
Mooring Pile	south dolphin, NW pile	Replace mooring pile	$6,000.00

ITEM	LOCATION	RECOMMENDATION	COST ($)
Mooring Pile	south dolphin, SW pile	Replace mooring pile	$6,000.00
Mooring Pile	south dolphin, SE pile	Replace mooring pile	$6,000.00
Substructure	General	Replace all flange connection hardware on float	$1,000.00
Mooring Dolphin #1			
General	General	Consideration should be given to removal at the next major upgrade	$6,500.00
Mooring Dolphin #2			
General	General	Consideration should be given to removal at the next major upgrade	$6,500.00
Mooring Dolphin #3			
General	General	Consideration should be given to removal at the next major upgrade	$6,500.00

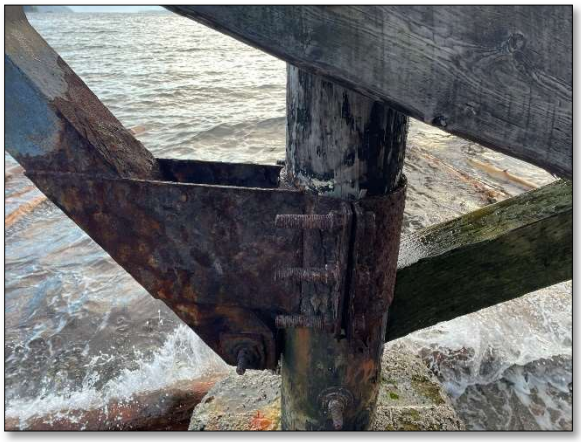
Subtotal	$274,190.00
Contingency (20%)	$54,838.00
COVID (19%)	$52,096.10
TOTAL	**$381,124.10**

Appendix A
Site Photographs

Photograph 1: *Hopkins Landing, note: general arrangement from shore looking south*

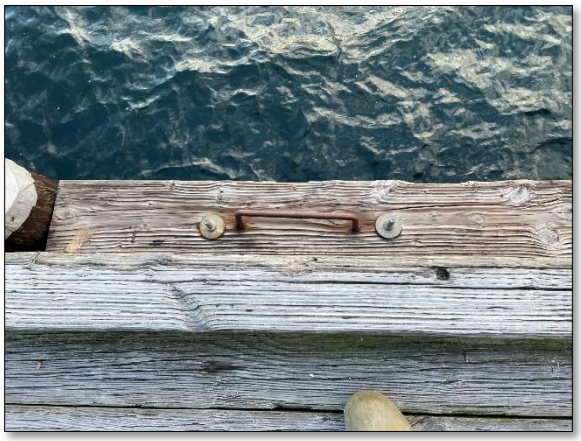
Photograph 2: *Hopkins Landing, note: general arrangement from seaward end looking north*

Photograph 3: *Beach access stairs, note: atypical configuration*



Photograph 4: *Light post mounting bracket, note: significant corrosion*

Photograph 5: *Traffic bollards, note: coating failures*



Photograph 6*: Safety Ladder, note: no signage*

Photograph 7: *Handrail post, note: cross section loss at cut end*

Photograph 8: *Timber guard at 1.22m Gridline E, note: cross section loss and biological damage*

Photograph 9: *Handrails, note: general condition is fair to poor*

Photograph 10: *Timber guard at 7.9m Gridline E, note: damage to cross section*

Photograph 11: *Timber guard at 61m Gridline E, note: cracking through hardware, soft interior*

Photograph 12 *Timber guard riser at 26E, note: damaged and decayed**:***

Photograph 13: *Decking, note: general condition is fair to poor*

Photograph 14: *Stringer butt joint, note: missing splice connection*

Photograph 15: *Pile cap at Bent 1, note: strap repair and cracking*

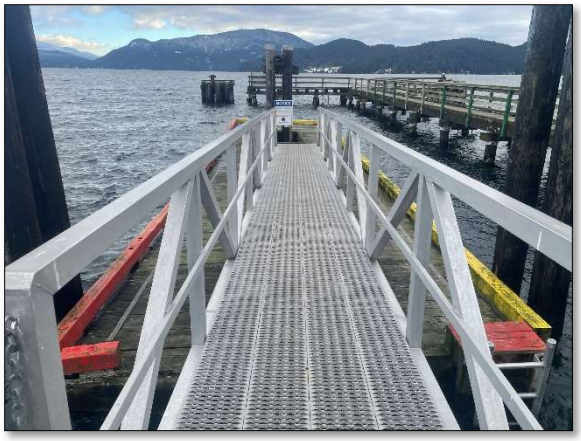
Photograph 16: *Bearing pile 2E, note: spalls and cracks in footing with cross section loss*

Photograph 17: *Bearing pile 11E, note: large crack in pile*

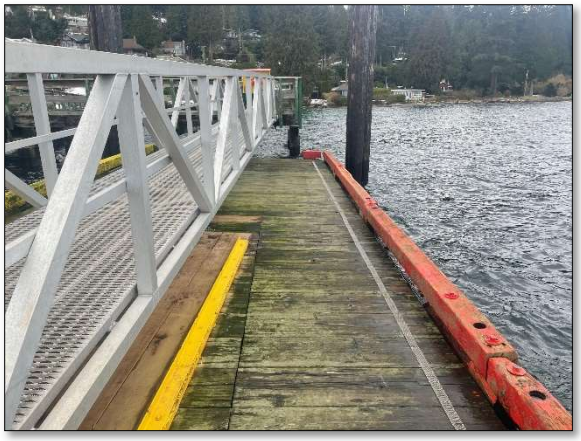
Photograph 18: *Bearing pile 14D, note: hole in pile with soft interior*

Photograph 19: *Bearing pile 19D, note: large crack in pile with evidence of marine borers*

Photograph 20: *Bearing piles 15E and 16E, note: corbel repairs with pile submerged at HHWLT*



Photograph 21: *Gangway decking, note: damage to two sections*



Photograph 22: *East edge of float, note: listing*

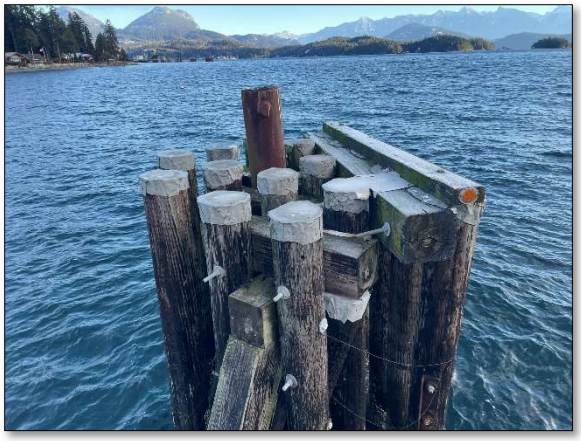
Photograph 23: *Float flange splice location, note: failed connection resulting in "sagging" of the bull rail/flange arrangement*

Photograph 24: *Spread dolphin mooring piles, note: abrasion through the intertidal zone*

Photograph 25: *Compact mooring dolphin, note: significant abrasion and cracking in the intertidal zone*

