Transportation

Small Craft Harbours,
Department of Fisheries and Oceans

Port Dalhousie, ON – East and West Piers Condition and Structural Evaluation Report

Prepared by:

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Project Number:

60334134

Date:

March, 2015

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March 5, 2014

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Dear Mr. MacDiarmid:

Project No: **60334134**

Regarding: Port Dalhousie, ON – East and West Piers
Condition and Structural Evaluation Report

AECOM is pleased to submit one (1) electronic copy of the Draft Condition and Structural Evaluation Report for the East and West Piers at Port Dalhousie, ON.

The study was conducted in general conformance with the Project Brief for Port Dalhousie, ON – East and West Piers Engineering Inspection and Option Analysis, and our Project Proposal dated October 2014.

We express our appreciation to SCH staff for providing valuable input and assistance throughout the course of the study. We are available to elaborate on any aspect of the report, and to assist in the implementation of the recommendations, at your request.

Sincerely,
AECOM Canada Ltd.

M.G. Shallhorn, P.Eng.
Project Manager

MS:jw
cc:

Distribution List

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	1	Small Craft Harbours, Department of Fisheries and Oceans

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	JW	April 1, 2015	Table 1 Revised

AECOM Signatures

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Executive Summary

AECOM has been retained by Small Craft Harbours (SCH), within the Canadian Department of Fisheries and Oceans, to review and asses the condition of two marine piers located on Lake Ontario at the entrance to Port Dalhousie Harbour. The piers are approximately 145 years old and are of historic and cultural significance. The piers protect the harbour entrance and the adjacent municipal marina, and are a popular summertime waterfront recreational area for the residents of St. Catharines.

AECOM's assessment of the piers found that while the concrete decks are generally in fair to good condition, the concrete coping blocks are generally in fair to poor condition and the timber cribs are in poor condition.

The individual timbers within the cribs have deteriorated around the connections. As a result, the front header timbers are coming free of the cross-tie-timbers and collapsing. This allows the rock fill to spill out, reducing the overall stability of the piers. The resulting loss of support for the coping blocks and the deck also creates potential for settlement and misalignment of those components.

If the rock fill is not encased and stabilized, in time the combined forces of gravity, waves, ice, and wind will eventually cause the collapse of sections of the piers' superstructures.

Without rehabilitation, the life expectancy of both piers is less than five years.

Until the appropriate repairs are completed, it is recommended that consideration be given to restricting use of the piers. The areas of each pier for which restrictions are recommended are summarized in the following table.

Location	Vehicular Load Restriction	Boat Mooring Restriction	Pedestrian Load Restriction
1. East Pier			
Station 0+000 to Station 0+075	✓	✓	
Station 0+150 to Station 0+225	✓	✓	
Station 0+225 to Station 0+275	✓	✓	✓
Station 0+275 to Station 0+325	✓	✓	
Station 0+375 to Station 0+490	✓	✓	
Station 0+515 to Station 0+575	✓	✓	✓
2. West Pier			
Station 0+000 to Station 0+300	✓	✓	
Station 0+300 to Station 0+350	✓	✓	✓
Station 0+350 to Station 0+450	✓	✓	
Station 0+450 to Station 0+525	✓	✓	✓
Station 0+525 to Station 0+550	✓	✓	

Alternative methods of repair will be developed and evaluated, and the preferred alternatives identified in the next phase of the study. The results will be documented in the Options Analysis Report.

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1. Introduction

Port Dalhousie is a small community located on the southwest shore of Lake Ontario, west of the Welland Canal and the Niagara River. It is part of the City of St. Catharines. Primarily a recreational area, there is a marina and harbour at the center of the community that is busy with small boats and pleasure craft in the summer. The key feature of the waterfront is two piers that project northward from Twelve Mile Creek and into the lake. These piers once formed the northern terminus of the Welland Canal. In addition to being a popular waterfront recreational area, the piers protect the marina and the entrance to the harbour. The location and general layout of the site is illustrated in Figure 1.

Small Craft Harbours (SCH), within the Canadian Department of Fisheries and Oceans, has retained AECOM to undertake a condition assessment of the existing piers on both sides of the harbour entrance. The condition assessment consists of a general inspection of the piers, above and below water, a geotechnical investigation of the site, determination of condition ratings and residual life for the various components of the pier, and recommendations for use restrictions and required repairs to the piers.

To complete the general inspection, AECOM undertook a detailed visual inspection of the piers, both above and below water, completed a detailed topographic survey and depth soundings of the piers and adjacent areas, and performed a delamination survey of the concrete deck surfaces. The underwater inspection was undertaken by a dive team from ASI Group, working under the direction of AECOM's engineer.

Detailed above and below water inspections of the piers were last conducted in 1991 by Acres International Limited/ASI Group. The report for this inspection was reviewed and compared to the results of the current inspection.

