INSPECTION OF PILES AND SUPERSTRUCTURE IN THE VAN ANDA DOCK TEXADA ISLAND, BRITISH COLUMBIA

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Prepared for:

POWELL RIVER REGIONAL DISTRICT
#202 – 4675 Marine Avenue
Powell River, BC
V8A 2L2

Prepared by:

FORESHORE TECHNOLOGIES INCORPORATED
118 Garden Avenue
North Vancouver, B.C.
V7P 3H2

Telephone: (604) 983-3111
Facsimile: (604) 983-3454
Email: fti@foreshore.ca

FORESHORE Technologies Inc.

TABLE OF CONTENTS

FORESHORE Technologies Inc.

VAN ANDA DOCK & FLOAT INSPECTION
SUMMARY REPORT

INTRODUCTION

The inspection was performed on July 18th and 19th, 2017 at the Van Anda Public Dock located in Van Anda Cove on Texada Island, BC. The inspection team consisted of Dominic Gerelle, Greg McCullagh and Logan Goodwin.

The following scope of work was performed:

- Above-water visual, sounding and coring inspection of harbour components including piles, superstructure and floats.
- Underwater visual inspection of piles and bracing.

For the purpose of defining damage estimates, the following levels are used in the report.

Light	< 10% cross-section loss
Moderate	10% to 50% cross-section loss
Heavy	> 50% cross-section loss

FACILITY DESCRIPTION

The Van Anda Public Dock is located in Van Anda Cove south of Sturt Bay on Texada Island, BC. The facility consists of a timber approach, running east to west, leading to a timber wharfhead; see Photograph 1. The wharfhead provides access to a single float located on the north side of the approach that is accessed by an aluminum gangway; see Photograph 2. The float is anchored by three pile clusters, one at the east end and two at the west end.

See Appendix 1 Drawings for Approach, Wharfhead and Float for reference system and dock geometry including location of "Project North".

The approach is 83.5m long; see Photograph 3. There is no loading rating for the approach however its design limits it to pedestrian use only. The approach is supported by timber stringers and caps on timber bearing piles with timber cross-bracing and horizontal walers; see Photograph 4. Individual components in the approach are as follows:

- Handrail - Post – (90mm x 90mm)
- Handrail – Top Rail – (38mm x 140mm)
- Handrail – Top and Mid Side Rail – (38mm x 90mm)
- Curbs – (190mm x 127mm)
- Curb Risers – (50mm x 190mm)
- Decking – (50mm x 300mm)
- Stringers – (330mm x 150mm) – creosote treated
- Caps – (330mm x 305mm) – creosote treated
- Braces – (180mm x 150mm) – creosote treated
- Walers – (180mm x 150mm) – creosote treated

- Timber Piling – (305mm diameter) – creosote treated

The wharfhead is 15.4m long by 21.5m wide; see Photographs 5 and 6. The wharfhead is supported by timber stringers and caps on timber bearing piles with timber brace piles and cross-bracing. Individual components in the wharfhead are as follows:

- Handrail - Post – (90mm x 90mm)
- Handrail – Top Rail – (38mm x 140mm)
- Handrail – Top and Mid Side Rail – (38mm x 90mm)
- Curbs – (290mm x 280mm)
- Curb Risers – (50mm x 290mm)
- Decking – (50mm x 300mm)
- Stringers – (330mm x 150mm) – creosote treated
- Caps – (330mm x 305mm) – creosote treated
- Braces – (180mm x 150mm) – creosote treated
- Walers – (180mm x 150mm) – creosote treated

The gangway is 11m long by 1.4m wide and is suspended from the deck at Bent 19 in the wharfhead; see Photograph 7.

The float is 14.0m long by 4.3m wide. The float is anchored by three groups of piles. Two piles at the northwest corner, two piles at the southwest corner and six piles at the east end; see Photograph 8. Individual above-water components of the float are as follows:

- Bull Rails – (90mm x 140mm) - treated
- Risers – (90mm x 140mm) - treated
- Decking – (38mm x 290mm) – treated
- Timber Piling – (320mm diameter) – creosote treated

INSPECTION RESULTS

The following summarizes the inspected condition of each component type within each structure.

Approach

Handrails and Posts: Handrails were visually inspected. The rail timbers and posts are in good condition with light weathering and abrasion wear from use. One post at Bent 5.2 – Row B, has some play.

Curb and Curb Riser: Curb and curb risers were visually inspected. The curb and curb risers are in good condition with weathering and checking on their upper surface. The curbs are secured with galvanized bolts. Bolts are slightly loose allowing for rotation of the timber washers.

Decking: Decking was visually inspected. The decking is in good condition with light weathering and abrasion wear.

Stringers: Stringers were inspected visually and selectively hammer sounded where accessible. They are in good condition.

Caps: All caps were visually inspected, selectively hammer sounded and cored when suspected to have internal decay. The caps are generally in good condition with light weathering and checking. The caps in Bent 11 and Bent 16 have heavy fungal damage with the damage in Bent 11 located adjacent to the walkway and the damage in Bent 16 extending over the length of the cap; see Photographs 9 and 10. See Table 2 List of Damaged Sub-structure Timbers.

Bearing Piles: All bearing piles were visually inspected above and under-water, hammer sounded and probed where accessible. See Table 1 Approach, Wharfhead and Float Piles for detailed results.

The creosote treated piles are in fair to good condition. Four piles were found with significant damage (Bent 5 – Row C, Bent 9 – Rows A and B and Bent 10 – Row B). Where a newer pile is located adjacent to a damage pile (Bent 16 – Row A) the damaged pile is considered to be derelict and not considered structural. Several piles have copper patches nailed over what are suspected to be open bolt holes. Patches were not removed.

Cross-Bracing and Spacer Blocks: Creosote treated cross-bracing is present throughout the approach. Cross-bracing runs between the piles in each Bent. Three braces have significant marine borer damage at their lower ends (Bents 5, 12 and 15); see Photograph 11. Two spacer blocks (used to take up space between the cross-brace and the pile) have heavy marine borer damage in Bents 14 and 16; see Photograph 12. Light damage is present in five braces.

Walers: Creosote treated horizontal walers are present throughout the approach. Walers extend between piles in successive bents along the same pile row. Significant marine borer and mechanical damage was found in five walers mostly along Row C; see Photograph 13. One of these walers is not attached to its pile (Bent 16 to 17 at Bent 16 - Row A).

Services: There are no services.

Wharfhead

Handrails: Handrails were visually inspected. These are located along the west, south and east sides of the structure. The rail timbers and posts are in good condition. Some of the posts along the west (offshore) side of the wharfhead are slightly loose.

Curb and Curb Riser: Curb and curb risers were visually inspected. The curb and curb risers are in good condition. Light checking is present in the tops of the curbs. The curb section north of the gangway along Bent 19 is loose.

Decking: Decking was visually inspected. The decking is in good condition with light weathering and checking. One section of decking at the top of the gangway is badly split, see Photograph 14.

Stringers: Stringers were inspected visually. The stringers appear to be in good condition.

Caps and Corbels: All caps and corbels were inspected visually and selectively hammer sounded and cored where accessible. The caps are in good condition. One cap has light mechanical damage at its end.

Bearing and Brace Piles: The creosote-treated bearing and brace piles were visually inspected both above and underwater, and probed where accessible; See Table 1 Approach, Wharfhead and Float Piles for detailed results. Four piles (three bearing and one brace) were found to have significant marine borer and mechanical damage; see Photograph 15.

Fender Piles: The creosote-treated fender piles are located along the north side of the wharfhead. They are grouped in clusters of three piles except at the north end of Bent 19 which has five piles. Five of the fender piles have significant marine borer damage. This damage is generally located in the intertidal zone and has occurred as a result of abrasion damage to the pile surface combined with marine borer attack; see Photograph 16.

Cross-Bracing and Spacer Blocks: There is cross-bracing in five of the six bents in the wharfhead. Four of the braces have significant marine borer or mechanical damage. Three spacer blocks are missing or have heavy marine borer damage.

Ladder: There is one ladder on the north side of the wharfhead. It is in poor condition as one side has failed; see Photograph 17.

Tie-off Bollards: Three tie-off bollards are located along the north and northeast sides of the wharfhead. These are in good condition. Two of the three bollards have one loose bolts each.

Services: There are no services.

Gangway

Body: The aluminum gangway is in good condition; see Photograph 7. There are no safety chains between the top of the gangway and the wharfhead railing leaving a gap; see Photograph 18.

Deck: The deck is in good condition.

Upper Hinge: The upper hinge consists of aluminum hinge pieces bolted to the wharfhead. Suspended from the upper brackets are four aluminum hangers (2 on each side) secured with lubricated hinge pins. The gangway is secured to the lower end of the hangers with additional lubricated hinge pins. All components are in good condition.

Upper Transition: The hinged aluminum tread plate is in good condition, one of the securing lag-bolts is loose; see Photograph 19. The deck timber that supports the upper transition plate is badly split; see Photograph 14.

Lower Transition: The lower transition is in fair to good condition. The leading edge abrades with the gangway pad and the nails that secure the gangway pad timbers; see Photograph 20. The lower transition remains functional.

Sliders & Guide Rails: The guiderails, sliders and wear surfaces located under the gangway are in good condition.

Float

Bull-Rails and Risers: Bull-rails were visually inspected. Rails are located on all four sides of the float. The north rail has moderate mechanical damage with up to 40% cross-section loss; see Photograph 21. A bull-rail securing bolt is loose at the southwest corner of the float, allowing for some play in the rail. The risers are in good condition with light weathering and abrasion.

Decking: Decking was inspected visually. The decking is in good condition.

Stringers and Cross-ties: Stringers and cross-ties were inspected visually where accessible. All stringers and cross-ties are in good condition.

Flanges: Flanges were inspected visually where accessible. All inspected flanges are in good condition.

Mooring Piles: Piles were inspected visually. See Table 1 Approach, Wharfhead and Float Piles for detailed results.

Abrasion damage has taken place to seven of the 10 piles. Generally this has resulted in a cross-section loss of 10% or less to the piles. One pile (East Cluster SW corner) has more significant damage with marine borers creating additional internal damage to the pile; see Photograph 22.

Pile Wells and Well-liners: Pile wells were inspected visually. The pile wells around the three pile clusters are in fair to good condition. There is 50% abrasion cross-section loss to the north well liner (East Cluster – NE Pile). In the Northwest Cluster there is anywhere between 10% and 40% abrasion to the well liners, and in the Southwest Cluster there is 15% to 30% abrasion of the liners.

Freeboard: Freeboard was measured to the top of the stringers at the corners of the float. The float sits higher at its west end (ramp end) with a freeboard ranging from 375mm to 400mm. At the east end (inshore end) the freeboard is 300mm. There is more flotation at the west end of the float that probably accounts for the difference in freeboard measurements

Upland Foreshore

Erosion: There is some erosion and undercutting of the slope on the north and south sides of the approach to the dock. This is more extensive on the north side; see Photograph 23. A vehicle parking and turn-around area is located at the top of the bank; see Photograph 24. Large rocks and concrete barriers are located along the edge of the bank to prevent vehicles from approaching too closely.

The following table lists each facility item/element, its overall inspected condition and estimated residual life (RLE).

RESIDUAL LIFE ESTIMATES TABLE

Item / Element	Condition	RLE (Yrs)
Approach (Handrail)	Good	8 – 10
Approach (Curb)	Good	8 – 10
Approach (Curb Risers)	Good	8 – 10
Approach (Deck)	Good	8 – 10
Approach (Stringers)	Good	10 – 15
Approach (Caps)	Good **except as noted**	4 – 15
Approach (Bearing & Batter Piles)	Good **except as noted**	**3** – 15
Approach (Cross-Braces & Walers)	Good **except as noted**	**3** – 10
Wharfhead (Handrail)	Good	8 – 10
Wharfhead (Curb)	Good	8 – 10
Wharfhead (Curb Risers)	Good	8 – 10
Wharfhead (Deck)	Good **except as noted**	**2** – 10
Wharfhead (Stringers)	Good	10 – 15
Wharfhead (Caps)	Good	10 – 15
Wharfhead (Bearing & Batter Piles)	Good **except as noted**	**3** – 15
Wharfhead (Fender Piles)	Good **except as noted**	**3** – 10
Gangway (Body)	Good	8 – 10
Gangway (Deck)	Good	8 – 10
Gangway (Sliders)	Good	2 – 5
Gangway (Guide Rails)	Good	5 – 8
Gangway (Hinge)	Good	5 – 8
Gangway (Upper Transition)	Good	5 – 8
Gangway (Lower Transition)	None	3 – 5
Float (Bull Rails and Risers)	Good **except as noted**	**2** - 5
Float (Deck)	Good	8 – 10
Float (Pile Wells)	Good	5 - 8
Float (Well Liners)	Good **except as noted**	**2** – 8
Float (Stringers)	Good	8 – 10
Float (Fascia)	Good	8 – 10
Float (Cross-ties)	Good	8 – 10
Float (Flanges)	Good	8 – 10
Float (Floatation)	Good	8 – 10
Float (Timber Anchor Piles - 10)	Good **except as noted**	**3** – 10
Upland Foreshore	Good **except as noted**	**2** – 15

RECOMMENDATIONS FOR REPAIR TABLE

MAINTENANCE /REPAIR WORK	Timing Estimations
APPROACH:	
Replace Caps (Bents 11 & 16)	2 – 5 Years
Replace Piles (Bent 5 – C, Bent 9 – A & B, Bent 10 – B)	2 – 5 Years
Multiple Piles. Plug and patch open bolt holes	2 – 5 Years
Replace Cross-braces (Bents 5, 12 & 15)	2 – 4 Years
Replace/Repair Walers (Row A (1), Row C (4)	2 – 4 Years
Replace brace spacer blocks (Bents 14 & 16)	2 – 4 Years
Tighten bolts securing handrail post (Bent 5.2 – Row B)	2 – 5 Years
WHARFHEAD:	
Tighten bolts securing curb along Bent 19	2 – 5 Years
Tighten bolts securing handrail posts along Bent 24	2 – 5 Years
Replace section of deck at top of gangway	**1** – 2 Years
Replace Bearing Piles (Bent 20 – G, Bent 22 – E & Bent 24 – H)	2 – 5 Years
Replace Brace Pile (Bent 29 – H Br (S)	2 – 5 Years
Replace four Cross-braces (Bents 20, 22 & 24)	2 – 5 Years
Replace three brace spacer blocks (Bent 20)	2 – 5 Years
Replace Fender Piles (Bent 19 – H Fr 4, Bent 20 – H Fr 1, Bent 23 – H Fr 1 & 2, & Bent 24 – H Fr 3)	2 – 5 Years
Replace Ladder	**1** – 2 Years
Tighten Tie-off bollard bolts.	2 – 5 Years
GANGWAY:	
Lower Transfer Plate	Monitor
Gangway Sliders abrasion	Monitor
Install safety chains between handrail and top of gangway	**1** – 2 Years
FLOAT & FLOAT ANCHOR PILES:	
Pile Cluster Well Liners. Install strips on piles & replace well liners as required	**1** – 2 Years
Replace Float Anchor Pile (East Cluster – Pile 2 SW Pile)	2 – 5 Years
Tighten bull-rail bolts as required	1 – 2 Years
Replace northeast bull-rail	1 – 2 Years
UPLAND FORESHORE:	
Install armour rock to protect bank from further erosion	**1 –** 2 Years

CONCLUSION & RECOMMENDATIONS

The Van Anda Dock has been in use for many years and was designed for commercial loading. Inspections of the structure have been undertaken by North Island Engineering Ltd. in 2005 and 2012 and have included recommendations for repair. In 2008, repair work appears to have been undertaken that included the demolition and removal of the offshore end of the wharfhead and the reconfiguration of the approach such that access was limited to pedestrian use by narrowing the width of the walkway.

Several of the repair recommendations indicated in the drawing from the 2005 do not appear to have been undertaken, however it is not possible to determine if these repairs were included as part of the 2008 repair project.

With the structure now being limited to pedestrian use only, its load bearing capacity likely well exceeds the new loads placed upon it. This inspection identified deficiencies in the piling, bracing, caps and float and gangway elements typical of structures of this age. Marine borer damage to the piles and bracing is present in both the approach and wharfhead and is developing in the float anchor piles. Fungal decay previously identified in two caps in the approach continues.

Repairs to the structure are recommended along with a suggested timeline. There is considerable redundancy in the structure allowing for some flexibility in the scheduling of repairs. Items identified in **bold** are more pressing and represent more immediate safety concerns.

Erosion of the foreshore is evident on the north side of the approach and to a lesser extent on the south side. Storm events are likely to continue this erosion and undermining of the bank with the risk of collapse. Armouring of the slope with rip-rap is a possible solution.

The requirement still exists for some significant repairs within the next five years in order to address concerns particularly with the piles, bracing and cap timbers. On-going inspections on a five year cycle are recommended and a repeat inspection should be undertaken prior to any major repairs especially if these repairs are left for a five year period.