Photograph 26: *Compact mooring dolphin, note: blocking significantly decayed*

Photograph 27: *Compact mooring dolphin, note: significant cross section loss to blocking*



Photograph 28: *Mooring Dolphin #1*

Photograph 29: *Mooring Dolphin #2*

Photograph 30: *Mooring Dolphin #3*

Appendix B
Damage Table

Table B1 Facility Damage Table
Note: items required to certify the load rating in Section 5 are identified in **BOLD*

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Approach & Wharfhead						
Beach access stairs	Adjacent to approach access	-	-	Stairs are not conventional construction and are a potential hazard.	Consideration should be given to erecting stairs adhering to BCBC 2018, or removal of the existing.	-
Electrical Services	Bent 1 & 2	Missing	-	Wire insulation has failed and wires are exposed	Review with electrical professional and repair as required	2023/2024
Lighting	Lamp post at Bent 2	Corrosive	Poor to Very Poor	Mounting bracket is significantly corroded	Replace bracket	2023/2024
Traffic Bollard	General	Mechanical/ Corrosive	Fair	Minor localized coating failures	Touch-up coating	2023/2024
Safety Ladder	Bent 27	Mechanical/ Missing	Poor	Concrete anchor is sheared off	Provide new anchor at safety ladder	2023/2024
Safety Ladder	Bent 27	Missing	Very Poor	No signage at ladder	Provide signage visible from water and from land	2023/2024
Handrails	General	Mechanical/ Biological	Fair to Poor	Significant weathering and evidence of vegetative growth. Select areas are being remediated and others are in very poor condition and require immediate replacement.	Ongoing monitoring. Consider full replacement within six years	2029/2030
Handrails	First (4) posts on gridline E	Mechanical	Fair	Abrasion and cross section loss at the cut ends.	Ongoing monitoring	-
Timber Guard	General	Mechanical/ Biological	Fair to Poor	Significant weathering and evidence of vegetative growth. Select areas require immediate replacement.	Ongoing monitoring. Consider full replacement within six years	2029/2030
Timber Guard	**1.22m at Gridline E**	**Mechanical/ Biological**	**Very Poor**	**Hardware has failed and guard is cracked and soft when probed**	**Replace timber guard**	**2023/2024**
Timber Guard	**2.2m at Gridline E**	**Missing**	**Very Poor**	**Guard is missing**	**Provide timber guard**	**2023/2024**
Timber Guard	**2.44m at Gridline D**	**Mechanical/ Biological/ Missing**	**Very Poor**	**Guard has failed through the cross section and is missing**	**Replace timber guard**	**2023/2024**

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Timber Guard	3.0m at Gridline D	Mechanical	Fair	Split through hardware	Ongoing monitoring	-
Timber Guard	**7.9m at Gridline D**	**Mechanical/ Biological**	**Poor**	**Cracking and cross section loss**	**Replace timber guard**	**2023/2024**
Timber Guard	**10.7m at E**	**Mechanical/ Biological**	**Poor**	**Cracking and biological damage to cross section at hardware connection**	**Replace timber guard**	**2023/2024**
Timber Guard	**25.6m at E**	**Mechanical/ Biological**	**Poor**	**Cracking and cross section loss**	**Replace timber guard**	**2023/2024**
Timber Guard	**47.5m at E**	**Mechanical/ Biological**	**Poor**	**Cracking and cross section loss**	**Replace timber guard**	**2023/2024**
Timber Guard	**61m at E**	**Mechanical/ Biological**	**Poor**	**Exposed bolt hole, soft interior when probed**	**Replace timber guard**	**2023/2024**
Timber Guard	**Bent 24 at E**	**Mechanical/ Biological**	**Poor**	**End of guard is smashed and soft when probed**	**Replace timber guard**	**2023/2024**
Timber Guard	**26E**	**Mechanical/ Biological**	**Poor**	**Riser is cracked and twisted**	**Replace riser**	**2023/2024**
Timber Guard	**Bent 15 and 16 (Gridlines A, B, C)**	**Mechanical/ Biological**	**Poor**	**Guard is significantly decayed with evidence of vegetative growth**	**Replace timber guards**	**2023/2024**
Decking	General	Mechanical/ Biological	Fair to Poor	Significant weathering and evidence of vegetative growth. Select areas require immediate replacement.	Ongoing monitoring. Consider full replacement within six years	2029/2030
Stringers	Typical	Corrosive	Fair	Minor to moderate corrosive damage to the splice connection hardware.	Ongoing monitoring	-
Stringers	**Bent 1 & 2**	**Missing**	**Very Poor**	**Stringer splice connections are butt connections with no splice block in place**	**Provide splice block and typical stringer connection**	**2023/2024**
Pile Cap	**Bent 1**	**Mechanical/ Biological**	**Poor**	**Pile cap has a large crack and moderate checking. The pile cap is strapped. There are exposed bolt holes along the length**	**Core pile cap to determine extent of cross section loss. If required, replace pile cap. If pile cap is competent, plug and patch bolt holes**	**2023/2024**

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Bearing Pile	**1D**	**Mechanical**	**Poor**	**Pile footing has minor undermining. No evidence of pile rotation was noted.**	**Excavate and establish solid bearing under footing. This may require replacement of the piling**	**2023/2024**
Bearing Pile	**2D**	**Mechanical**	**Fair**	**Spalling and exposed reinforcing on bearing pile footing**	**Recast footing**	**2023/2024**
Bearing Pile	**2E**	**Mechanical**	**Fair**	**Spalling and exposed reinforcing on bearing pile footing**	**Recast footing**	**2023/2024**
Bearing Pile	4D	-	-	Concrete Pile	-	-
Bearing Pile	**4E**	**Mechanical/ Biological**	**Poor**	**Pile is soft at the mudline and hollow when sounded**	**Replace bearing pile**	**2023/2024**
Bearing Pile	**5D**	**Mechanical/ Biological**	**Very Poor**	**Heavy marine growth with 50mm diameter hole at base, soft when probed**	**Replace bearing pile**	**2023/2024**
Bearing Pile	**5E**	**Mechanical**	**Fair**	**600mm long split from the top through the hardware**	**Install stainless steel strapping first 1.5m of the pile**	**2023/2024**
Bearing Pile	**6E**	**Mechanical/ Biological**	**Poor**	**25mm diameter hole in splash zone. Soft when probed.**	**Plug and patch hole**	**2023/2024**
Bearing Pile	**7E**	**Mechanical/ Biological**	**Poor**	**25mm diameter hole at base. Soft when probed**	**Plug and patch hole**	**2023/2024**
Bearing Pile	**8E**	**Missing**	**Very Poor**	**Concrete pile with no visible connection to pile cap. Shims are no longer present**	**Provide steel strap or collar connection to pile cap complete with shims to ensure full bearing**	**2023/2024**
Bearing Pile	9E	Mechanical/ Biological	Very Poor	Splitting at the top of the pile with visible wear of the creosote layer. Cracks at the seabed	Ongoing monitoring. Consider replacing pile within the next three years	2026/2027
Bearing Pile	**11D**	**Mechanical**	**Fair**	**Cracking from the top through the hardware**	**Install stainless steel strapping first 1.5m of the pile**	**2023/2024**