The following figures provide cost estimates to maintain the facility for the next 20 years and also cost for removal and disposal of the facility.

- 0 – 5 years $50 to $60K plus cost of armouring foreshore slope
- 5 – 10 years $60 to $70K
- 10 – 20 years $90 to $100K
- Demolition and removal $300K

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PHOTOGRAPHS

PHOTOGRAPH 1. Van Anda Dock, Texada Island. Approach, Wharfhead and Float.

PHOTOGRAPH 2. Float and Float anchor piles along with gangway at the northeast side of the wharfhead.

PHOTOGRAPH 3. Approach to the Van Anda Dock. Approach is limited to pedestrian use only.

PHOTOGRAPH 4. Typical configuration of the approach sub-structure with piles, cross-braces, walers, caps, stringers and decking.

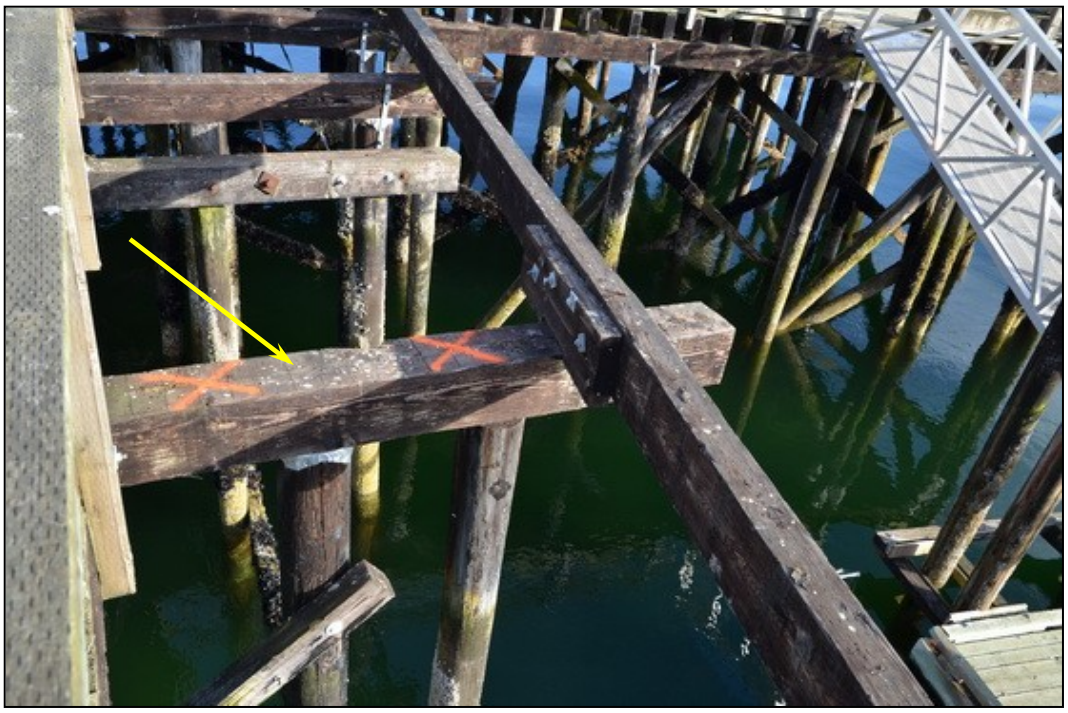
PHOTOGRAPH 5. West side of the wharfhead (Bent 24) showing piles, bracing, caps, stringers and railing.

PHOTOGRAPH 6. Deck of the wharfhead looking north. The north side does not have handrails.

PHOTOGRAPH 7. Aluminum gangway that extends from the wharfhead down to the float.

PHOTOGRAPH 8. Float and float anchor piles.

PHOTOGRAPH 9. Cap located at Bent 11 in the approach has heavy fungal damage from Row A (left) to Row B (middle).



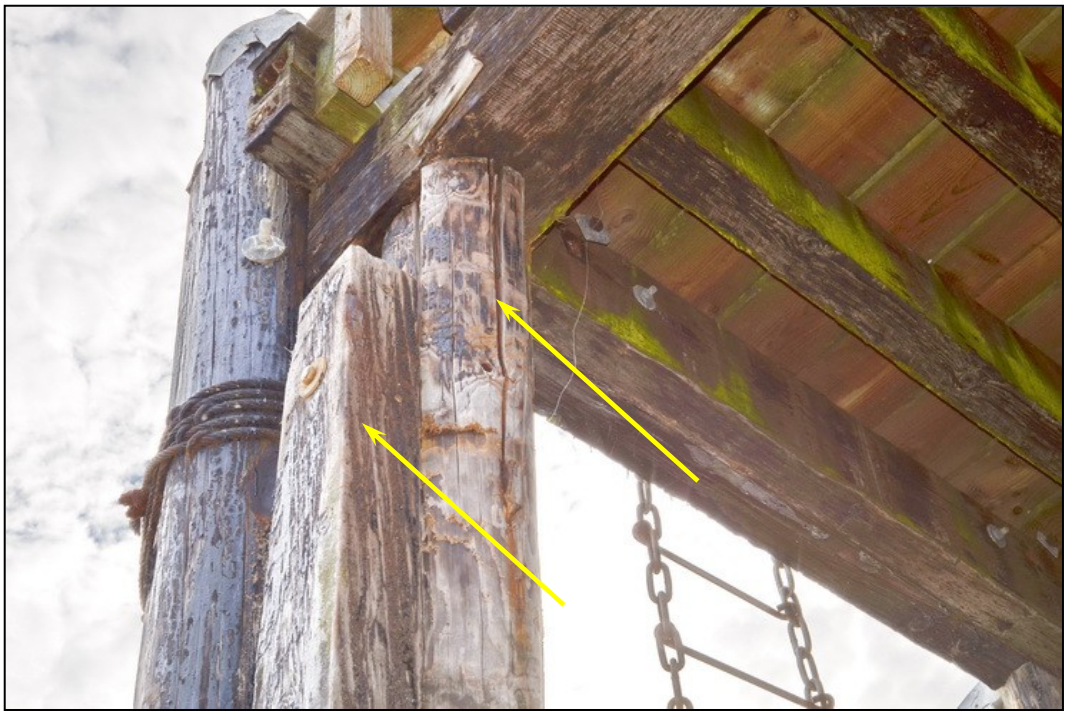
PHOTOGRAPH 10. Cap located at Bent 16 in the approach has heavy fungal damage from Row A to Row C (right).

PHOTOGRAPH 11. Marine borer damage in the lower end of a cross-brace in the approach. Damage extends up to the attachment bolt.

PHOTOGRAPH 12. Heavy marine borer damage to a spacer block between the cross-brace and the pile in the approach.

PHOTOGRAPH 13. Failed horizontal waler along Row C in the approach.

PHOTOGRAPH 14. Deck at the top of the gangway is badly split and is recommended for replacement.



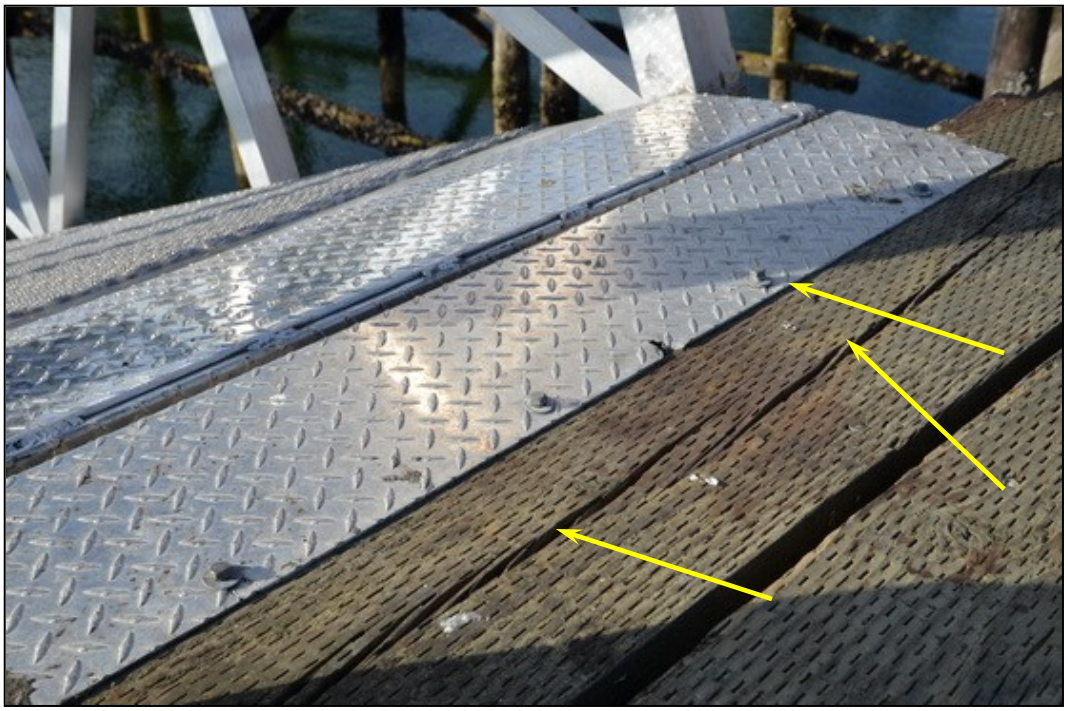
PHOTOGRAPH 15. Mechanical impact damage to Pile 24 – H in the wharfhead. The pile is badly split, and the associated cross-brace has failed.

PHOTOGRAPH 16. Heavy marine borer damage to one of the fender piles along the north side of the wharfhead.

PHOTOGRAPH 17.

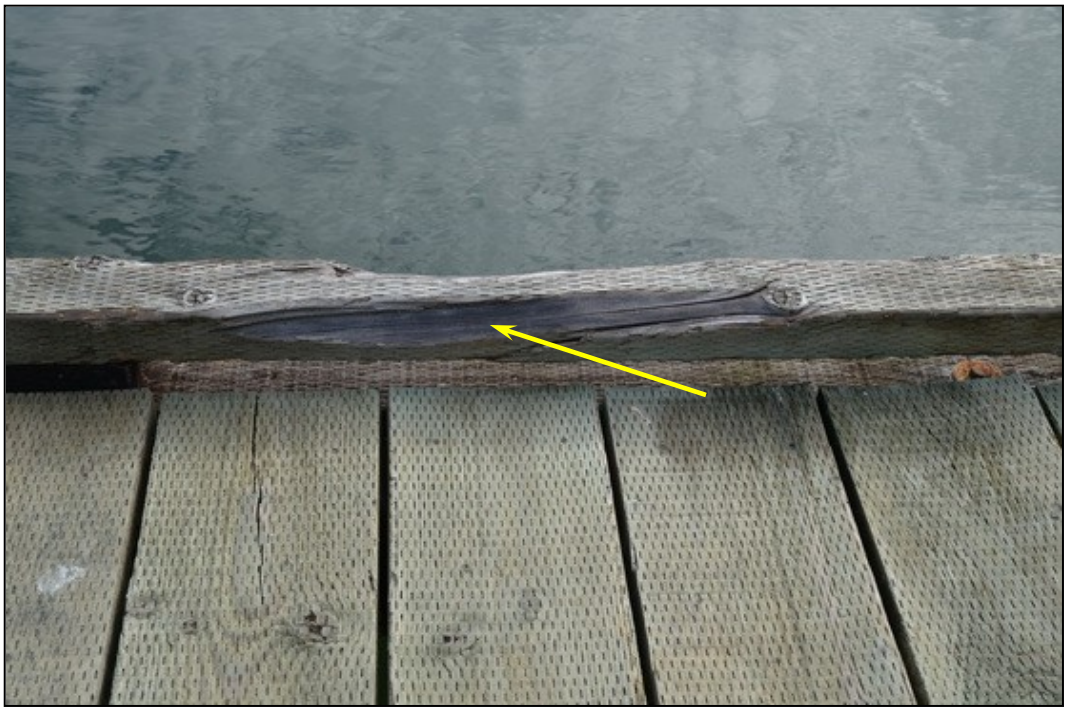
Failure of the only ladder between Bents 23 and 24 at Row G, that provides access to the wharfhead.

PHOTOGRAPH 18. Eyes are present on the gangway to secure safety chains to the posts around the wharfhead. Chains are missing.



PHOTOGRAPH 19. Bolts securing part of the upper transition plate are loose. Mounting timber is also split.

PHOTOGRAPH 20. The lower edge of the lower transfer plate abrades with the pad that supports the sliders and ramp guides. It remains functional.



PHOTOGRAPH 21. Mechanical damage to the rail along the north side of the float. The rail is recommended for replacement.

PHOTOGRAPH 22. Float anchor pile (East Cluster SW corner) has a combination of abrasion and marine borer damage. This pile will likely require replacement within the next 3 to 5 years

PHOTOGRAPH 23. Erosion of the bank along the north side of the approach creates the potential for a slope failure.

PHOTOGRAPH 24. Erosion of the bank along the north side of the approach creates the potential for a slope failure. Concrete barriers are located along the top of the slope. The area should be armoured with rip-rap to prevent further erosion.

TABLE 1

INSPECTION RESULTS OF THE PILES
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Pile Location		Rating	Remarks
Bent	Row		
Approach			
1	A	100%	Bottom 1.5m encased in steel culvert pipe
1	B	100%	Bottom 1.5m encased in steel culvert pipe
1	C	100%	Bottom 1.5m encased in steel culvert pipe
2	A	100%	
2	B	100%	
2	C	100%	
3	A	100%	
3	B	100%	
3	C	100%	
4	A	100%	
4	B	100%	
4	C	100%	
5	A	100%	
5	B	100%	
5	**C**	**75%**	**25% marine borer cavity in open bolt hole 1.8m from mudline**
6	A	100%	
6	B	100%	
6	C	100%	
7	A	100%	
7	B	100%	
7	C	100%	
8	A	100%	
8	B	100%	
8	C	100%	
9	**A**	**75%**	**25% marine borer cavity in open bolt hole 1.0m above mudline**
9	**B**	**30%**	**70% marine borer cavity 6.0m from pile top**
9	C	100%	

TABLE 1 continued

INSPECTION RESULTS OF THE PILES
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Pile Location		Rating	Remarks
Bent	Row		
10	A	100%	
10	**B**	**50%**	**50% marine borer cavity in open bolt hole intertidal zone**
10	C	100%	Concrete footing
11	A	100%	
11	B	100%	
11	C	95%	5% marine borer cavity 1.0m from mudline
12	A (N)	100%	
12	A (S)	100%	
12	B	100%	
12	C (N)	95%	5% marine borer cavity 1.5m from mudline
12	C (S)	100%	Open bolt hole 4.6m from top
13	A	100%	
13	B	100%	
13	C	100%	
14	A	100%	Open bolt hole 2.7m from mudline
14	B	100%	
14	C	100%	
15	A	100%	
15	B	100%	
15	C	100%	
16	A (N)	90%	10% marine borer cavity in open bolt hole 4.6m from mudline
16	A (S)	10%	Derelict. Replaced by Pile A (N)
16	B	100%	
16	C	100%	
16	C.5	100%	
17	A	100%	
17	B	100%	
17	C	100%	
17	D	100%	

TABLE 1 continued

INSPECTION RESULTS OF THE PILES
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Pile Location		Rating	Remarks
Bent	Row		
18	A	100%	
18	B	100%	
18	C	100%	
18	D	100%	
Wharfhead			
19	A (N)	100%	
19	A (S)	0%	Derelict. Replaced by Pile A (N)
19	B (N)	100%	
19	B (S)	0%	Derelict. Replaced by Pile B (N)
19	C (N)	100%	
19	C (S)	0%	Derelict. Replaced by Pile C (N)
19	D	100%	
19	E	100%	
19	E.5 Br (S)	100%	Brace pile
19	F	100%	
19	G (N)	100%	
19	G (S)	100%	
19	G Br (S)	100%	Brace pile
19	H (N)	0%	Derelict. Replaced by Pile H (S)
19	H (S)	100%	
19	**H Br (S)**	**70%**	**Moderate marine borer damage in top of pile (limited access)**
19	H Br (W)	100%	Brace pile
19	H Fr - 1	100%	Fender pile (SE)
19	H Fr - 2	100%	Fender pile (Middle)
19	H Fr - 3	100%	Fender pile (SW)
19	**H Fr - 4**	**50%**	**Fender pile. 50% marine borer cavity interdial zone (NE)**
19	H Fr - 5	100%	Fender pile (NW)
20	A (N)	100%	
20	A (S)	100%	
20	B (N)	100%	
20	B (S)	10%	Derelict. Replaced by Pile B (N)
20	C	100%	
20	D	100%	