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Bearing Pile	11E	Mechanical/ Biological	Very Poor	1.22m long crack from the top. 50mm of penetration when probed, reported to be soft in the interior	Replace bearing pile	2023/2024
Bearing Pile	12D	Mechanical/ Biological	Very Poor	Cracks in pile extending from the top downwards. Soft inside cracks and at pile base when probed	Replace bearing pile	2023/2024
Bearing Pile	12E	Mechanical/ Missing	Very Poor	Larger crack in pile with no bearing connection to pile cap	Install stainless steel banding along pile length. Install shims and connect pile to pile cap to ensure load transfer and adequate bearing	2023/2024
Bearing Pile	13D	Mechanical/ Biological/Unstable	Very Poor	Pile has three corbels installed between the top of the pile and pile cap. This is not considered structurally reliable. The pile is soft at the base and fully submerged to the connections and HHWLT	Remove corbels and replace bearing pile	2023/2024
Bearing Pile	13E	Missing	Very Poor	Concrete pile with no visible connection to pile cap. Shims are no longer present	Provide steel strap or collar connection to pile cap complete with shims to ensure full bearing	2023/2024
Bearing Pile	14D	Mechanical/ Biological	Very Poor	Splitting at the top of the pile with visible wear of the creosote layer. Large hole at base, soft interior	Replace bearing pile	2023/2024
Bearing Pile	14E	Mechanical	Poor	Large crack extending from the top of the pile	Install stainless steel banding	2023/2024

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Bearing Pile	**15D**	**Mechanical/ Unstable**	**Very Poor**	**Pile has two pile caps and two corbels at the top. The assembly is considered structurally unreliable. The entire connection is submerged at HHWLT**	**Remove corbels and replace bearing pile**	**2023/2024**
Bearing Pile	**15E**	**Mechanical/ Unstable**	**Very Poor**	**Pile has two pile caps and one corbel at the top. A single drift pin appears to hold the connection**	**Remove corbels and replace bearing pile**	**2023/2024**
Bearing Pile	**16D**	**Mechanical/ Unstable**	**Very Poor**	**Pile has two corbels and appears to be twisted. Connection is uncertain, and the entire assembly is submerged at HHWLT**	**Remove corbels and replace bearing pile**	**2023/2024**
Bearing Pile	**16E**	**Mechanical**	**Fair to Poor**	**Cracking at the top of the pile with visible wear of the creosote layer**	**Install stainless steel banding on pile**	**2023/2024**
Bearing Pile	17D	-	-	Concrete Pile	-	-
Bearing Pile	**17E**	**Mechanical/ Unstable**	**Poor to Very Poor**	**Two corbels on top of pile. The pile is cracked and the assembly is twisted.**	**Remove corbels and replace bearing pile**	**2023/2024**
Bearing Pile	**18E**	**Mechanical/ Unstable**	**Very Poor**	**Corbel does not appear to be connected to either the bearing pile, nor the pile cap. Creosote layer is deteriorating at the pile top**	**Provide strapping between pile, pile cap and corbel. Ensure symmetrical connection that fully connects all three elements. Consider removal of corbels and replace bearing pile within three years**	**2023/2024 & 2026/2027**
Bearing Pile	**19D**	**Mechanical/ Biological**	**Very Poor**	**Large crack with 150mm of penetration when probed. Soft interior with evidence of marine borer activity**	**Replace bearing pile**	**2023/2024**

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Bearing Pile	19E	Mechanical	Fair	Creosote layer is beginning to deteriorate	Ongoing monitoring. Consideration should be given to replacement of the pile within three years	2026/2027
Bearing Pile	**21D**	**Mechanical/ Biological**	**Very Poor**	**Large crack starting at mudline. Soft when probed with marine borer activity**	**Replace bearing pile**	**2023/2024**
Bearing Pile	**21E**	**Mechanical/ Biological**	**Very Poor**	**1m long split approx. 25mm wide. Marine borers are present and the section is soft**	**Replace bearing pile**	**2023/2024**
Bearing Pile	**22E**	**Mechanical/ Biological**	**Very Poor**	**1.9m long split in pile, soft when probed with large internal cavity**	**Replace bearing pile**	**2023/2024**
Bearing Pile	**23E**	**Mechanical/ Biological**	**Very Poor**	**Creosote layer is deteriorating. There is a large split in pile from base extending approximately 6m. Marine borers are present**	**Replace bearing pile**	**2023/2024**
Bearing Pile	26A	-	-	Concrete Pile	-	-
Bearing Pile	**26B**	**Mechanical/ Biological**	**Poor**	**Splitting at the base with visible marine borers**	**Install stainless steel banding and consider for replacement within three years**	**2023/2024 & 2026/2027**
Bearing Pile	26C	-	-	Concrete Pile	-	-
Bearing Pile	**26F**	**Mechanical/ Biological**	**Poor**	**Splitting at the base with visible marine borers**	**Install stainless steel banding and consider for replacement within three years**	**2023/2024 & 2026/2027**
Bearing Pile	**26G**	**Mechanical/ Biological/ Unstable**	**Very Poor**	**Two large splits with evidence of marine borers. Two corbel repairs submerged at HHWLT**	**Remove corbels and replace bearing pile**	**2023/2024**
Bearing Pile	**27A**	**Mechanical**	**Fair to Poor**	**Creosote layer is deteriorating. There is splitting at the top of the pile**	**Install stainless steel banding and consider replacing bearing pile within three years**	**2023/2024 & 2026/2027**

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Cross Brace	**3D**	**Mechanical/ Corrosive**	**Poor**	**Brace connection is loose with visible impact damage**	**Re-secure brace connection**	**2023/2024**
Cross Brace	**4E**	**Mechanical/ Corrosive**	**Poor**	**Corroded hardware**	**Replace hardware**	**2023/2024**
Cross Brace	**5D**	**Mechanical/ Corrosive**	**Poor**	**Corroded hardware**	**Replace hardware**	**2023/2024**
Cross Brace	**5E**	**Mechanical/ Corrosive**	**Poor**	**End of brace is soft when probed. Hardware is corroded**	**Replace cross brace and mounting hardware**	**2023/2024**
Cross Brace	**6D**	**Mechanical**	**Fair**	**Split in brace**	**Install stainless steel strapping on brace**	**2023/2024**
Cross Brace	**7D**	**Mechanical/ Corrosive**	**Poor**	**Corroded hardware**	**Replace hardware**	**2023/2024**
Cross Brace	7E	Mechanical	Fair	Split in brace, has been remediated with steel banding	Ongoing monitoring	-
Cross Brace	**8D**	**Mechanical**	**Fair**	**Cracks in brace length**	**Install stainless steel strapping on brace**	**2023/2024**
Cross Brace	**9E**	**Mechanical**	**Fair**	**Cracks in brace length**	**Install stainless steel strapping on brace**	**2023/2024**
Cross Brace	**13E**	**Mechanical**	**Fair**	**Cracks in brace length**	**Install stainless steel strapping on brace**	**2023/2024**
Cross Brace	**18D**	**Missing**	**Very Poor**	**Brace connection has failed**	**Re-instate connection**	**2023/2024**
Cross Brace	**$20D^{BOT}$ to $20E^{TOP}$**	**Biological**	**Poor**	**Marine borers present with softness of the cross section**	**Replace cross brace**	**2023/2024**
Cross Brace	**24E**	**Mechanical/ Corrosive**	**Poor**	**Corroded hardware**	**Replace hardware**	**2023/2024**
Gangway						
Chain Guarding	Shoreward End	Mechanical	Poor	Connection to timber posts has failed at both locations	Re-instate chain guarding	2023/2024
Serrated Aluminum Grating	Two sections	Mechanical	Poor	Damage to the grating	Replace two sections of grating	2023/2024
Float						
Spread Dolphin	Header	-	Fair to Good	Header size appears small for the application	Ongoing monitoring	-
Spread Dolphin	Mooring Piles	Mechanical	Fair	Moderate cross section loss due to abrasion. Localized areas of up to 50% cross section loss	Ongoing monitoring. Consider full replacement of (4) mooring piles within the next six years.	2029/2030
Spread Dolphin	Mooring Piles	Biological	Fair	Marine borers present	Ongoing monitoring	-