TABLE 1 continued

INSPECTION RESULTS OF THE PILES
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Pile Location		Rating	Remarks
Bent	Row		
20	E	100%	
20	F	100%	Open bolt hole 6.1m from top
20	**G**	**20%**	**80% marine borer cavity intertidal zone**
20	H	100%	
20	**H Fr - 1**	**10%**	**Fender pile. 90% marine borer damage top to mudline (SE)**
20	H Fr - 2	100%	Fender pile (SW)
20	H Fr - 3	100%	Fender pile (N)
21	A	100%	
21	B	100%	
21	C	100%	
21	D	95%	Marine borer attack at mudline
21	E	90%	10% cross-section loss at mudline, checked
21	E Br (S)	100%	Brace pile
21	F	100%	
21	G	100%	
21	G Br (S)	100%	Brace pile
21	H	100%	
21	H Br (S)	100%	Brace pile
21	H Fr - 1	100%	Fender pile (SE)
21	H Fr - 2	100%	Fender pile (SW)
21	H Fr - 3	100%	Fender pile (N)
22	A	100%	
22	B	100%	
22	C	100%	
22	D	100%	
22	**E**	**25%**	**75% marine borer cavity in open bolt hole 1.8m from top**
22	F	100%	
22	G	100%	
22	G Br (W)	100%	Brace pile
22	H	100%	
22	H Fr - 1	100%	Fender pile (SE)
22	H Fr - 2	100%	Fender pile (SW)
22	H Fr - 3	100%	Fender pile (N)

TABLE 1 continued

INSPECTION RESULTS OF THE PILES
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Pile Location		Rating	Remarks
Bent	Row		
23	A	100%	
23	B	100%	
23	C	100%	
23	D	100%	
23	E	100%	
23	E Br (S)	100%	Brace pile
23	F	100%	
23	G	90%	10% marine borer damage 5.0m from top
23	G Br (S)	100%	Brace pile
23	H	100%	
23	H Br (S)	100%	Brace pile
23	**H Fr - 1**	**75%**	**Fender pile. 25% marine borer cavity 5.5m from top (SE)**
23	H Fr - 2	95%	Fender pile. 5% marine borer cavity 5.5m from top (SW)
23	**H Fr - 3**	**10%**	**Fender pile. 90% marine borer cavity intertidal zone (N)**
24	A	100%	
24	B	100%	
24	C	100%	
24	C Br (E)	100%	Brace pile
24	D	100%	
24	E	100%	
24	F	100%	
24	G	100%	Open bolt hole 2.4m from top
24	**H**	**10%**	**Split and broken top 1.8m**
24	H Fr - 1	100%	Fender pile (SE)
24	H Fr - 2	100%	Fender pile SW)
24	**H Fr - 3**	**50%**	**Fender pile. 50% marine borer cavity intertidal zone (N)**

TABLE 1 continued

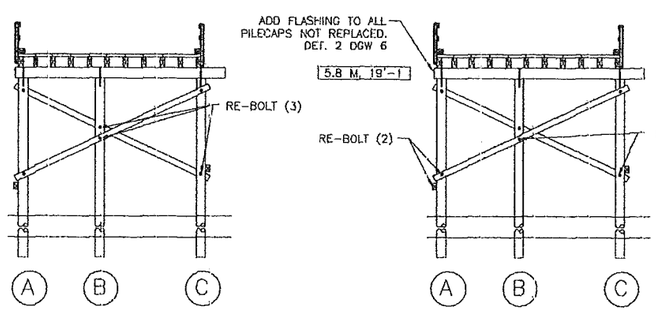
INSPECTION RESULTS OF THE PILES
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Pile Location		Rating	Remarks
Pile			
Landing Float			
Northwest Cluster			
1	W	95%	5% abrasion intertidal zone
2	E	90%	10% abrasion intertidal zone
Southwest Cluster			
1	W	95%	5% abrasion intertidal zone
2	E	95%	5% abrasion intertidal zone
East Cluster			
1	NW	90%	
2	**SW**	**70%**	**15% abrasion and 15% marine borer cavity intertidal zone**
3	N (middle)	100%	
4	S (middle)	95%	5% abrasion intertidal zone
5	NE	90%	10% abrasion intertidal zone
6	SE	100%	

TABLE 2

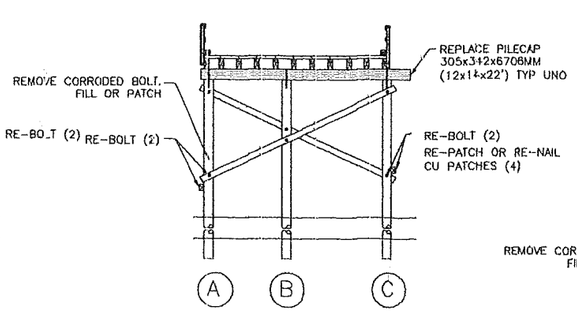
LIST OF DAMAGE SUB-STRUCTURE TIMBERS
LOCATED IN THE VAN ANDA DOCK
APPROACH, WHARFHEAD & FLOAT
TEXADA ISLAND, BRITISH COLUMBIA

Location		Rating	Remarks
Bent	Row/Pile		
Cross-Bracing			
4	C to A	90%	Light mechanical impact damage bottom 0.3m at Row A
5	**C to A**	**10%**	**Heavy marine borer damage over bottom 0.6m at Row A**
6	A to C	95%	Light mechanical impact damage bottom 0.3m at Row C
11	C to A	90%	Light marine borer damage bottom 0.3m at Row A
12	**A to C**	**10%**	**Heavy marine borer damage over bottom 0.9m at Row C**
14	A to C	95%	Light marine borer damage bottom 0.3m at Row C
14	C to A	90%	Light mechanical impact damage bottom 0.15m at Row A
15	**C to A**	**10%**	**Heavy marine borer damage over bottom 0.6m at Row A**
20	**E to G**	**5%**	**Heavy marine borer damage along length**
20	F to D	90%	Light marine borer damage bottom 0.6m at Row D
22	A to D	90%	Split at Row B
22	**D to F**	**0%**	**Heavy marine borer damage Row E to Row F**
24	**D to G**	**10%**	**Heavy marine borer damage Row D to Row E**
24	**H to F**	**0%**	**Failed at Row G, hanging from H**
Spacer Blocks			
14	**C**	**0%**	**Heavy marine borer damage at Row C** (between x-brace & pile)
16	**A**	**0%**	**Heavy marine borer damage at Row A** (between x-brace & pile)
20	**B**	**0%**	**Missing at Row B**
20	**C**	**0%**	**Missing & heavy marine borer damage at Row C**
Walers			
6 to 8	**C**	**75%**	**Moderate marine borer damage at Bent 7 - Row C**
8 to 10	**C**	**5%**	**Heavy marine borer damage along length**
12 to 14	**C**	**0%**	**Disconnected at Bent 12, broken at Bent 14**
16 to 17	**A**	**100%**	**Not attached at Bent 16**
16 to 18	**C**	**10%**	**Heavy marine borer damage over 1.2m at Bent 18**
Caps			
11	**A to C**	**50%**	**Heavy fungal damage from Row A to Row B**
12	A to C	90%	Light fungal damage at Row C
16	**A to D**	**30%**	**Heavy fungal damage from Row A to Row D**
21	A to D	90%	Light mechanical damage at Row A



BENT 2

BENT 3



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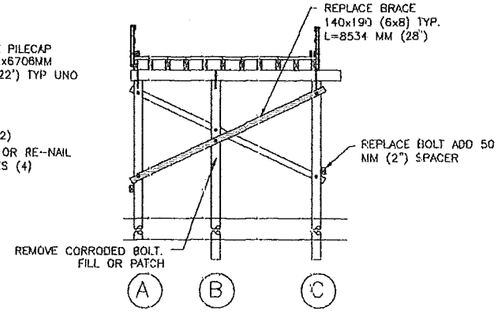


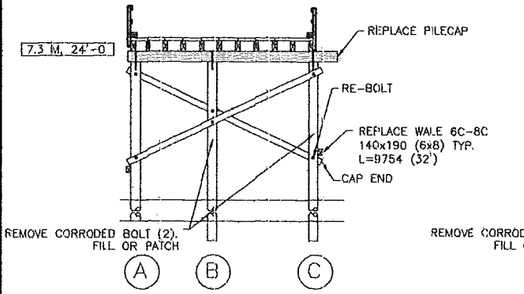
BENT 5

NOTES:

1. ALL SECTIONS LOOKING WEST.
2. SHOWN WITH BRACES REQUIRING TWO SEPARATE BOLTS AT LINE B. (MAY NOT BE THE CASE FOR ALL BENTS)
3. WALES SHOWN AS ONE SIDE. OVERLAPS NOT SHOWN. WALES MAY BE ABOVE OR BELOW THE BRACES.
4. CENTER NEW PILECAPS ON BENT.
5. REPLACE MOST SEVERELY CORRODED BOLTS WHERE THERE ARE MORE ON THE MEMBER THAN INDICATED.
6. SPACERS TO BE A MINIMUM OF 190MM (8") WIDE AND 450MM (18") LONG.

LEGEND:

4.9 M, 16'-2 GROUNDLINE TO TOP OF DECK



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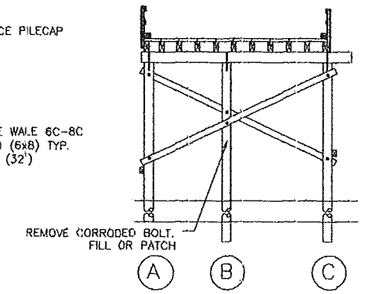

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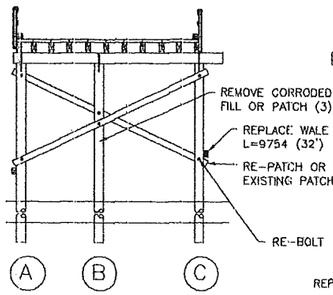

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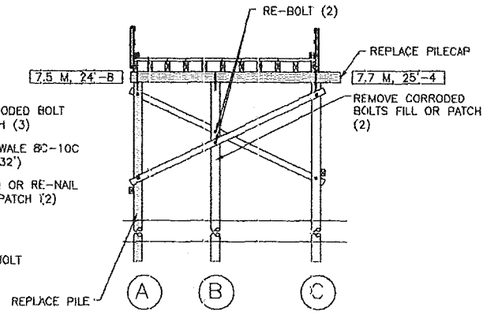

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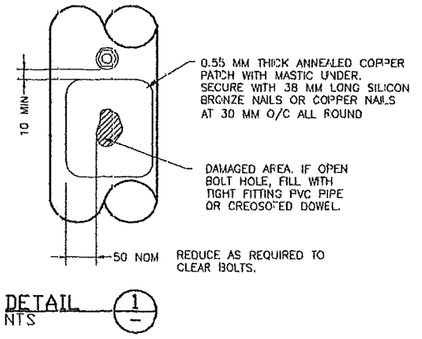
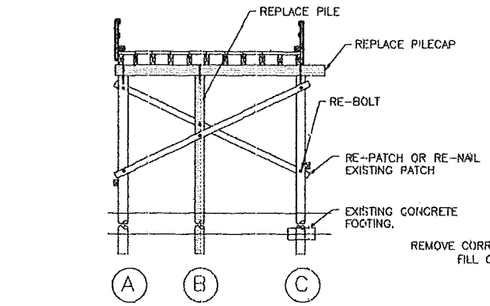


DETAIL 1 NTS

DETAIL OF COPPER (CU) PATCH OVER HOLES



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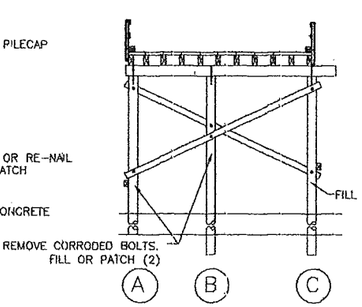

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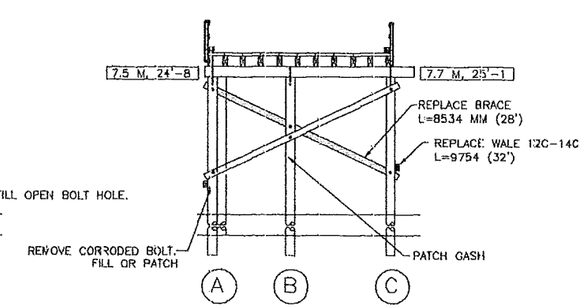

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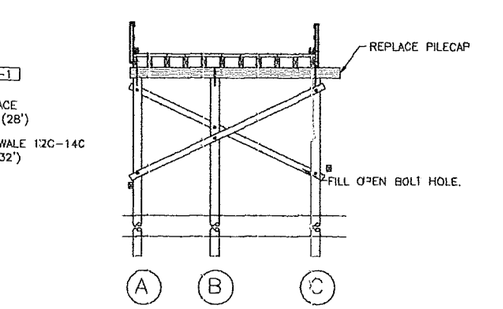

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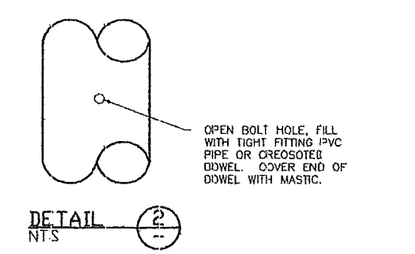
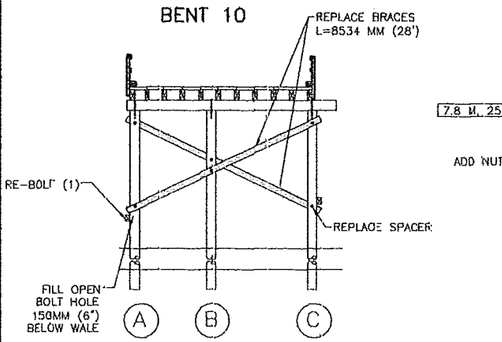


DETAIL 2 NTS

DETAIL OF FILLING OPEN BOLT HOLES



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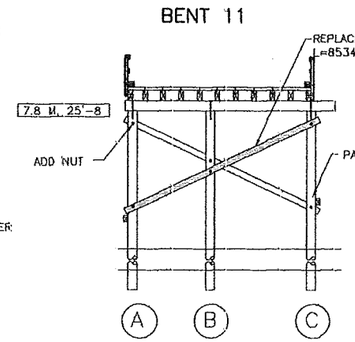

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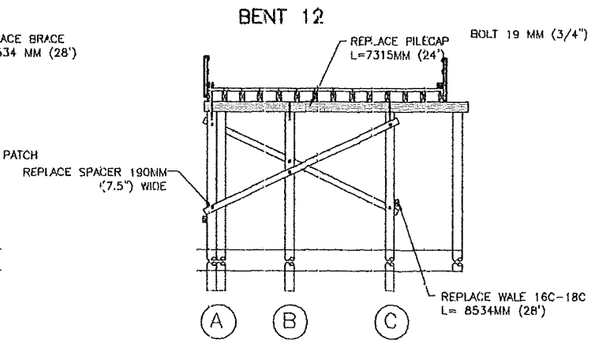

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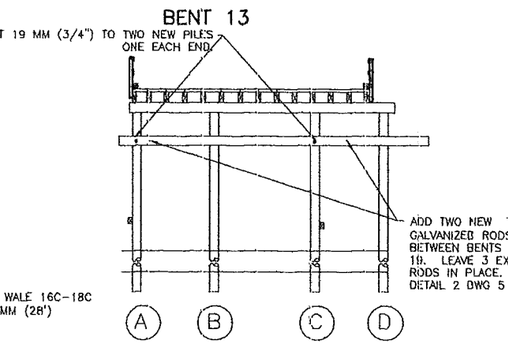
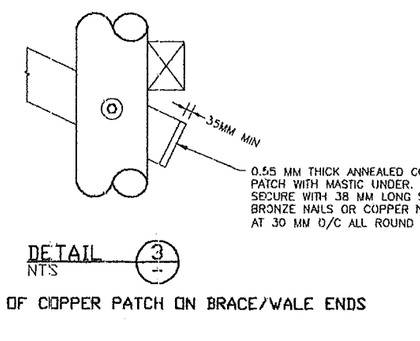


BENT 17



DETAIL 3 NTS

DETAIL OF COPPER PATCH ON BRACE/WALE ENDS

B MOST OF DRAWING NEW.

FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

E				J			
D				I			
C				H			
B	FOR FULL DECK REPLACEMENT	08/02/02	RDW	G			
A	FOR TENDER	08/05/31	RDW	F			
	REVISIONS	Y/M/D	BY		REVISIONS	Y/M/D	BY

PLOT SCALE 1:100

NORTH ISLAND ENGINEERING LTD.
2005012
1833 ROBB AVENUE, COMOX, B.C.
TEL./FAX (250) 339-2243

APPROVED FOR USE IN CONSTRUCTION

DRAWN BY: RDV DESIGN BY: RDV
DATE: 8 NOV 2005 CHECKED BY: RDV
FILE No: 2005012 SCALE: NTS

POWELL RIVER REGIONAL DISTRICT

VAN ANDA
TEXADA ISLAND

WHARF AND FLOAT REPAIRS

APPROACH REPAIRS

DRAWING No. 2005012- 3 B
CANCEL PRINTS BEARING EARLIER REVISIONS

Ralph Watts, NIELO5/03/2006 10:4 AM\VanAndaDeck-2006Mar5Ver1.DWG

DESIGN CRITERIA

THIS STRUCTURE HAS BEEN DESIGNED IN GENERAL ACCORDANCE WITH THE FOLLOWING CODES AND STANDARDS:

- CSA STANDARD, S6-88 DESIGN OF HIGHWAY BRIDGES, AS MODIFIED BY THE RG SEXSMITH REPORT OF 1992 FOR TRANSPORT CANADA.

DESIGN LOADS (SERVICE)

MAX. AXLE LOAD	--	73 KN (16,400 LB)
WALKWAY	--	4.8 KPA (100 PSF)
FLOAT (LOCALLY)	--	4.8 KPA (100 PSF)
FLOAT (BOUYANCY)-		1.2 KPA (25 PSF)

GENERAL NOTES

CONFIRM DIMENSIONS OF EXISTING STRUCTURE PRIOR TO COMMENCEMENT OF FABRICATION AND INFORM THE ENGINEER OF ANY DIFFERENCES.

PROVIDE THE ENGINEER WITH A SCHEDULE OF TIMBERS BEFORE ORDERING.

PROVIDE THE ENGINEER WITH A SCHEDULE OF CONSTRUCTION ACTIVITIES AND KEEP HIM INFORMED OF CHANGES SO HE MAY ARRANGE SITE INSPECTIONS.

THE CONTRACTOR TO CO-OPERATE WITH THE ENGINEER OR HIS REPRESENTIVES IN TAKING SAMPLES AND TO SUPPLY ACCESS AS REQUESTED.

REQUEST AND SUBMIT TO THE ENGINEER A COPY OF ALL DOCUMENTATION REGARDING THE SPECIFIED MATERIALS IF THE GRADE OF THE MATERIAL CANNOT BE READILY IDENTIFIED, E.G., MILL CERTIFICATES FOR STEEL, BOLTS, CONCRETE WAYBILLS, ETC.

CONTRACTOR TO COMPLY WITH THE "BEST MANAGEMENT PRACTICES FOR PILE DRIVING AND RELATED OPERATIONS - BC MARINE AND PILE DRIVING CONTRACTORS ASSOCIATION" LATEST REVISION.

STANDARDS TO BE THE LATEST EDITION UNLESS NOTED OTHERWISE

TIMBER

UNLESS OTHERWISE NOTED THE FOLLOWING MEMBER SIZES TO BE USED

PILES SIZE 33

PILE PENETRATIONS TO BE 5.0M (16FT) OR REFUSAL. CONTRACTOR TO KEEP DETAILED PILE DRIVING RECORDS FOR ALL PILES INSTALLED.

MATERIALS TO CONFORM TO THE FOLLOWING:

TIMBER TO BE COAST DEFICIENCY NO. 1 STRUCTURAL GRADE OR BETTER TO THE NLGA STANDARD GRADING RULES FOR CANADIAN LUMBER.

PILES TO BE NEW PEELED ROUND COAST DOUGLAS FIR, CONFORMING TO THE REQUIREMENTS OF CSA STANDARD CAN3-O56 AND CREOSOTED IN ACCORDANCE WITH CSA O80 TO A NET RETENTION OF 290 KG/M^3 (18 PCF).

TIMBER BELOW HIGH WATERLINE TO BE TREATED IN ACCORDANCE WITH CSA STANDARD O80 TO A NET RETENTION OF 290 KG/M^3 (18 PCF).

TIMBERS BELOW DECK LEVEL BUT ABOVE THE HIGH WATERLINE TO BE TREATED IN ACCORDANCE WITH CSA STANDARD O80 TO A NET RETENTION OF 160 KG/M^3 (10 PCF)

DECK PLANKS, BULL RAILS, GUARDS, RUB BOARDS, MOORING WELL LINERS, RAILS, HANDRAILS, AND POSTS TO BE TREATED WITH ACZA TO 6.4 KG/M^3 (0.4 PCF)

PLYWOOD TO BE TREATED IN ACCORDANCE WITH CSA STANDARD O80 TO A NET RETENTION OF 290KG/M^3 (18 PCF)

ALL TIMBERS TO BE TREATED TO CANADIAN INSTITUTE OF TREATED WOOD'S BEST MANAGEMENT PRACTICES FOR USE OF WOOD IN AQUATIC ENVIRONMENTS.

FLOAT TIMBERS AND TIMBER SPACERS BE CUT AND PRE-DRILLED PRIOR TO TREATMENT. DECKING TO BE CUT TO LENGTH PRIOR TO FIELD TREATMENT EXCEPT AS NOTED.

TREATED TIMBERS AND PILES TO BE CAREFULLY HANDLED TO AVOID DAMAGE TO THE TREATED SURFACES EXCEPT AS SPECIFICALLY NOTED IN THE SPECS.

TOPS OF BEARING PILES TO BE CUT SQUARE AND LEVEL. RE-CUT AND SHIM EXISTING BEARING PILES THAT ARE NOT BEARING EVENLY UNDER NEW CAPS OR CORBELS. MOORING PILE TOPS TO BE CUT AT A SLIGHT SLOPE (~10°).

CUTS, BREAKS AND HOLES IN TIMBERS TO BE TREATED WITH TWO SEPARATE COATS OF COPPER NAPHTHENATE AND A COATING OF MASTIC. AFTER TREATING, TOPS OF PILES TO RECEIVE A HEAVY COAT (MIN 5 MM) OF APPROVED MASTIC. BATTER PILES AND FENDER PILES TO BE FINISHED TO THE DETAIL SHOWN.

DRIFT PINS OR PIPE SLEEVES TO BE DRIVEN INTO HOLES THAT ARE 0.8 TO 1.5 MM (1/32 TO 1/16") SMALLER THAN THE DIAMETER OF THE PIN OR PIPE. TAPER ENDS TO PERMIT PROPER DRIVING.

OLD DRIFT PINS TO BE REMOVED OR CUT FLUSH TO THE UNDERSIDE OF THE STRINGERS. OLD HOLES MAY BE REUSED IF THEY STILL PROVIDE A TIGHT FIT TO THE NEW DRIFTS. CONTRACTOR TO TAKE PRECAUTIONS TO PREVENT SPLITTING OF THE TIMBERS.

NAILS TO BE DRIVEN FLUSH, NOT OVERDRIVEN AND SQUARE TO DECKING.

BOLTS TO BE TIGHTENED FROM THE NUT END. PUT MASTIC UNDER WASHERS.

MISC. STEEL

MATERIALS TO CONFORM TO THE FOLLOWING:

MISCELLANEOUS STEEL	CAN/CSA G40.20/G40.21 GRADE 300W
BOLTS	ASTM A307

STEELS TO BE GALVANIZED TO HAVE
A CARBON CONTENT LESS THAN 0.25%
A PHOSPHORUS CONTENT LESS THAN 0.04%
A SILICON CONTENT EITHER LESS THAN 0.03% OR BETWEEN 0.15 AND 0.25%,
AND A MANGANESE CONTENT BELOW 1.35%

WASHERS TO BE PROVIDED AT BOTH NUT AND HEAD AND MAY BE PLATE WASHERS, MALLEABLE IRON OR OGEE, UNO. PLATE WASHERS TO HAVE THE FOLLOWING DIMENSIONS:

BOLT SIZE (MM)	WASHER SIZE (DIA. MM x T MM)
16	70x6
19	76x6
25	87x9

FOR FLOAT, BOLT LENGTHS BASED ON PLATE WASHERS IF OTHER TYPES ARE USED ADJUST LENGTHS AS REQUIRED.

DRIFT PINS TO BE CUT NOT SHEAR FROM ROUND STOCK AND TO HAVE THE ENDS TAPERED TO PERMIT EASIER DRIVING AND AVOID DAMAGING THE FIELD TREATMENT.

NAILS (FOR 38MM DECKING AND LUMBER) TO BE 316 STAINLESS ANNULAR THREAD NAILS CONFORMING TO B111. NAILS TO BE 89 MM LONG x 4.2 MM ø (3 1/2 x 8 GAUGE) UNO. 76MM (3") NAILS TO BE 3.7MMø (9 GAUGE)

SPIKES (FOR 89 MM DECKING) TO BE 200 MM (8") HOT DIPPED GALVANIZED COMMON SPIKES CONFORMING TO B111.

ALL BOLTS AND MISC. STEEL TO BE HOT-DIP GALVANIZED TO CSA STANDARD G164 WITH THE SPELTER COAT OF AT LEAST 0.61 KG ZINC PER SQUARE METER.

SCREWS AND LAG SCREWS TO BE 316 STAINLESS STEEL.

STEEL TO BE HANDLED CAREFULLY TO AVOID DAMAGING THE COATING. COATING TO BE TOUCHED UP WHERE DAMAGED WITH ZINGA OR APPROVED EQUAL.

GANGWAY - ADDITIONAL NOTES

BEARINGS TO BE RHP NP SELF LUBE BEARINGS TO MATCH THE SHAFT DIAMETER. BEARINGS TO BE FILLED FULL OF GREASE PRIOR TO INSTALLATION. EACH BEARING TO HAVE A STANDARD 90° GREASE NIPPLE INSTALLED SO IT MAY BE EASILY ACCESSED AFTER INSTALLATION.

BEARINGS ARE FRAGILE AND ARE TO BE TREATED ACCORDINGLY.

PAINTING

AS PER SPECIFICATIONS

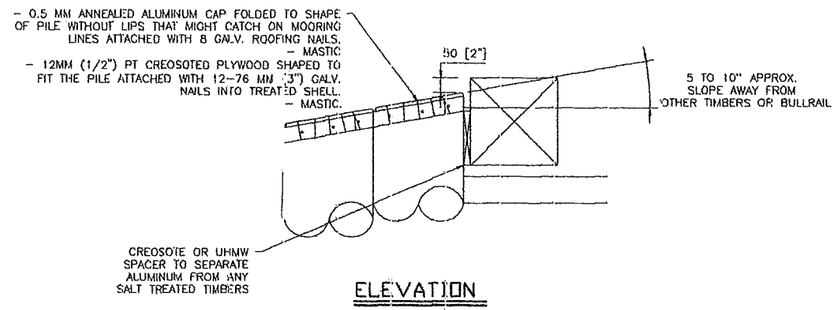
SOILS INFORMATION

LITTLE IS KNOWN OF THE SOILS IN THIS AREA. THE ABUTMENT IS SLAG FROM THE OLD SMELTER AND IS LIKELY UNDERLAIN BY LIMESTONE. SLAG COBBLES FORM THE TOP LAYER OF THE UPPER BEACH.

THE ROCK APPEARS TO BE CLOSE TO THE SURFACE IN SOME LOCATIONS AND APPEARS TO BE OVERLAIN BY SANDS, SILTS AND CLAYS. DEPTH OF THE OVERBURDEN IS NOT KNOWN. ALTHOUGH SOME PILES IN THE WHARFHEAD ARE REPORTED TO HAVE ABOUT 3M OF PENETRATION.

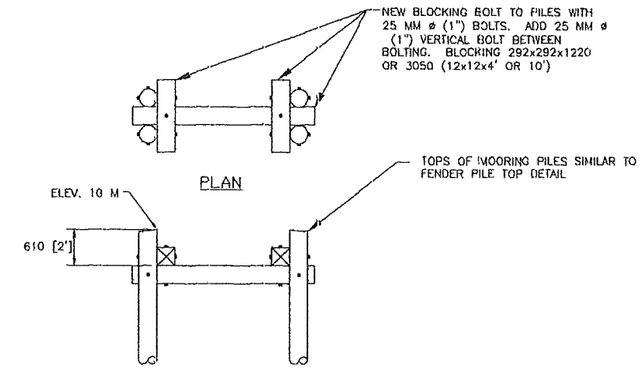
TO INCREASE OUR KNOWLEDGE OF THE SOIL CONDITIONS THE CONTRACTOR IS TO RECORD THE FOLLOWING FOR 10 SELECTED PILES EXTRACTED FROM THE DERELICT SECTION:

1. PULL ON THE LINE
2. NUMBER OF PARTS ON THE LINE
3. WAS A HAMMER REQUIRED
4. THE DEPTH OF PENETRATION
5. THE CONDITION OF THE PILE TIP AND
6. THE NATURE OF ANY ADHERING SEDIMENTS.

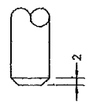


ELEVATION
SCALE 1:10

DETAIL 2/6
TOP OF FENDER PILES



DETAIL 3/1
SCALE 1:50
TOP OF MOORING PILES



DETAIL OF TAPER ON DRIFT PIN OR PIPE
NOT TO SCALE

DRAWING AT HALF SCALE

E				J				
D				I				
C				H				
B	FOR FULL DECK REPLACEMENT	08/02/07	RDW	G				
A	FOR TENDER	06/05/31	RDW	F				
	REVISIONS	Y/M/D	BY		REVISIONS	Y/M/D	BY	

PLOT SCALE 1:100

NORTH ISLAND ENGINEERING LTD.
2005012
1833 ROBB AVENUE, COMOX, B.C.
TEL/FAX (250) 339-2243

APPROVED FOR USE IN CONSTRUCTION

DRAWN BY: RDW DESIGN BY: RDW
DATE: 8 NOV 2005 CHECKED BY: RDW
FILE No.: 2005012 SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT

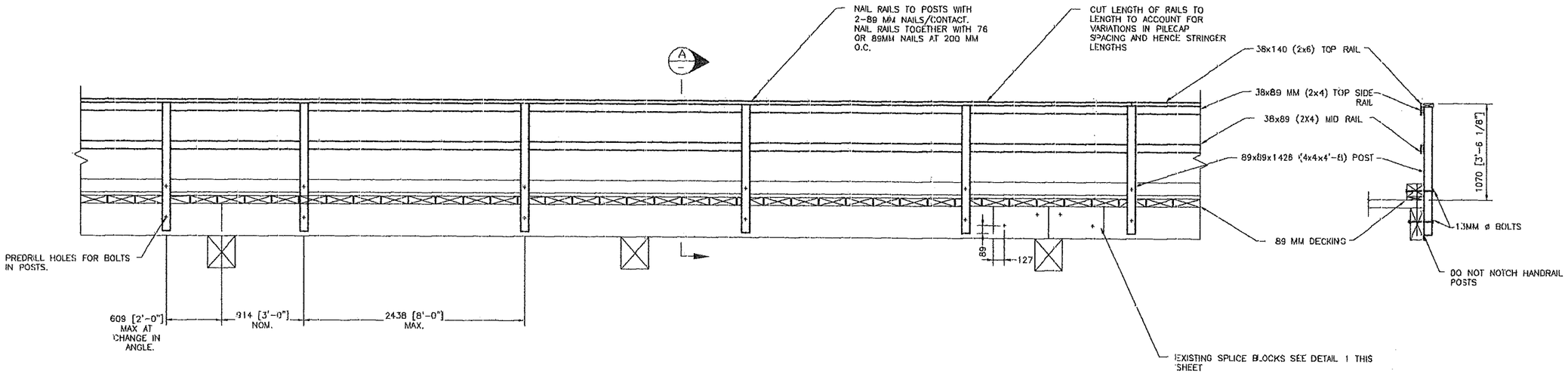
VAN ANDA TEXADA ISLAND

WHARF AND FLOAT REPAIRS

NOTES

DRAWING No. 2005012- 4 B
CANCEL PRINTS BEARING EARLIER REVISION

Ralph Watts, NIELS05/03/2008 10:4 AMVanAndaDeck-2005Mar31ver1.DWG

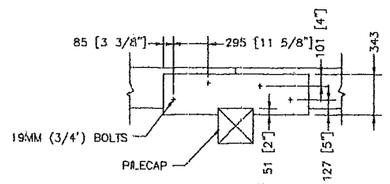


ELEVATION - HANDRAILS
SCALE: 1:25

NOTES:

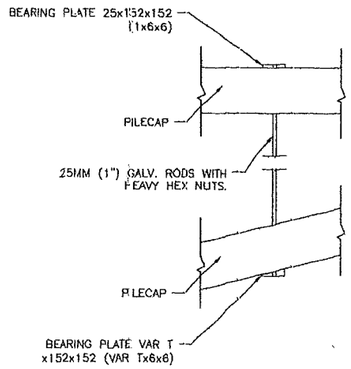
1. PILES NOT SHOWN
2. SLOPE ON APPROACH NOT SHOWN.