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
Flange	Northwest edge of float	Mechanical	Very Poor	Flange is broken and hanging down below float	Replace flange and associated hardware	2023/2024
Flange	Southeast edge of float	Mechanical	Very Poor	Flange is broken and hanging down	Replace flange and associated hardware	2023/2024
Floatation	General	Mechanical/ Biological	Very Poor	Exposed polystyrene floatation with significant damage and displacement	Replace all floatation with BMP approved encased floatation	2023/2024
Substructure	General	Mechanical/ Biological/ Corrosive	Very Poor	Flange connections are failing and the float is listing and moving significantly	Replace all flange connection hardware on float	2023/2024
Mooring Dolphin #1						
General	General	-	-	Structure(s) are in good condition, but are reported to be a recreational feature for the public. This is not the design intent and the structure is not considered safe for climbing and jumping off of	Consideration should be given to removal at the next major upgrade	-
Mooring Dolphin #2						
General	General	-	-	Structure(s) are in good condition, but are reported to be a recreational feature for the public. This is not the design intent and the structure is not considered safe for climbing and jumping off of	Consideration should be given to removal at the next major upgrade	-
Piles	General	Biological	Poor to Fair	Significant marine borers present at seabed.	Ongoing monitoring	-
Piles	-	Mechanical	Very Poor	One pile is broken below waterline. This is a navigation hazard, as well as life safety hazard if kids are playing on structure(s).	Remove dolphin at next major upgrade to eliminate recreational use	2023/2024
Mooring Dolphin #3						

ITEM	LOCATION	DAMAGE	CONDITION	COMMENTS	RECOMMENDATION	REMEDIAL YEAR
General	General	-	-	Structure(s) are in good condition, but are reported to be a recreational feature for the public. This is not the design intent and the structure is not considered safe for climbing and jumping off of	Consideration should be given to removal at the next major upgrade	-
Piles	General	Biological	Poor to Fair	Significant marine borers present at seabed.	Ongoing monitoring	-
Miscellaneous						
Seabed	Near float	-	-	Eel grass was noted around the structure(s)	This is a species at risk. All BMPs should be adhered to, to ensure no damage/ interference with the species. Engage a registered environmental specialist for all remedial/ construction activities and in-water works.	Ongoing

Appendix C
Reference Drawings

GENERAL:

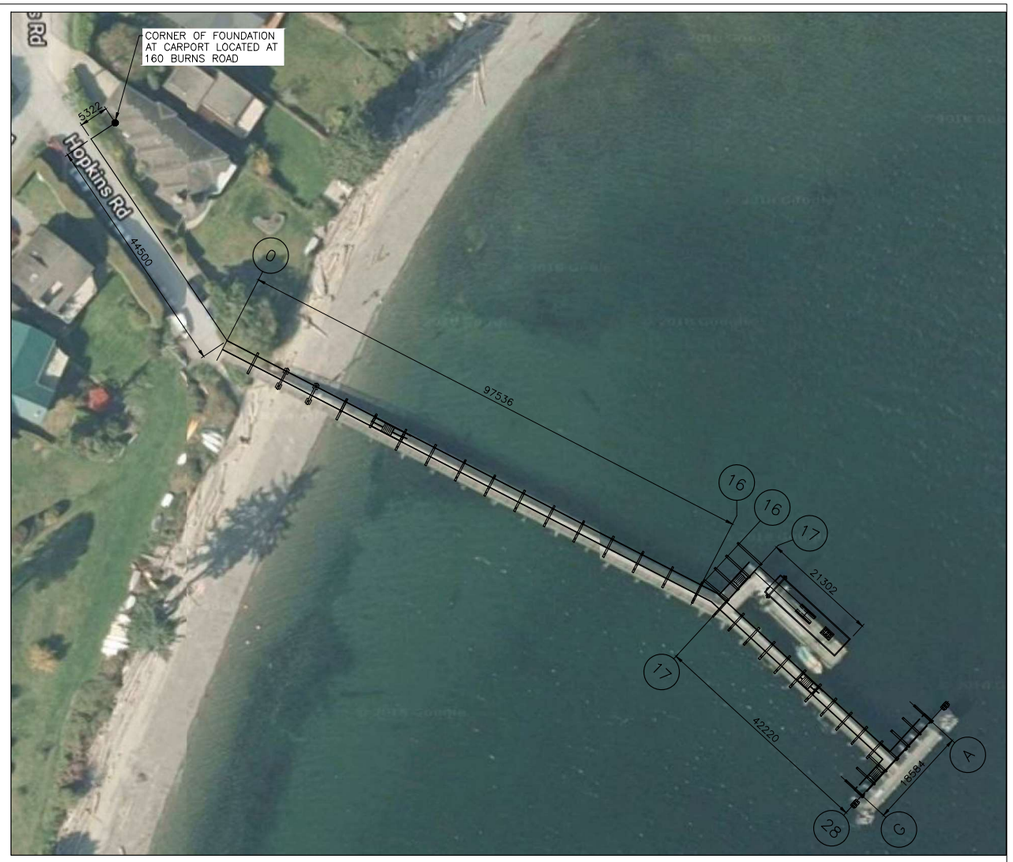
1. READ STRUCTURAL DRAWINGS IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS AND DOCUMENTS. REPORT ANY CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK
2. VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO CONSTRUCTION.
3. NOTIFY THE ENGINEER 48 HOURS IN ADVANCE FOR INSPECTION OF STRUCTURAL CONNECTIONS BEFORE COVERING UP.
4. CONTRACTOR'S RESPONSIBILITY: THESE DRAWINGS SHOW COMPLETED STRUCTURAL COMPONENTS OF THE DOCKS. THE REQUIRED TEMPORARY BRACING AND SHORING TO PERFORM THE WORK SAFELY IS THE RESPONSIBILITY OF THE CONTRACTOR.
5. ENVIRONMENTAL WORK PROCEDURES, TIMING AND SPECIAL PRECAUTIONS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS AND LIMITATIONS OF THE FEDERAL DEPARTMENT OF FISHERIES AND OCEANS, AND THE PROVINCIAL MINISTRY OF WATER, LAND AND AIR PROTECTION.
6. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS OTHERWISE NOTED.
7. HORIZONTAL DATUM U.T.M NAD 83.
8. VERTICAL DATUM (ELEVATIONS AND CONTOURS) TO CHART DATUM (C.D.).
9. TIDE ELEVATIONS AT THE SITE ARE BASED ON VALUES PUBLISHED BY THE CANADIAN HYDROGRAPHIC SERVICE (CHS) FOR THE SITE AS FOLLOWS:

HIGHER HIGH WATER, LARGE TIDE (H.H.W.L.T.)	5.1 METRES
HIGHER HIGH WATER, MEAN TIDE (H.H.W.M.T.)	4.6 METRES
MEAN WATER LEVEL (M.W.L.)	3.2 METRES
LOWER LOW WATER, MEAN TIDE (L.L.W.M.T.)	1.3 METRES
LOWER LOW WATER, LARGE TIDE (L.L.W.L.T.)	0.1 METRES

10. SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR FABRICATION.

ABBREVIATIONS:

CL.	–	CLEAR
C	–	CENTRELINE
CP.	–	COMPLETE PENETRATION
C/W	–	COMPLETE WITH
DWG.	–	DRAWING
EL.	–	ELEVATION
I.D.	–	INSIDE DIAMETER
LLH	–	LONG LEG HORIZONTAL
LLV	–	LONG LEG VERTICAL
MAX.	–	MAXIMUM
MIN.	–	MINIMUM
N.T.S.	–	NOT TO SCALE
OPP.	–	OPPOSITE
PL	–	PLATE
R	–	RADIUS
SIM.	–	SIMILAR
S.S.	–	STAINLESS STEEL
T.O.	–	TOP OF
TYP.	–	TYPICAL
U/S	–	UNDERSIDE
U.N.O.	–	UNLESS NOTED OTHERWISE
WP	–	WORK POINT



KEY PLAN
1:500

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

ISSUES

No.	DATE YYY.MM.DD	ISSUED FOR
A	2023.03.24	CLIENT REVIEW
B	2023.04.14	REPORT

SUB CONSULTANT

DRAFTED: PHU
DRAFTING REVIEW:
DESIGNED: SPS
DESIGN REVIEW:

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250-751-8558 Fax: 250-751-8559
Email: mail@heroldengineering.com

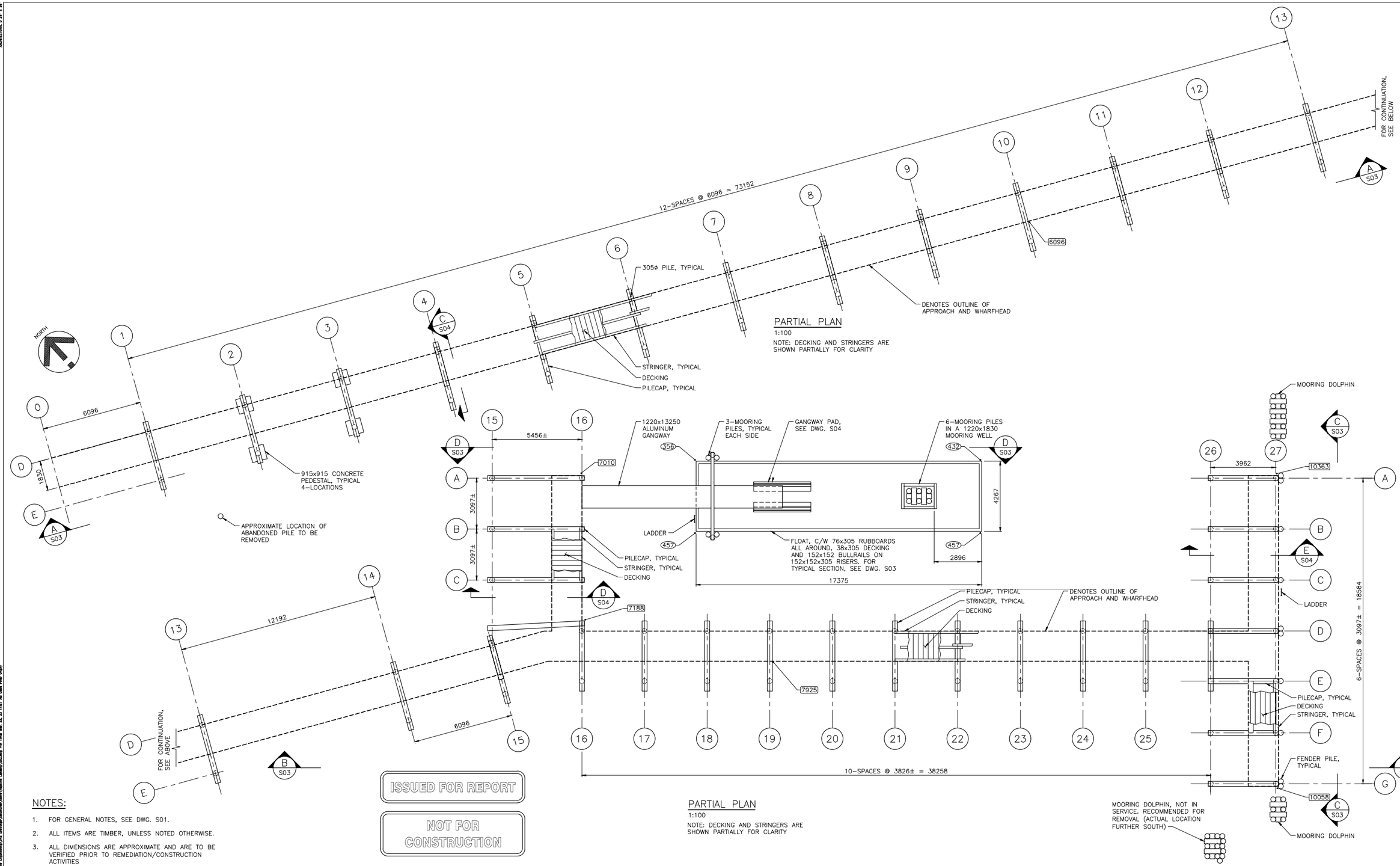
ENGINEERS SEAL

HOPKINS LANDING:
GENERAL NOTES
AND KEY PLAN

PORTS CONDITION ASSESSMENT
HOPKINS LANDING
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No. 4551-012	CLIENT DWG. No. N/A
SCALE AS SHOWN	PERMIT No. N/A
HEL DRAWING No. S01	REVISION B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION



PARTIAL PLAN
1:100
NOTE: DECKING AND STRINGERS ARE SHOWN PARTIALLY FOR CLARITY

PARTIAL PLAN
1:100
NOTE: DECKING AND STRINGERS ARE SHOWN PARTIALLY FOR CLARITY

NOTES:

1. FOR GENERAL NOTES, SEE DWG. S01.
2. ALL ITEMS ARE TIMBER, UNLESS NOTED OTHERWISE.
3. ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE VERIFIED PRIOR TO REMEDIATION/CONSTRUCTION ACTIVITIES

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

ISSUES											
No.	DATE YYYY.MM.DD	ISSUED FOR	No.	DATE YYYY.MM.DD	ISSUED FOR	No.	DATE YYYY.MM.DD	ISSUED FOR
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SUB CONSULTANT

DRAFTED: PHU
DRAFTING REVIEW:
DESIGNED: SPS
DESIGN REVIEW:

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
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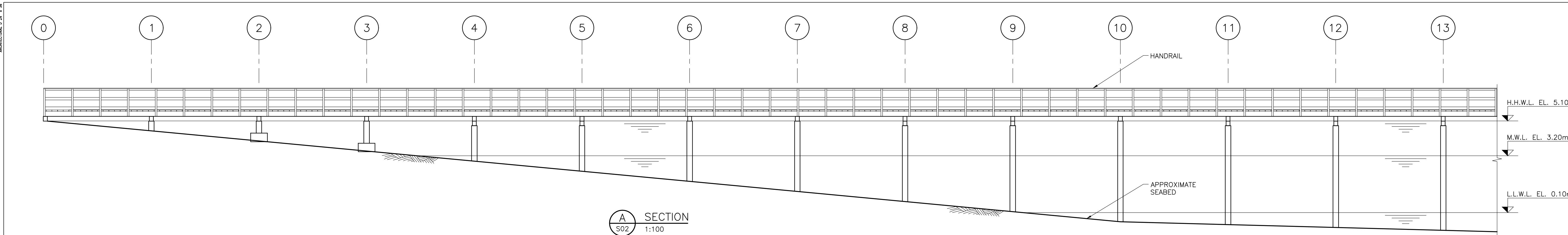
ENGINEERS SEAL

HOPKINS LANDING: GENERAL ARRANGEMENT - SHEET 1

PORTS CONDITION ASSESSMENT
HOPKINS LANDING
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No.	CLIENT DWG. No.
4551-012	N/A
SCALE: AS SHOWN	PERMIT No.: N/A
HEL DRAWING No.: S02	REVISION: B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION



A SECTION
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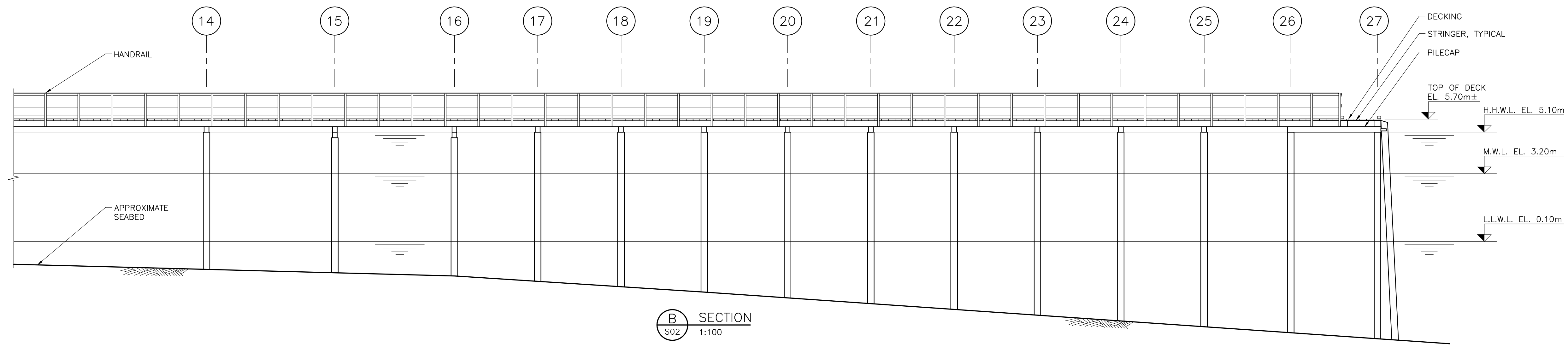

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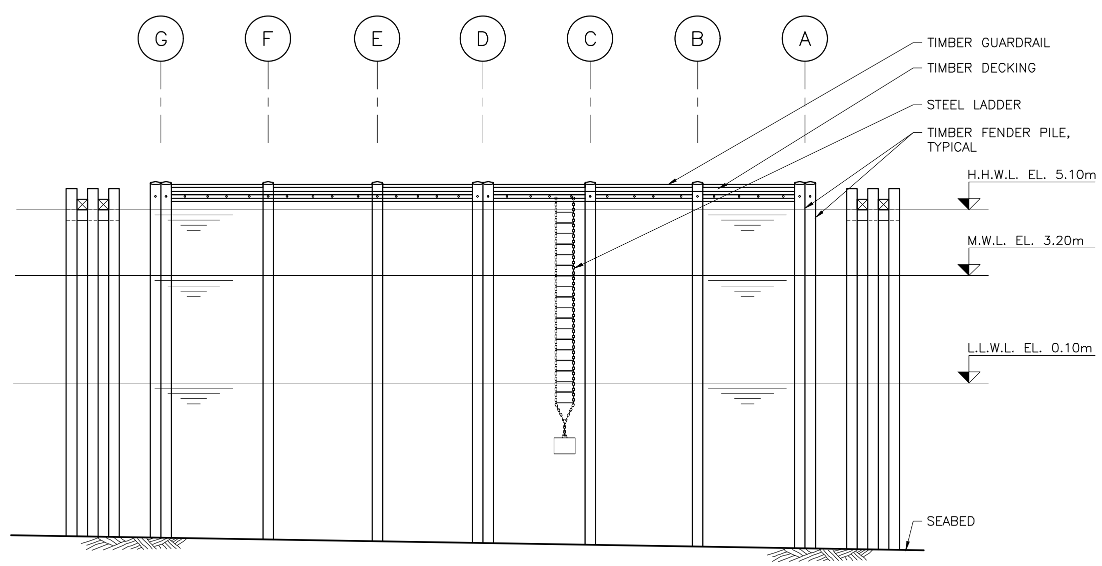

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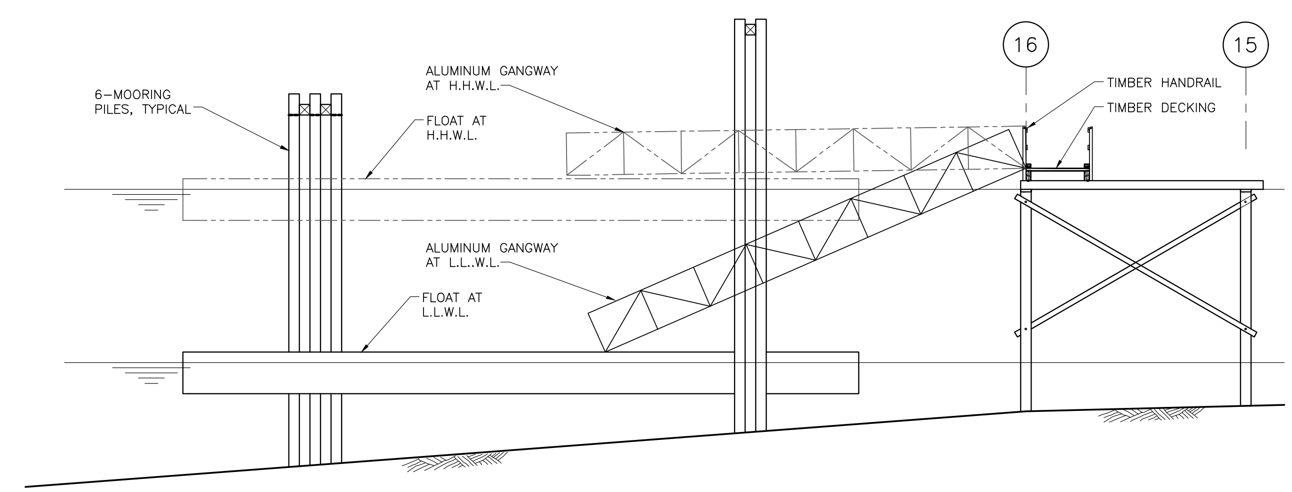