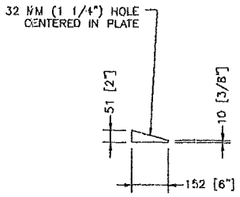
SECTION (A)
SCALE 1:25



DETAIL (1) EXISTING FISH PLATE
SCALE 1:25

NOTES: 1. BOLT SPACINGS APPROX. NOT SYM SIDE TO SIDE
2. NO. OF FISH PLATES VARIES AT JOINTS 0 TO 2





DETAIL SLOPED BEARING PLATE
SCALE 1:12.5

DETAIL (2/3) BEARING PLATE DETAILS FOR LONG RODS
SCALE 1:25

FOR GENERAL NOTES SEE DRAWING 4
DRAWINGS AT HALF SCALE

E				J			
D				I			
C				H			
B	FOR FULL DECK REPLACEMENT	08/02/07	RDW	G			
A	FOR TENDER	06/05/31	RDW	F			
REVISIONS		Y/M/D	BY	REVISIONS		Y/M/D	BY

PLOT SCALE 1:25

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2005012
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DRAWN BY: RDW DESIGN BY: RDW
DATE: 8 NOV 2005 CHECKED BY: RDW
FILE No.: 2005012 SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT

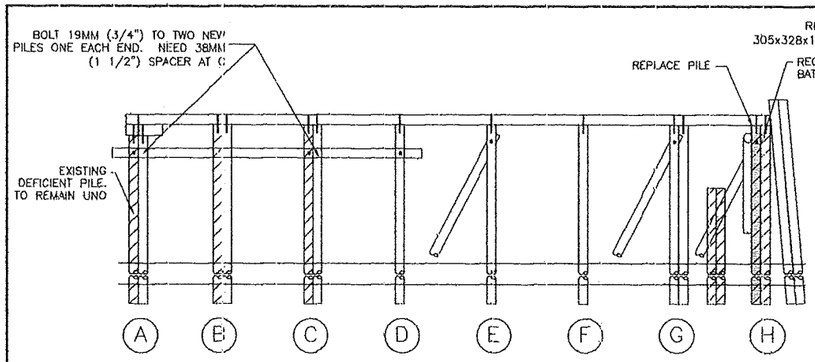
VAN ANDA TEXADA ISLAND

WHARF AND FLOAT REPAIRS

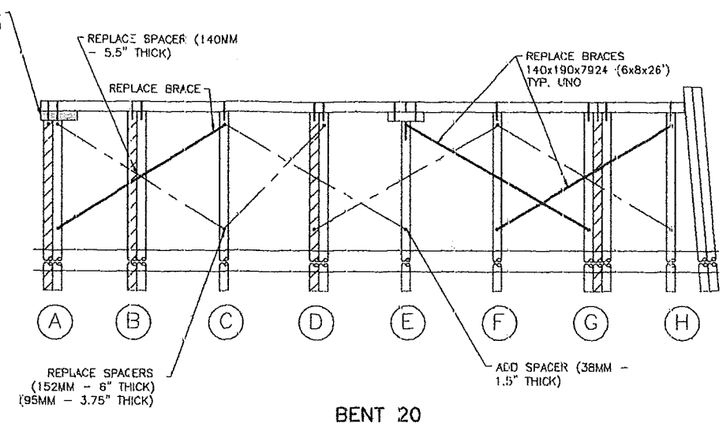
HANDRAILS

DRAWING No. 2005012- 5 B
CANCEL PRINTS BEARING EARLIER REVISION

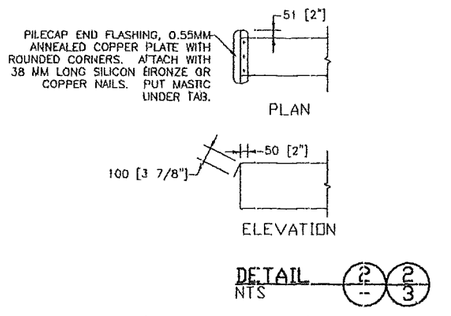
Ralph Watts, NIELS 5/03/2008 10:4 AM\arAndaHDeck-2008MarSVer1.DWG



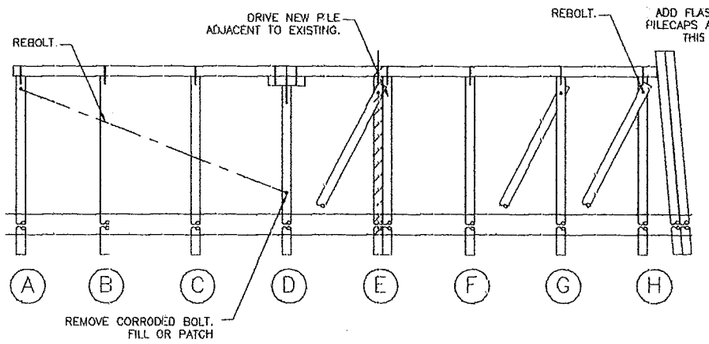
BENT 19



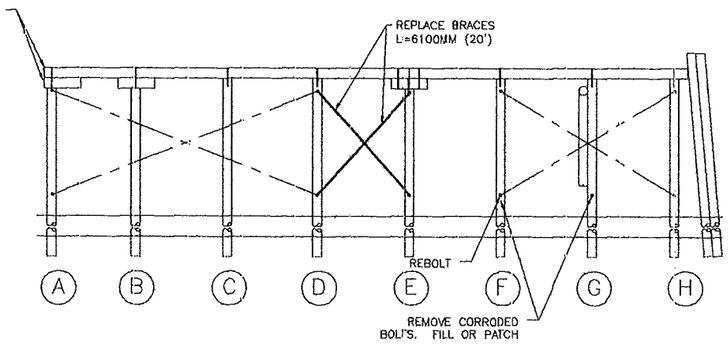
BENT 20



DETAIL OF PILECAP END FLASHING



BENT 21



BENT 22

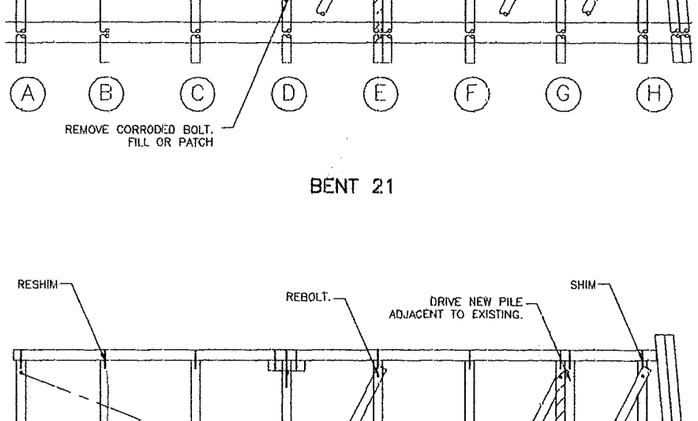
NOTES:

1. WHOLE DRAWING NEW
2. STRINGERS, DECKING ETC NOT SHOWN FOR CLARITY.
3. CONNECTION DETAILS SIMILAR TO APPROACH REF. DWG. 2

LEGEND:

DEFICIENT PILE

TO BE REPLACED



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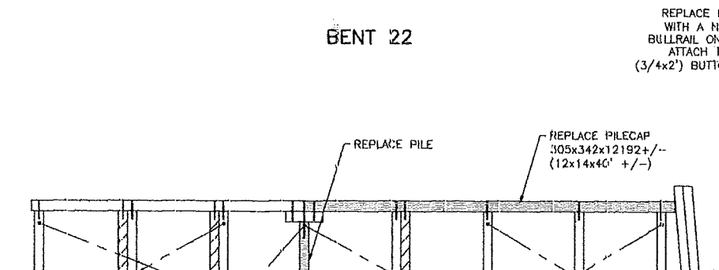
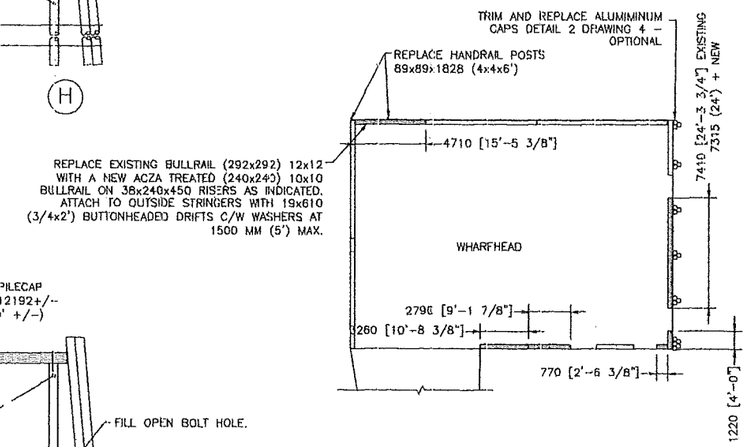


BENT 24



PLAN

SCALE: 1:200

FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

E				J			
D				I			
C				H			
B	FOR FULL DECK REPLACEMENT	08/02/07	ROW	G			
A	FOR TENDER	08/05/31	ROW	F			
REVISIONS		Y/M/D	BY	REVISIONS		Y/M/D	BY

PLOT SCALE 1:100

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2005012
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DATE 8 NOV 2005 CHECKED BY: RDW
FILE No. 2005012 SCALE 1:100 UNO

POWELL RIVER REGIONAL DISTRICT

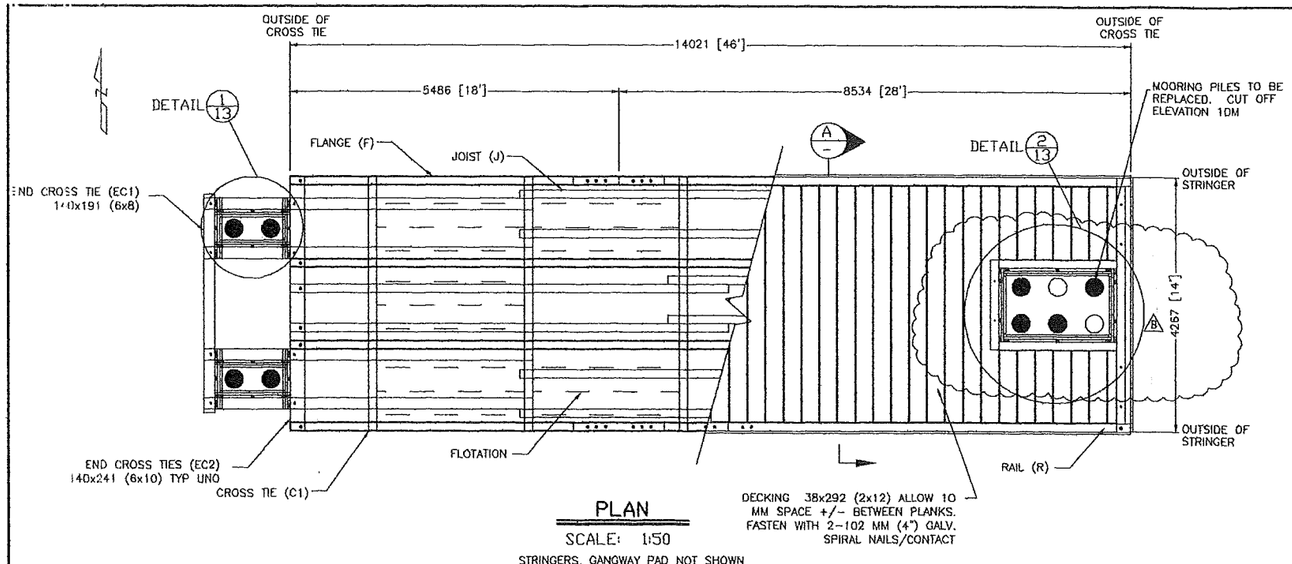
VAN ANDA TEXADA ISLAND

WHARF AND FLOAT REPAIRS

WHARFHEAD REPAIRS

DRAWING No. 2005012- 6 B
CANCEL PRINTS BEARING EARLIER REVISION

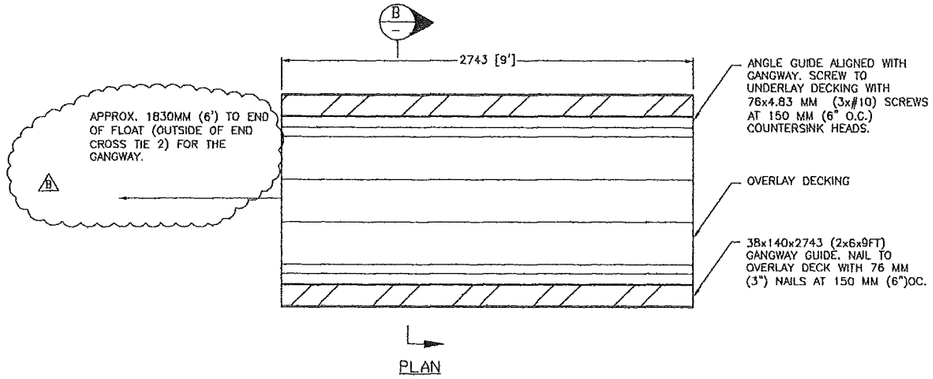
Ralph Watts, NIELDS/03/2008 10:4 AM\anVanDeck-2006Mar5Ver1.DWG



PLAN

SCALE: 1:50

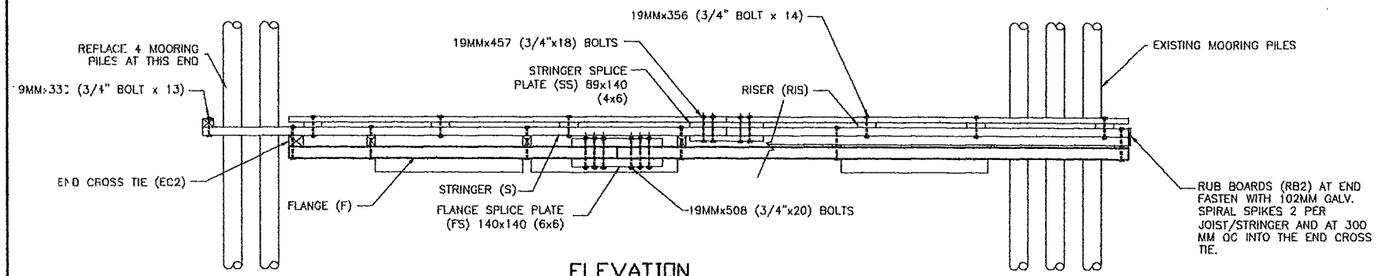
STRINGERS, GANGWAY PAD NOT SHOWN FOR CLARITY



PLAN

DETAIL GANGWAY PAD

SCALE 1:20

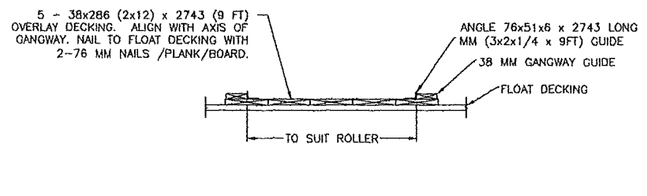


ELEVATION

SCALE: 1:50

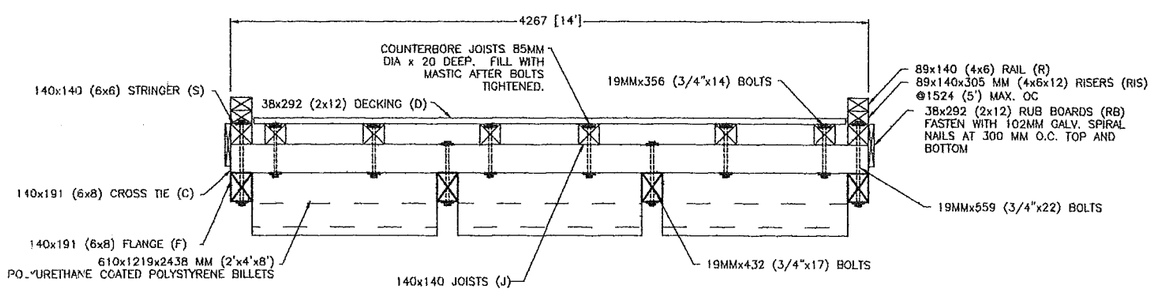
NOTES:

1. SIDE RUB BOARDS, DECKING AND PILE FENDERING SYSTEM NOT SHOWN FOR CLARITY



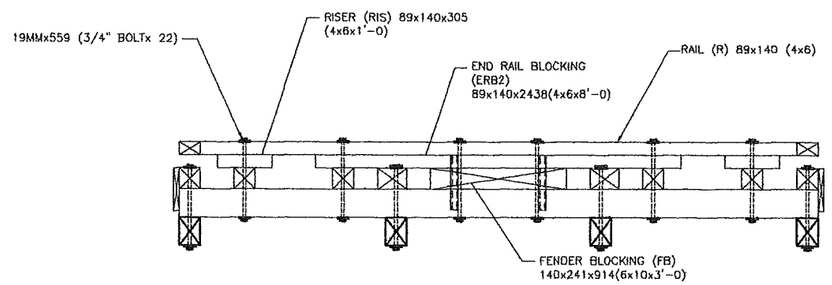
SECTION B

SCALE 1:20



SECTION A

SCALE 1:20



END SECTION

LOOKING WEST

SCALE 1:20

NOTES:

1. END RUB BOARDS, RUB PLANKS FOR FENDERING DECKING AND PILES NOT SHOWN FOR CLARITY

FOR GENERAL NOTES SEE DRAWING 4

DRAWING AT HALF SCALE

E				J			
D				I			
C				H			
B	ADDED 4 M. PILES EAST END	07/11/30	RDW	G			
A	FOR TENDER	06/05/31	RDW	F			
	REVISIONS	Y/M/D	BY	REVISIONS		Y/M/D	BY

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FILE No.: 2005012 | SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT

VAN ANDA TEXADA ISLAND

WHARF AND FLOAT REPAIRS

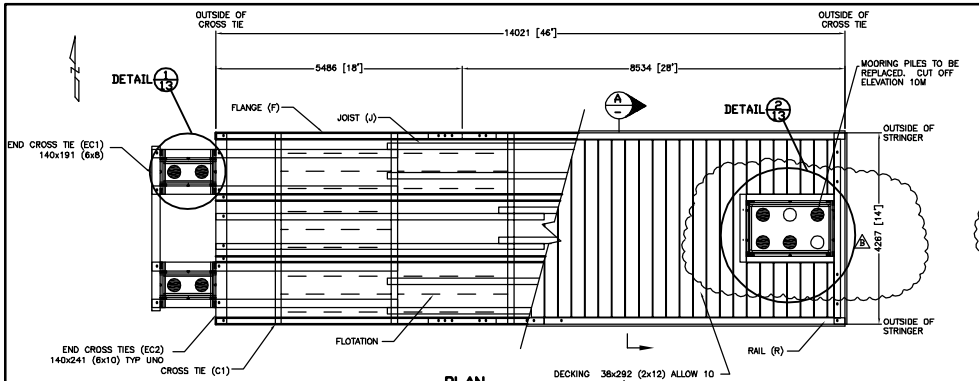
FLOAT - GA

DRAWING No. 2005012- 11 B

CANCEL PRINTS BEARING EARLIER REVISION

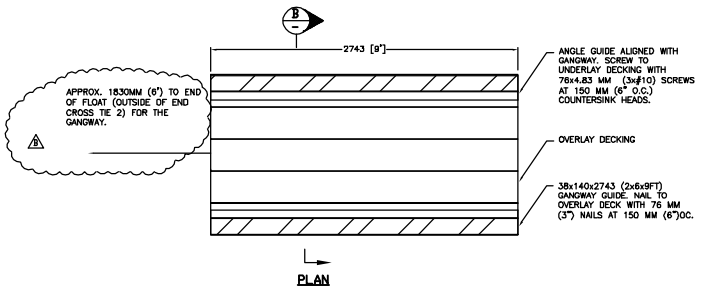
PLOT SCALE 1:50

Ralph Watts, NIELDS/03/2008 9:48 AM\VanAndaFloat-08MarSRevB-Ver1.dwg



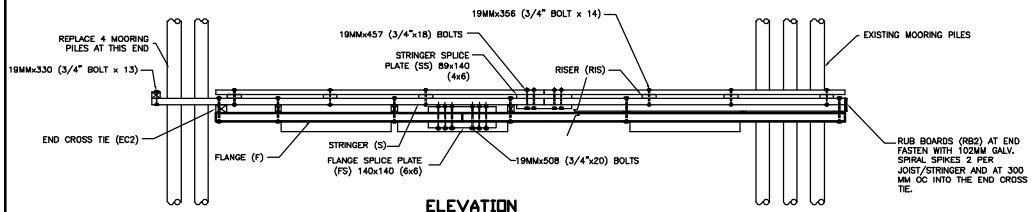
PLAN
SCALE: 1:50

STRINGERS, GANGWAY PAD NOT SHOWN FOR CLARITY



PLAN

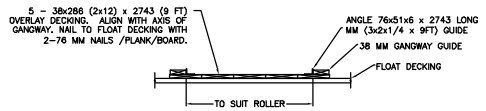
DETAIL GANGWAY PAD
SCALE 1:20



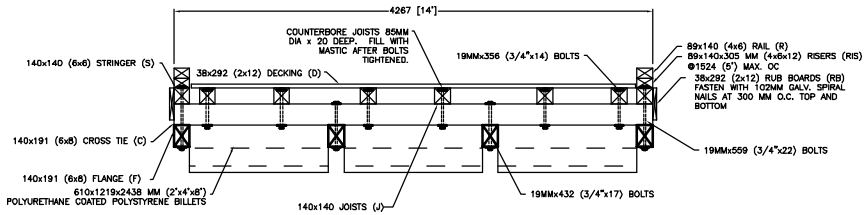
ELEVATION
SCALE: 1:50

NOTES:

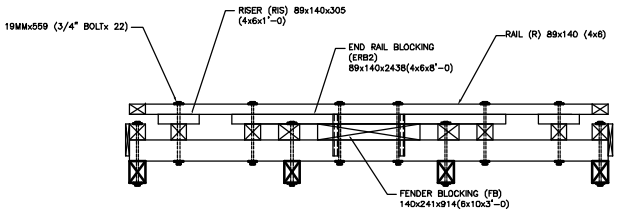
1. SIDE RUB BOARDS, DECKING AND PILE FENDERING SYSTEM NOT SHOWN FOR CLARITY



SECTION B
SCALE 1:20



SECTION A
SCALE 1:20



END SECTION LOOKING WEST
SCALE 1:20

NOTES:

1. END RUB BOARDS, RUB PLANKS FOR FENDERING DECKING AND PILES NOT SHOWN FOR CLARITY

FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

E				J			
D				I			
C				H			
B	ADDED 4 M. PILES EAST END	07/11/30	RDW	G			
A	FOR TENDER	06/05/31	RDW	F			
	REVISIONS	Y/M/D	BY		REVISIONS	Y/M/D	BY

PLOT SCALE 550

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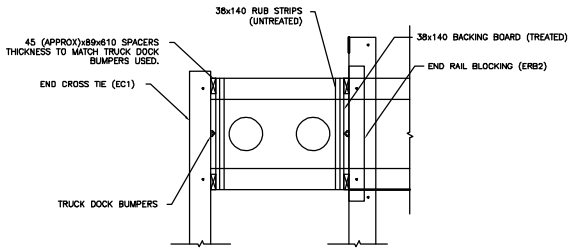
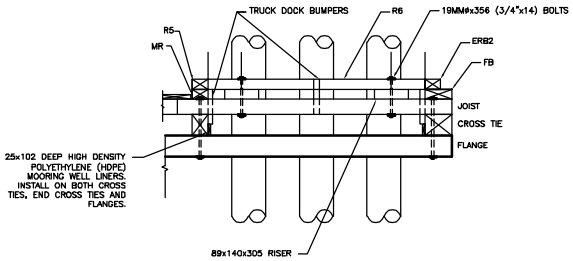
DATE: 8 NOV 2005 CHECKED BY: RDW
FILE No.: 2005012 SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT
VAN ANDA TEXADA ISLAND
WHARF AND FLOAT REPAIRS
FLOAT - GA
DRAWING No. 2005012- 11 B
CANCEL PRINTS BEARING EARLIER REVISION

Ralph Watts, NIELOS/03/2008 9:48 AMVanAndaFloat-08Mar5RevB-Ver1.dwg



PLAN AT ELEVATION OF THE BLOCKING



SIDE ELEVATION

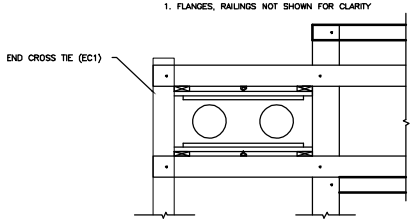
NOTES:

1. TRUCK DOCK BUMPERS M2 BY ACCURATE RUBBER OR APPROVED EQUAL (APPROX DEPTH 1 3/4" TO 2"). ATTACH WITH 2 – 6MM x75MM (1/4 x 3) LAG SCREWS. ENSURE HEADS WILL NOT GOUGE THE PILES
2. THICKNESS OF SPACERS TO MATCH TRUCK BUMPERS SUPPLIED. CONFIRM DEPTH OF BUMPER BEFORE ORDERING THICKNESS OF SPACERS. SPACERS TO BE PLANED PRIOR TO TREATMENT. OR HIGH DENSITY POLYETHYLENE MAY BE USED FOR THE SPACERS.
3. HDPE LINERS – CHAMFER EDGES ADJACENT TO PILES 10 MM. LOCATE LAG SCREWS BEYOND MOORING WELL. ATTACH WITH 6MMØx76 MM LAG SCREWS. ENSURE HEADS WILL NOT GOUGE THE PILES

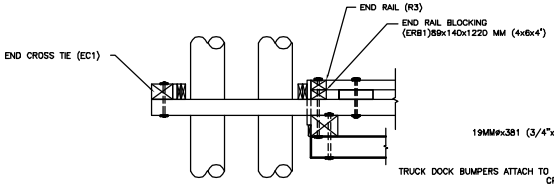
B

NOTES:

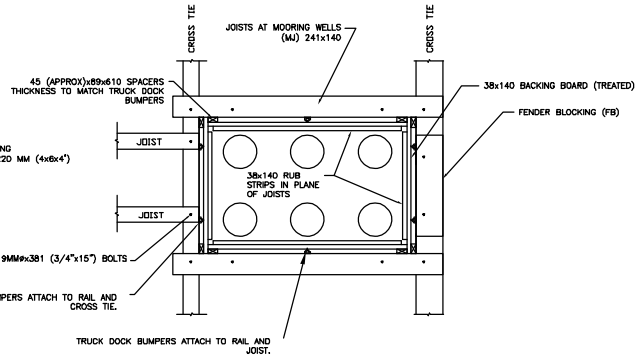
1. FLANGES, RAILINGS NOT SHOWN FOR CLARITY



PLAN AT ELEVATION OF THE JOISTS



ELEVATION



PLAN AT ELEVATION OF THE JOISTS

DETAILS AT WEST MOORING WELLS

SCALE 1:20

DETAIL 1/11
SCALE 1:10

DETAILS AT EAST MOORING WELL

DETAIL 2/11
SCALE 1:10

DECKING, RAILS, MOORING TIES, FLANGES AND STANDARD FENDERING NOT SHOWN FOR CLARITY

FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

REVISIONS				REVISIONS			
E				J			
D				I			
C				H			
B	ADDED 4 M. PILES EAST END	07/11/30	RDW	G			
A	FOR TENDER	06/05/31	RDW	F			

PLOT SCALE 1:1

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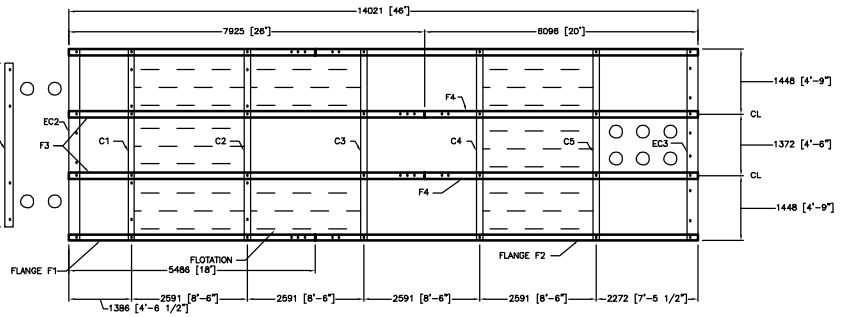
DATE: 8 NOV 2005 | CHECKED BY: RDW
FILE No.: 2005012 | SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT
VAN ANDA TEXADA ISLAND
WHARF AND FLOAT REPAIRS
FLOAT - DETAILS
DRAWING No. 2005012- 13 B
CANCEL PRINTS BEARING EARLIER REVISION

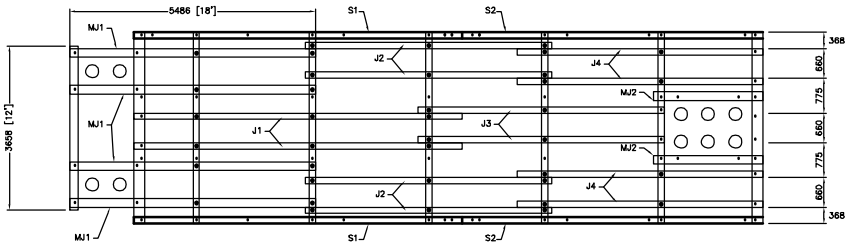
Ralph Watts, NIELDS/03/2008 9:48 AM/anAndaFloat-08Mar5RevB-Ver1.dwg



FRAMING PLAN - FLANGES, CROSS TIES AND FLOTATION

SCALE: 1:50

NOTES:
1. SPLICE PLATES NOT SHOWN FOR CLARITY

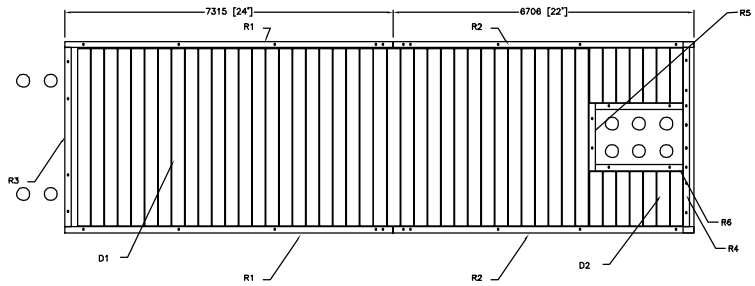


FRAMING LAYOUT - JOISTS, STRINGERS

SCALE: 1:50

NOTES:
1. SPLICE PLATES AND BLOCKING NOT SHOWN FOR CLARITY

DECKING (D1)
38x292x3962
(2x12x13'-0)



FRAMING LAYOUT - RAILS AND DECKING

SCALE: 1:50

NOTES:
1. SPLICE PLATES, BLOCKING AND RUB BOARDS NOT SHOWN FOR CLARITY

MEMBERS NOT SHOWN

1. FENDER BLOCKING AT EC2 AND EC3 (ERB1, ERB2, FB)
2. RAIL RISERS (RIS)
3. RUB STRIPS AND BACKING BOARDS
4. OVERLAY DECKING AND GANGWAY GUIDES

DECK PLANKS

REF.	SIZE	LENGTH	NO.
D1	38x292	3962 (13')	38
D2	38x292	1219 (4')	14

RUB BOARDS — ENDS - RB3; SIDES - RB1-RB2-RB2-RB2

REF.	SIZE	LENGTH	NO.
RB1	38x292	3048 (10')	2
RB2	38x292	3658 (12')	6
RB3	38x292	4267 (14')	1

FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

E			J		
D			I		
C			H		
B			G		
A	FOR TENDER	08/05/31 RDW	F		
REVISIONS		Y/M/D BY	REVISIONS		Y/M/D BY

PLOT SCALE 1:50

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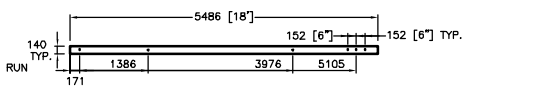
DRAWN BY: RDW DESIGN BY: RDW
DATE: 8 NOV 2005 CHECKED BY: RDW
FILE No.: 2005012 SCALE: AS NOTED

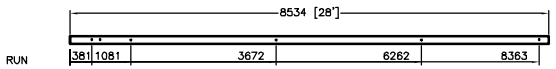
POWELL RIVER REGIONAL DISTRICT
VAN ANDA TEXADA ISLAND
WHARF AND FLOAT REPAIRS
FLOAT - FRAMING LAYOUT
DRAWING No. 2005012- 12 A
CANCEL PRINTS BEARING EARLIER REVISION

Ralph Watts, NIELDS/03/2008 9:48 AMVanAndaFloat-08Mar5RevB-Ver1.dwg

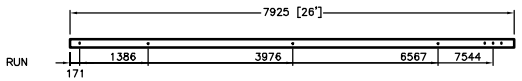
FLANGES (F) 140x191 (6x8)



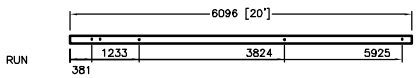
F1
(2 REQ)



F2
(2 REQ)

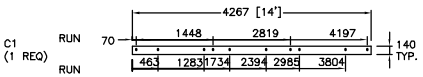


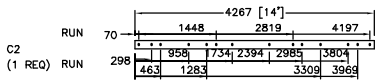
F3
(2 REQ)