D SECTION
S02 1:100

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

NOTES:

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ISSUES

No.	DATE YYYY.MM.DD	ISSUED FOR
A	2023.03.24	CLIENT REVIEW
B	2023.04.14	REPORT

SUB CONSULTANT

DRAFTED PHU
DRAFTING REVIEW
DESIGNED SPS
DESIGN REVIEW

HEROLD ENGINEERING
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Email: mail@heroldengineering.com

ENGINEERS SEAL

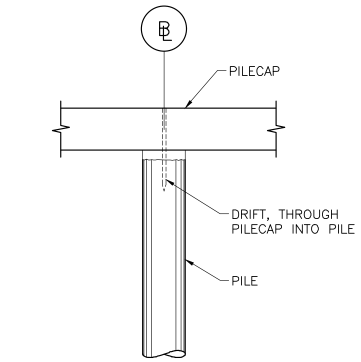
HOPKINS LANDING: GENERAL ARRANGEMENT - SHEET 2

PORTS CONDITION ASSESSMENT
HOPKINS LANDING
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No. 4551-012
CLIENT DWG. No. N/A
SCALE AS SHOWN
PERMIT No. N/A
HEL DRAWING No. S03
REVISION B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION



PILE TO PILECAP CONNECTION
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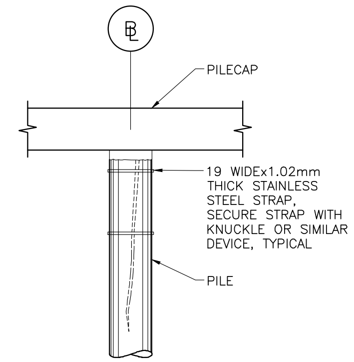
NOTE: STRINGERS, DECKING, AND BRACING NOT SHOWN



PILE STRAPPING DETAIL
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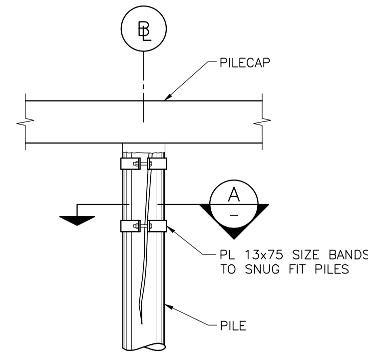
NOTE: STRINGERS, DECKING, AND BRACING NOT SHOWN



PILE BANDING DETAIL
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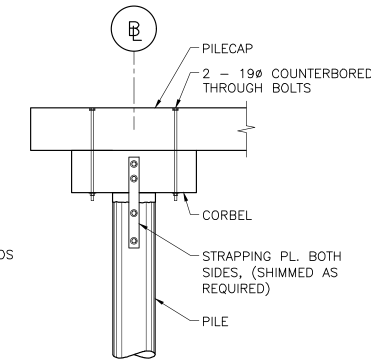
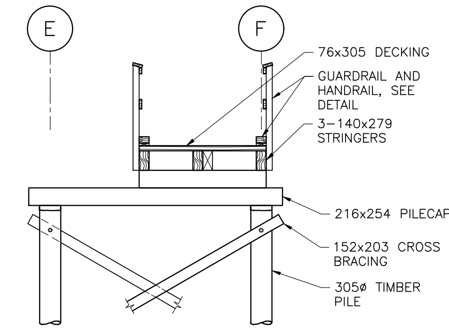
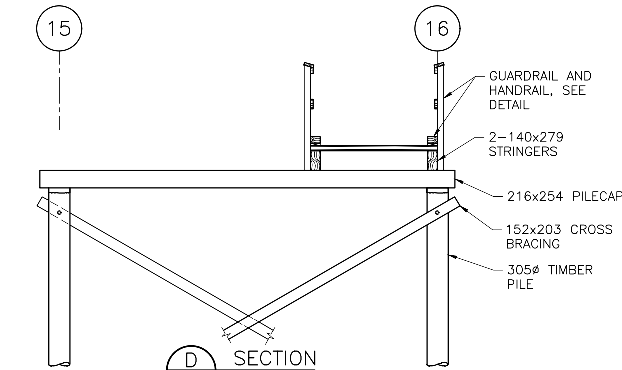


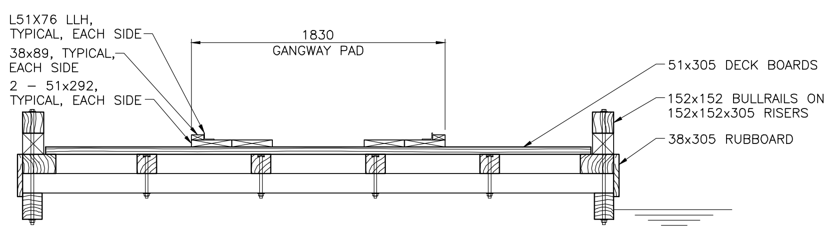
TYPICAL CORBEL DETAIL
1:25
NOTE: STRINGERS, DECKING AND BRACING NOT SHOWN.



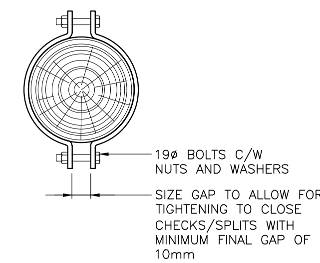
C SECTION
S02 1:50



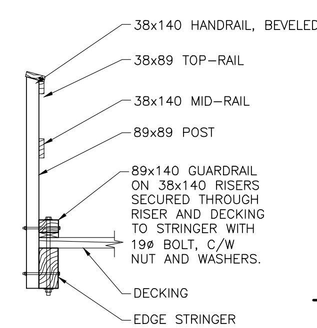
D SECTION
S02 1:50



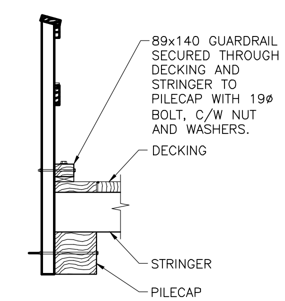
TYPICAL SECTION THROUGH FLOAT
1:25
FLOAT DETAILS BELOW WATERLINE AND DECK NOT CONFIRMED AS THEY ARE OUTSIDE OF PROJECT SCOPE. ITEMS BELOW WATERLINE SUCH AS STRINGERS, FLANGES, ETC. ARE SHOWN MERELY FOR CONVENIENCE