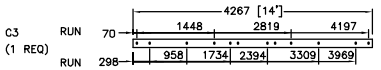


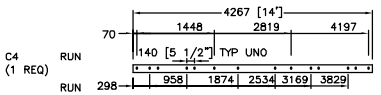
F4
(2 REQ)

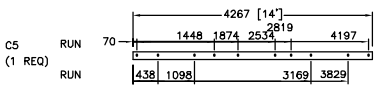
CROSS TIES (C) 140x191 (6x8)











NOTES:

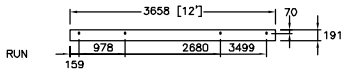
1. HOLES ON CENTERLINE UNO
2. FOR GENERAL NOTES SEE DRAWING 4

LEGEND:

- • HOLE 20.6 MM (13/16") DIA
- ● HOLE 20.6 MM AND COUNTERBORE 85MM ø x20MM DEEP (3 3/8ø x3/4")
- RUN RUNNING OR BASELINE DIMENSIONS

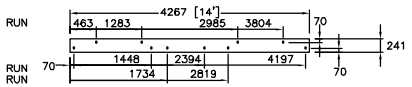
END CROSS TIES (EC) VARIOUS

EC1 140x191 (6x8)



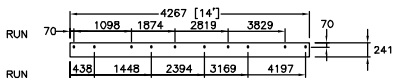
(1 REQ)

EC2 140x241 (6x10)



(1 REQ)

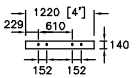
EC3 140x241 (6x10)



(1 REQ)

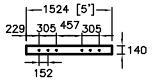
STRINGER SPLICES (SS) 89x140 (4x6)

SS
(4 REQ)



FLANGE SPLICES (FS) 140x140 (6x6)

FS
(8 REQ)



FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

REVISIONS				REVISIONS			
E				J			
D				I			
C				H			
B				G			
A	FOR TENDER	08/08/31	RDW	F			

PLOT SCALE 1:40

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DATE: 8 NOV 2005 | CHECKED BY: RDW
FILE No.: 2005012 | SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT

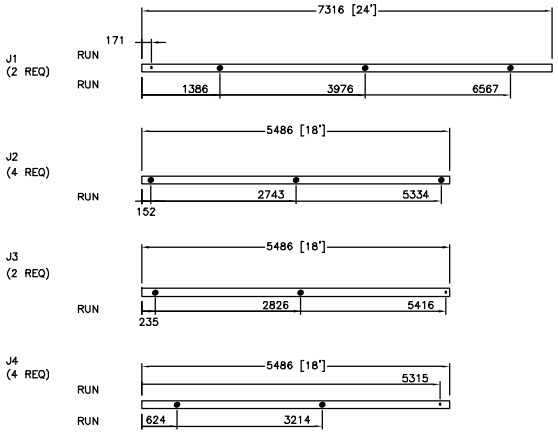
VAN ANDA
TEXADA ISLAND

WHARF AND FLOAT REPAIRS

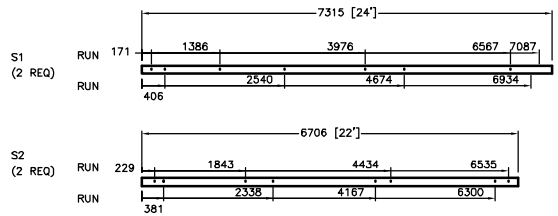
FLOAT - PARTS SHEET 1

DRAWING No. 2005012- 14 | A
CANCEL PRINTS BEARING EARLIER REVISION

JOISTS (J) 140x140 (6x6)



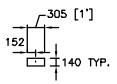
STRINGERS (S) 140x140 (6x6)



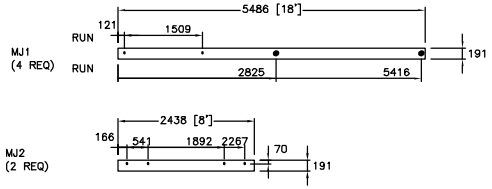
RISERS (RIS) 89x140 (4x6)

HOLES ON CENTERLINE UNO

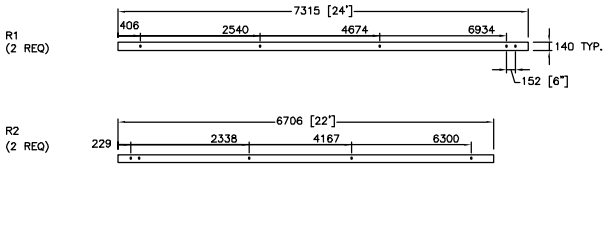
RIS1 (20 REQ) (INCL. 2 SPARES) HOLES 20.6 MM (13/16") DIA.



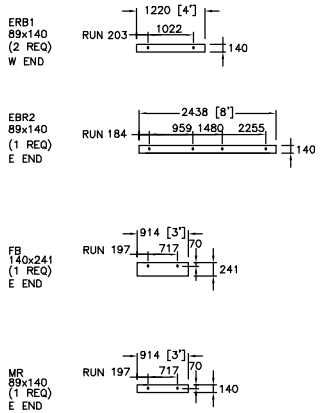
MOORING JOISTS (MJ) 140x191 (6x8) ON THE FLAT



RAILS (R) 89x140 (4x6)



MISC. BLOCKING



NOTES:

1. HOLES ON CENTERLINE UNO
2. FOR GENERAL NOTES SEE DRAWING 4
3. OVERLAY DECKING, GANGWAY GUIDES, RUB STRIPS, BACKING BOARDS FOR THE MOORING WELL LINERS NOT SHOWN.
4. FOR DECKING AND RUB BOARDS SEE DWG 12
5. FOR OVERLAY DECKING SEE DWG 11.

LEGEND:

- • HOLE 20.6 MM (13/16") DIA
- ● HOLE 20.6 MM AND COUNTERBORE 85MM ⌀x20MM DEEP (3 3/8⌀x3/4")
- RUN RUNNING OR BASELINE DIMENSIONS

FOR GENERAL NOTES SEE DRAWING 4
DRAWING AT HALF SCALE

E				J				NORTH ISLAND ENGINEERING LTD.	
D				I				2005012	
C				H				1833 ROBB AVENUE, COMOX, B.C.	
B				G				TEL/FAX (250) 339-2243	
A	FOR TENDER	08/05/31	RDW	F					
REVISIONS		Y/M/D	BY	REVISIONS		Y/M/D	BY		

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DATE: 8 NOV 2005 CHECKED BY: RDW
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POWELL RIVER REGIONAL DISTRICT

VAN ANDA
TEXADA ISLAND

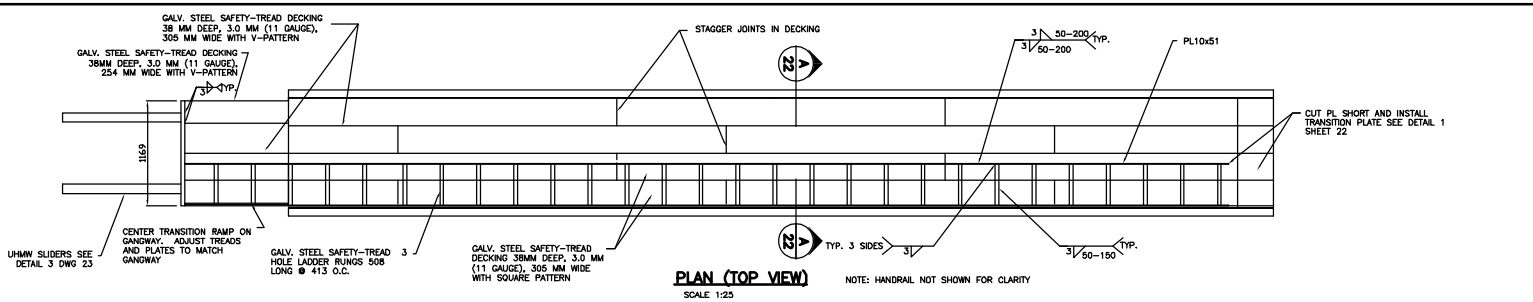
WHARF AND FLOAT REPAIRS

FLOAT - PARTS SHEET 2

DRAWING No. 2005012- 15 A
CANCEL PRINTS BEARING EARLIER REVISION

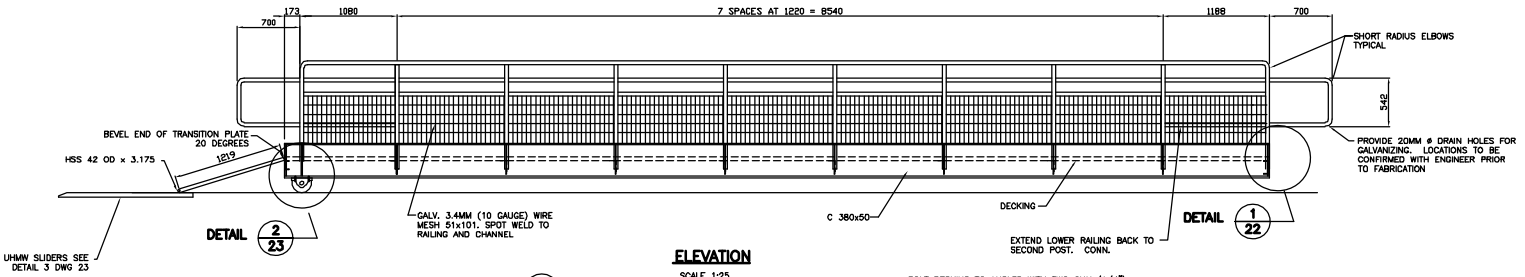
PLOT SCALE 1=1

Ralph Watts, NIEL05/03/2008 9:48 AM\VanAndaFloat-08Mar-5RevB-Ver1.dwg

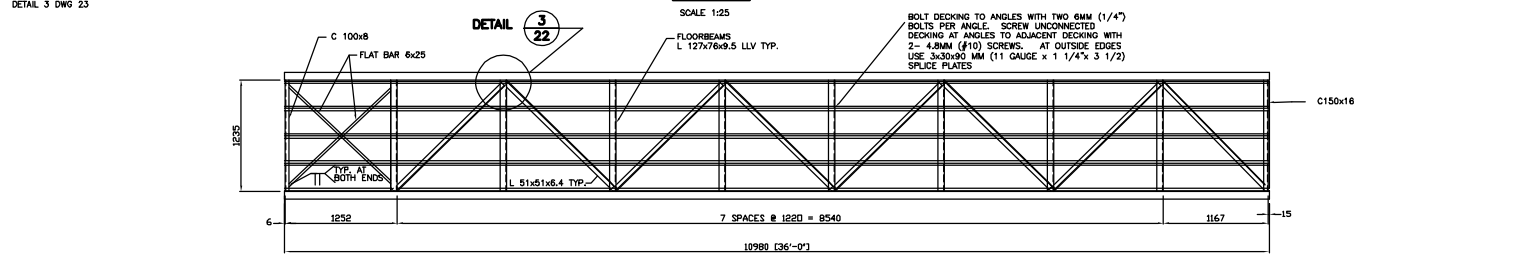


PLAN (TOP VIEW)
SCALE 1:25

NOTE: HANDRAIL NOT SHOWN FOR CLARITY



ELEVATION
SCALE 1:25



NOTE: TRANSITION RAMP NOT SHOWN FOR CLARITY

PLAN (BOTTOM VIEW)
SCALE 1:25

NOTE: HANDRAIL NOT SHOWN FOR CLARITY

FOR GENERAL NOTES FOR GANGWAY ONLY SEE DRAWING 23
DRAWING AT HALF SCALE

E				J			
D				I			
C				H			
B	FOR FULL DECK REPLACEMENT TENDER	08/02/28	RDW	G			
A	NOT USED		RDW	F			
	REVISIONS	Y/M/D	BY		REVISIONS	Y/M/D	BY

PLOT SCALE 1:20

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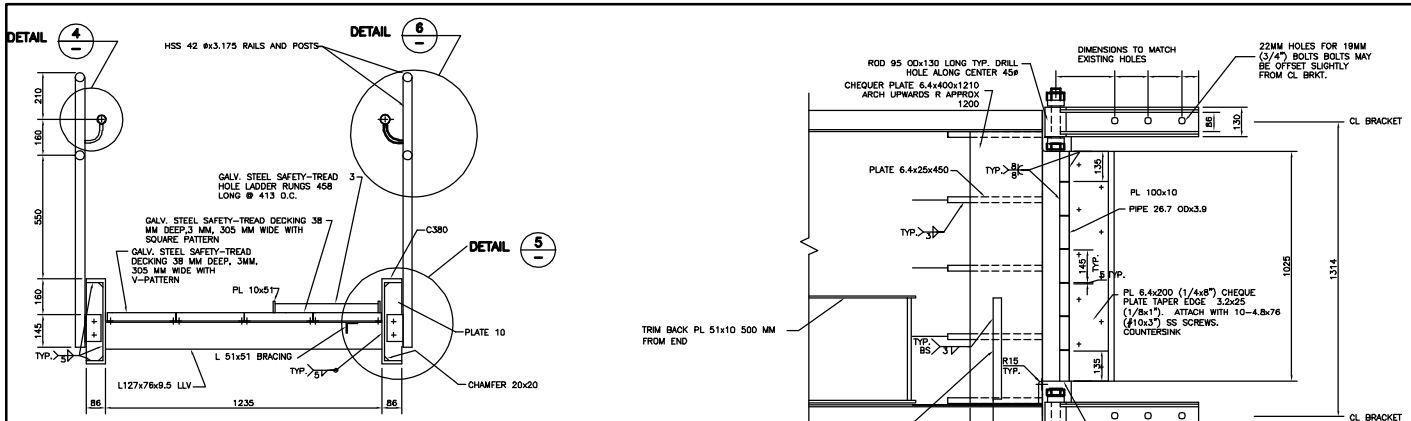
DATE: 20 FEB 2008 CHECKED BY: RDW
FILE No.: 2005012 SCALE: AS NOTED

POWELL RIVER REGIONAL DISTRICT
VAN ANDA TEXADA ISLAND
WHARF AND FLOAT REPAIRS
GANGWAY - GA
DRAWING No. 2005012- 21 B
CANCEL PRINTS BEARING EARLIER REVISION

Ralph Watts, NIELO5/03/2008 11:34 AMGangwaySteel36ft2008Mar5RevOVer1.dwg



FOR GENERAL NOTES FOR GANGWAY ONLY SEE DRAWING 23

PRELIMINARY NOT FOR CONSTRUCTION

E				J			
D				I			
C				H			
B	FOR FULL DECK REPLACEMENT TENDER	08/02/20	RDW	G			
A	NOT USED		RDW	F			
	REVISIONS	Y/M/D	BY		REVISIONS	Y/M/D	BY

PLOT SCALE 1:20

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POWELL RIVER REGIONAL DISTRICT

VAN ANDA
TEXADA ISLAND

WHARF AND FLOAT REPAIRS

GANGWAY- DETAILS

DRAWING No. 2005012- 22 B
CANCEL PRINTS BEARING EARLIER REVISION

Ralph Watts, NIELDS/03/2008 11:34 AMGangwaySteel36ft2008Mar5RevOVer1.dwg

GENERAL NOTES AND DESIGN CRITERIA - GANGWAY ONLY

THIS STRUCTURE HAS BEEN DESIGNED IN GENERAL ACCORDANCE WITH THE FOLLOWING CODES AND STANDARDS:

- NBC BUILDING CODE 1995, PART 4.
- WCB OCCUPATIONAL HEALTH AND SAFETY REGULATION, 296/97, AMENDED 185/99
- CSA STANDARD, S16.1 LIMIT STATES DESIGN OF STEEL STRUCTURES, 1994
- CSA STANDARD, S136 COLD FORMED STEEL STRUCTURAL MEMBERS, 1994

DESIGN LOADS (SERVICE)

DEADLOAD	2.0 KPA
LIVELOAD	4.8 KPA
TWIST AT BASE	10 DEGREES
LATERAL DEFLECTION AT ROLLER	150 MM
TIDAL RANGE	5.5 M

IMMEDIATELY INFORM THE ENGINEER OF ALL DISCREPANCIES AND PROBLEMS ENCOUNTERED.

STEEL

MATERIALS TO CONFORM TO THE FOLLOWING:

ROLLED SECTIONS	GRADE 300W, CSA STANDARDS G40.20/G40.21
PLATE	GRADE 300W, CSA STANDARDS G40.20/G40.21
HSS	GRADE 350W, CSA STANDARDS G40.20/G40.21 OR ASTM A500
AXLE	AISI, C1045 PRECISION SHAFTING

ALL STEELS EXCEPT THE AXLE TO BE SUITABLE FOR GALVANIZING WITH
A CARBON CONTENT LESS THAN 0.25%
A PHOSPHORUS CONTENT LESS THAN 0.04%
A SILICON CONTENT EITHER LESS THAN 0.03% OR BETWEEN 0.15 AND 0.25% AND
AND A MANGANESE CONTENT BELOW 1.35%.

OBTAIN AND PROVIDE THE ENGINEER WITH COPIES OF ALL MILL CERTIFICATES.

BOLTS TO CONFORM TO ASTM A307, GALV.

SCREWS AND OTHER FASTENERS TO BE GALVANIZED, OR 304 OR 316 STAINLESS STEEL

WELDING ELECTRODES TO BE E48018 (E7018).

STEEL TO BE HOT-DIP GALVANIZED TO CSA STANDARD G164-M92, WITH THE SPELTER COAT OF AT LEAST 0.61 KG ZINC PER SQUARE METER. LOCATION OF SPLICES IN HANDRAILS, IF ANY, TO BE APPROVED BY THE ENGINEER PRIOR TO FABRICATION

BOLTS FOR STEEL CONNECTIONS TO BE SIZED TO EXCLUDE THE THREADS FROM THE SHEAR PLANE AND RESULT IN AT LEAST 1.5 TURNS PROTRUDING FROM THE NUT.

FAYING SURFACES OF BOLTED CONNECTIONS TO BE CLEAN AND FREE OF BURRS, WELD SPLATTER OR OTHER MATERIAL THAT WOULD INTERFERE WITH SOLID BEARING AND/OR FRICTION. ROUGHEN SURFACE BY HAND WIRE-BRUSHING.

BOLTS TO BE SNUG TIGHT. ON STEEL CONNECTIONS USE LOCKNUTS. ON STEEL-WOOD CONNECTIONS TIGHTEN FROM THE NUT END ONLY.

WELDING TO BE IN ACCORDANCE WITH CSA W59, INCLUDING CLAUSE 12. WELDERS TO BE QUALIFIED BY THE CANADIAN WELDING BUREAU.

FILLET WELDS, UNLESS NOTED, TO BE 5 MM (3/16) WELDS.

FILLET WELDS LESS THAN OR EQUAL TO 8 MM (5/16) TO BE DONE IN A SINGLE PASS.

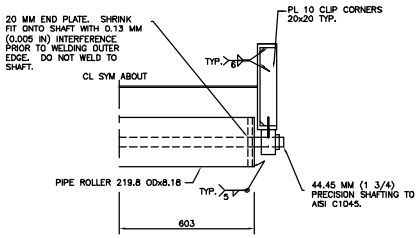
STEEL TO BE HANDLED CAREFULLY TO AVOID DAMAGING THE COATING. COATING TO BE TOUCHED UP WHERE DAMAGED WITH ZINGA OR APPROVED EQUAL TO ASTM A780.

BEARINGS

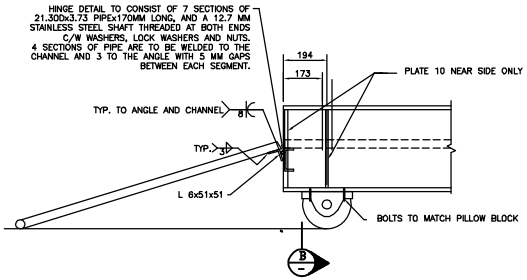
BEARINGS TO BE RHP NP SELF LUBE BEARING IN A CAST STEEL PILLOW BLOCK OR APPROVED EQUAL. BEARING TO HAVE A 90° GREASE NIPPLE INSTALLED WITH THE NIPPLE POINTING OUTWARDS FOR EASY LUBRICATION.

BEARINGS TO BE HANDLED AS FRAGILE ITEMS.

BEARINGS TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. HOUSING TO BE COMPLETELY FILLED WITH A LITHIUM BASED EP 2 GREASE.

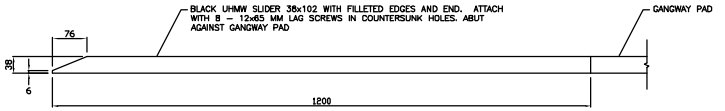


SECTION B/- SCALE 1:10



ELEVATION

DETAIL 2/21 SCALE 1:10



DETAIL 3/21 SCALE 1:10

DRAWING AT HALF SCALE

PLOT SCALE 1:20

E				J				
D				I				
C				H				
B	FOR FULL DECK REPLACEMENT TENDER	08/02/28	RDW	G				
A	NOT USED		RDW	F				
REVISIONS		Y/M/D	BY	REVISIONS		Y/M/D	BY	

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POWELL RIVER REGIONAL DISTRICT

VAN ANDA TEXADA ISLAND

WHARF AND FLOAT REPAIRS

GANGWAY - NOTES

DRAWING No. 2005012- 23 B
CANCEL PRINTS BEARING EARLIER REVISION

Ralph Watts, NIELO5/03/2008 11:34 AMGangwaySteel36ft2008Mar5RevOVer1.dwg

Powell River Regional District
VAN ANDA WHARF AND FLOAT INSPECTION

1st Edition
16 May 2012

North Island Engineering Ltd.
1833 Robb Avenue
Comox, B.C.
V9M 2C9

Phone (250) 339-2243

Prepared by Ralph Watts, P.Eng.

Project No. 2012009

TABLE OF CONTENTS

THIRD PARTY DISCLAIMER

1.0 INTRODUCTION

Facility: Van Anda Wharf and Float

Inspected by: North Island Engineering Ltd. (Ralph Watts) **Date:** 6 May 2012

Purpose of Inspection

The purpose of the inspection was to assess the condition of the approach, wharfhead and float at Van Anda

Scope of Work

The inspection of the approach, wharfhead and floats was by the method outlined in "Procedures for Inspection and Assessment of Fixed Timber Docks, 4th Edition," by RG Sexsmith Ltd. The inspection focussed on known issues and significant deficiencies only.

Reference Materials

The following reference materials were available prior to the inspection:

- Transfer Plan
- North Island Engineering's Inspection Report, 12 August 1996, by R. Watts
- North Island Engineering's Inspection Report, 15 July 2005, by R. Watts
- Drawings Repairs, 2007
- Site reports by North Island Engineering and Others, 2009

Use of Facility:

While we only observed one person down on the wharfhead for a walk, Bruce Mortson mentioned the facility saw a fair bit of use during the winter when the ferry was having mechanical problems and water taxis were using the float.

He also mentioned that tugs still tie up to the cleats periodically.

2.0 ISSUES

There are a number of key issues:

- Roughness of timbers.
- Corrosion of connectors
- Rot in pile caps
- Gangway - hinges
- Gangway - roller
- Mooring piles - excessive wear
- Mooring piles - loose connections
- Wharf - other issues
- Float - other issues

2.1 Roughness of timbers

This is the problem primarily with the handrails as they are usually the only ones most people touch. Looking at them closely, the problem seems to stem from the incisor which was likely dull, which has left the chips from the incisor marks embedded in the marks themselves and protruding.

2.2 Corrosion of Connectors

Numerous fasteners are getting badly corroded (Photographs 1 and 2) and in some cases members have fallen off as a result of this corrosion . While the loss of some members either due to corroded fasteners or borer damage on most pedestrian facilities is not critical, the bracing and wales play an important role in stabilizing the whole structure. Unlike many wharves, where the piles penetrate into the sediments and provide a good measure of stability for lightly loaded structures such as these, there may be substantial areas of the wharfhead and approach where this penetration is minimal. An example of this was noted on this inspection, where the corbel and two piles at 19A have displaced laterally (Photograph 3). For some reason, the cap had never been properly drifted to the corbel and when the nails rusted out the corbel was displaced laterally.

Another member that has come "free" is one end of the "clamp" that ties the approach to the wharfhead. It has come loose from the piles on bent 20 and is sitting on top of a brace (Photograph 4).

2.3 Rot in pile caps

This is a long standing issue. Some of the borate rods were checked (many are no longer easily accessible being right at the end of the caps), with some still intact, others dissolved and in one case (Bent 16) water poured out one hole when the plug was removed. The worst cap is Bent 9 which has been previously identified.

2.4 Gangway - hinges/transfer plate

The hinges are very difficult to inspect properly (Photographs 5 and 6) which is a common problem with many hinges. However, from our prior inspection during fabrication in 2009, the lower connection has a steel sleeve (Photograph 7) and it is likely there is a steel sleeve in the upper connection as well.

Also the transfer plate (Photographs 5 and 6) has fallen down into the gap.

2.5 Gangway - roller

The gangway roller is severely damaged: one bearing is gone, the shaft bent, the end plates damaged and the roller itself worn through (Photographs 8 and 9) .

2.6 Mooring piles - excessive wear

The piles have received excessive wear in part due to strong wave action but also due to the poor placement of nails in the mooring well liners. The nails should be kept out of areas that might rub against the piles so the liner can wear. Instead, in most of the liners, there is a nail or nails that rub against the piles (Photograph 10) so these nails have gouged the piles in a number of locations (Photograph 11).

In some locations, the liners have been pulled off and the rubber bumpers damaged (Photograph 12).

2.7 Mooring piles - loose connections

Four bolts between the mooring piles and the blocking have worked loose with the worse one sticking out about 18" to 2' (450 - 600 mm) (Photograph 13).

2.8 Wharf - Other Issues

There is rot in the bull rail in the SW corner (Photograph 14).

There is no life saving equipment on the wharfhead.

2.9 Float - Other Issues

One of the timbers for the mooring wells has a check but it has not been wrapped (Photograph 15).

There is no ladder on the float.

3.0 OPTIONS and RECOMMENDATIONS

The options and recommendations are based on the assumption that the facility will see continued use, even if only spasmodically, and must be maintained in a safe condition. Some of the recommendations are preventative maintenance to keep the existing capacity or slow the deterioration.

3.1 Roughness of timbers

There are five basic approaches to dealing with this problem:

1. Bury the defects in a dense coat of paint.
2. Remove the chips by sanding.
3. Replace the top rail.
4. Wrap the top rail with something like torch on roofing.
5. Do nothing.

It is hard (close to impossible) to get a durable coating on weathered wood. So the preparation would require sanding or the coating is likely to fail quickly. Sanding is problematic as the wood is treated and would generate a toxic dust. The third and fourth options are likely fairly expensive. While wrapping them might increase the life of the wood, it would important to get the right material and it would likely be very expensive as it is labour intense. With the last option, the problem will continue as these chips will not likely degrade quickly.

Recommendation: Either live with the problem or replace the top rails.

3.2 Corrosion of Connectors

This is a tough one to figure out. The primary goal here is to maintain the stability of the structure. This is more a problem on the approach than the wharfhead. On the wharfhead, there are both bracing and batter piles. All the bracing and most of the batter piles run NS, with only a couple of batter piles (both at the north end) going EW. (The gangway is EW). Most of the batter piles in the EW direction were on the section that was removed. This arrangement while far from ideal has worked for a number of years in part because the loads are so light.

If the opportunity presents itself, it would be good to add a batter pile at the south end of the wharfhead. Other than letting borers into the piles, most of the NS bracing on the wharfhead is likely no longer needed.

The approach is quite different. Normally, approaches derive their stability from bracing transversely and from the abutment (and short piles at that end) and the wharfhead longitudinally. Where pile penetration is difficult, such as on rock shelves, it is common practice to use a concrete footing. This was only done on one pile. The stability of the system is provided by a combination of bracing, the deck structure, the wales and likely some piles that penetrate into the ground.

This wharf has an odd clamping arrangement between the wharfhead and the approach. Its function is not entirely clear, although it dates back to at least 1948. We are not quite sure why it is there, however, we are reluctant to delete it as it may contribute to the overall stability of the system.

Recommendations:

1. Reposition the wharf end of the "clamp" and bolt back onto the piles.
2. Add an EW batter pile towards the south end of the wharfhead if possible. This might only be half way down as it would depend heavily on soil conditions. To be effective, they need about 10' of penetration.
3. Replace corroded bolts particularly in the lower end of the brace connections and in the wales. The reasons for this are three fold: (a) protect the piles from marine borers, (b) provides some of that necessary stability and (c) secures a potential "battering ram".
4. Remove the broken wale.

3.3 Rot in pilecaps

The borate rods are likely helping to limit the spread of the rot along the timbers; however, many of them are at the ends of the caps and not all that accessible. However, the water coming out of the cap on Bayline 16 clearly indicates water is still making into that cap and likely some others.

Recommendations:

1. Place roofing or flashing over the damaged area of the pilecap at Bent 9 to deflect the bulk of moisture away from the damaged area. The damage area should also be stabilized with a thin epoxy resin.
2. Maintain borate rods on the approach side of the stringer at Pilecap 9
3. Find and seal the leak into Pilecap 16.
4. Maintain the borate rods in areas where they are being dissolved quickly, but also look to seal any cracks from the top or cover with roofing material.

3.4 Gangway - hinges/transfer plate

The options for the hinges are to (1) keep the existing arrangement, monitor the bolts, and install a safety line in case the bolts fail or (2) revise the connection detail. The connection detail suggested by Bruce Mortson sounds much better than the current arrangement and should have been used from day one. However, while it would be reasonably easy to modify the connection to the wharfhead, it would be significantly more difficult to modify on the gangway side and field modifications are always expensive.

Monitoring the pins should be achievable with a little effort. The ramp is light (a rough guess is less than 1500 lbs) so it should be able to be either lifted either from the cross

beam on the mooring piles (after the bolts are secured) with a come-a-long or by a lifting rig on the wharfhead.

For the transfer plate, it could either be modified or replaced with conveyor belting.

Recommendations:

1. Place a safety line on the end of the gangway and regularly inspect and/or replace the bolts. Lubricate the connection at the inspection times.
2. Replace the transfer plate with conveyor belting. To extend the life of the belting an aluminum plate should be attached to the grating to cut down on the wear from the diamond grip decking.
3. Based on some photographs we have from the shop and a discussion with the fabricator, we believe the connection has sleeves, so it is likely just best to leave the connection as is and monitor the wear on the pins and sleeves.

3.5 Gangway - roller

The gangway roller could either be replaced with another roller or a pair of sliders. Rollers, if functioning properly, have much less friction than a roller so there is less wear on the mooring piles and smaller horizontal forces on the hinge bracket. However, sliders are much simpler and require very little maintenance (just clearing the guides of debris periodically). Once a roller fails as has happened here the frictional forces become much larger than they would be with a slider.

From a discussion with the fabricator, the bolts are likely threaded into tapped holes in the aluminum.

Recommendation:

As the gangway is light, a slider is likely a better choice here. While they increase the wear on the mooring piles, these have already received substantial wear. A simple half pipe slider similar to Photograph 16 should be adequate.

3.6 Mooring piles - excessive wear

Much of the excessive wear on the mooring piles is due to the presence of nails in the wear areas on the mooring pile lines.

For some of the piles the wear has already extended into the untreated zone of the pile. As these are now susceptible to borer attack adding a thin HDPE liner would likely not help much as it would protect the marine borers to some extent.

Recommendations:

1. Replace piles when worn.
2. Add thin HDPE liner on piles that do not show excessive wear once nails are removed. The number of these will depend on how long it takes to remove the nails, get the materials and the number of storms in between.

3.7 Mooring piles - loose connections

A number of the bolts between the blocking and the mooring piles have common loose (or were never tightened) and have started to come out of the piles. In the worst case, one bolt has come out about 2 feet (0.6 m).

Recommendation:

1. Drive bolts back into position and re-tighten. Add a second nut to the bolts. The known bolts are three on the NW end of the float and one in the main group of mooring piles (NW pile).

3.8 Wharf - other issues

The bullrail should be replaced soon. It does not need to be the size it is for safety reasons, but you may want it that size to maintain the look.

WorkSafeBC Rules requires ladders and life saving equipment on wharves if workers on going to be on the wharf. Historically the federal government ignored the latter requirement. With open public facilities, it is problematic to comply with these rules as the equipment is either stolen or vandalized.

While the ladders should be there all the time, the life saving equipment could be brought down when people are going to work on the facility and removed when they are finished.

Recommendations:

1. Replace the bull rail.
2. Consider a throwing line on the wharfhead, but this would only make sense if you think it will not be tampered with or stolen.

3.9 Float - other issues

On some of the other ends, the timbers were wrapped in fiberglass to contain the growth of the check. This would be difficult here as it over the water and would require disassembly of the mooring system to install the fiberglass.

WorkSafeBC Rules require ladders on docks. A float is not a dock in the conventional meaning of the word nor does WorkSafe define the term; however, they have recently fined Kitimat for not have ladders and lifesaving equipment on their floats. They also require the ladders to be kept clear of marine growth which for here would be impractical given the minimal usage.

Recommendations:

1. Add a clamp to the end of the timber. This would need to be custom made to slide under the cross member and then be tightened by a bolt underneath.
2. Add a galvanized ladder to the float, it should extend into the water 1 m and the best location would likely be near the gangway on the approach side. Paint the railing yellow or add a yellow strip. While it is likely never to see use, climbing out onto a float can be difficult.

APPENDIX A

PHOTOGRAPHS