A SECTION
– 1:10



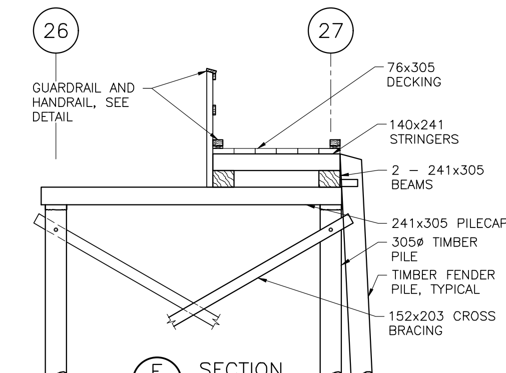
SECTION – HANDRAIL PARALLEL TO STRINGER



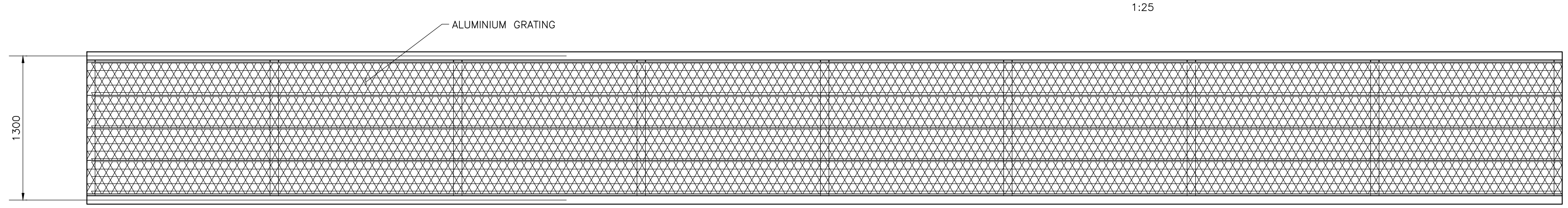
SECTION – HANDRAIL PARALLEL TO PILE CAP

NOTE: SIMILAR TO SECTION – HANDRAIL PARALLEL TO STRINGER, UNLESS NOTED OTHERWISE.

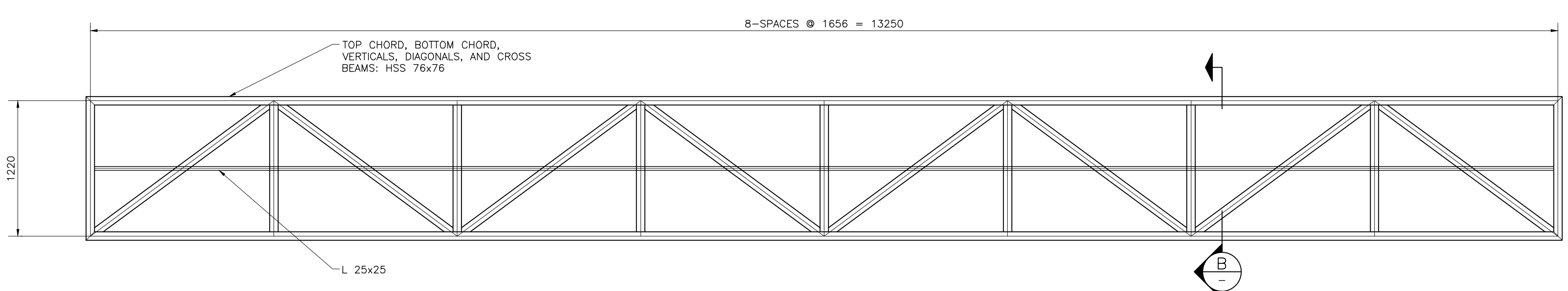
HANDRAIL AND GUARDRAIL DETAILS
1:25



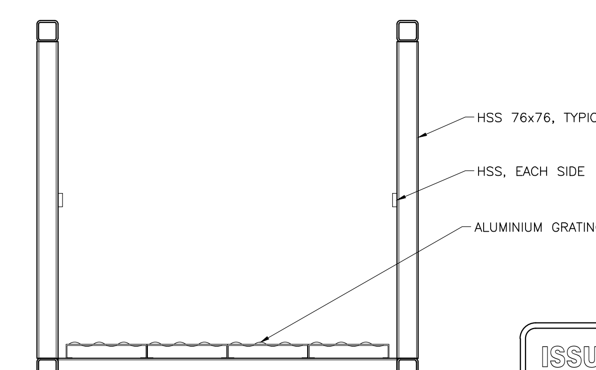
E SECTION
S02 1:50



PLAN – ALUMINIUM GANGWAY
1:25



ELEVATION – ALUMINIUM GANGWAY
1:25



B SECTION
– 1:10

ISSUED FOR REPORT

NOT FOR CONSTRUCTION

NOTES:

1. FOR GENERAL NOTES, SEE DWG. S01.
2. ALL ITEMS ARE TIMBER, UNLESS NOTED OTHERWISE.
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ISSUES

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SUB CONSULTANT

DRAFTED: PHU
DRAFTING REVIEW
DESIGNED: SPS
DESIGN REVIEW

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250–751–8558 Fax: 250–751–8559
Email: mail@heroldengineering.com

ENGINEERS SEAL

HOPKINS LANDING: DETAILS

PORTS CONDITION ASSESSMENT
HOPKINS LANDING
1975 FIELD ROAD SECHELT BC V0N 3A1
SUNSHINE COAST REGIONAL DISTRICT

SUNSHINE COAST REGIONAL DISTRICT

HEL PROJECT No.	CLIENT DWG. No.
4551–012	N/A
SCALE	PERMIT No.
AS SHOWN	N/A
HEL DRAWING No.	REVISION
S04	B

DESTROY ALL DRAWINGS SHOWING PREVIOUS REVISION

Appendix D
Load Rating Calculations

The following table summarizes the results of the evaluation method in Sections 3 and 9 of CAN/CSA S6-19 including characteristic member loading, capacities and associated maximum area and point loads for the structural elements on the approach and wharfhead.

Table D1: Approach & Wharfhead Shear Load Rating Results

Element	Live Load Type	Max. Dead Load Shear (kN)	Max. Material Resistance (kN)	Maximum Load
Decking	Area	0.083	16.8	26.0kPa
	Point	0.083	16.8	128kN
Stringer	Area	2.8	27.3	12.6kPa
	Point	2.8	27.3	376kN
Pile Cap	Area	14.0	40.2	0.6kPa
	Point	14.0	40.2	421kN

Table D2: Approach & Wharfhead Flexural Load Rating Results

Element	Live Load Type	Max. Dead Load Bending (kNm)	Max. Material Resistance (kNm)	Maximum Load
Decking	Area	0.013	2.03	13.8kPa
	Point	0.013	2.03	69kN
Stringer	Area	4.22	28.6	8.3kPa
	Point	4.22	28.6	248kN
Pile Cap	Area	10.16	32.0	0.97kPa
	Point	10.16	32.0	405kN

Table D3: Approach & Wharfhead Compression Load Rating Results

Element	Live Load Type	Max. Dead Load Compression (kN)	Max. Material Resistance (kN)	Maximum Load
Bearing Pile	Area	19.8	114	7.7kPa
	Point	19.8	114	221kN