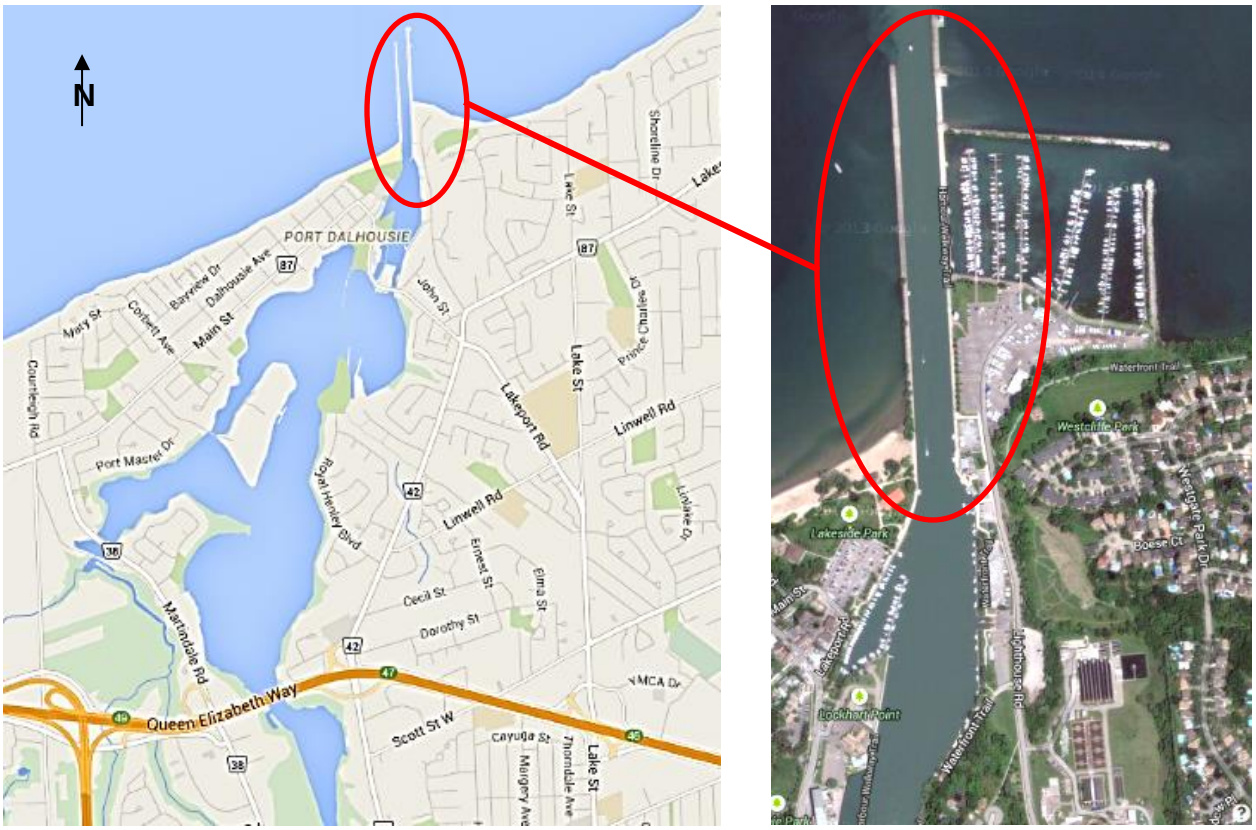


Figure 1: Key Map

2. Background Information

The following background material and information was available for this study:

1. Pier and Entrance Improvements, Drawings C-1 to C-7, 1983, Public Works Canada
2. Wharf Repairs-Stage II, Drawings MA000 to MA005, 1993, Public Works Canada
3. Port Dalhousie Marine Structure Inspection, Acres International Limited, 1991

The two sets of Public Works drawings are included in Appendix A.

3. Description of Piers

The piers consist of timber cribs filled with rock and topped with concrete coping blocks, and a cast-in-place concrete deck. The West Pier is approximately 600 m long and the East Pier is approximately 700 m long. The piers are approximately 5.7 m wide along both sides of the harbour and widen to approximately 8.8 m wide where they extend into Lake Ontario. The height of the piers varies between 4 and 6 metres, above the bed of the channel. The concrete deck and coping comprise the top 2 metres (approximate) of the piers.

The piers are oriented approximately in a north-south direction, with the south end of the piers being closest to shore. The north limit of the East Pier is at Station 0+681.5 and the south limit of this study is at Station 0+000, which is the junction of the timber crib pier with the steel sheet pile wall at the yacht club. The north limit of the West Pier is at Station 0+674.5 and the South limit of the study is at Station 0+080, which is about 50 m south of the point where the West Pier intersects with the shoreline of Lake Ontario. The general layout of the piers, the adopted chainage, and the limits of the study are illustrated in Figure 2 on page 3.

The piers were originally constructed in the late 1840's as the northern terminus of the Second Welland Canal (the terminus of the First Welland Canal was further west). The channel was made deeper and piers were improved in the 1870's for the Third Welland Canal. It is likely that the piers were replaced or rebuilt at this time. It is possible that some of the timbers used to construct the existing cribs were salvaged from the original 1840 construction. The concrete coping blocks and original concrete deck were added circa 1900. The outer (northerly) 94 m of the East Pier and the lighthouse at the end of the East Pier may be newer, but AECOM found no definitive history regarding timing of the construction of the north end of the East Pier outside of the information provided in the 1983 and 1991 repair drawings and the Acres report.

AECOM does not have detailed knowledge of the original construction of the piers; however, it was common at the time for piers to be entirely composed of timber cribs filled with rock and covered with either a crushed-limestone working surface or a timber deck. The top portion of the piers, which were exposed to frequent wettings from waves and oxygen from the air, would have had a life expectancy of approximately 20 to 30 years. It is understood that the concrete coping walls and deck were added around 1900 to replace the upper timbers of the cribs that would have deteriorated and no longer be usable by this time. The timbers in the lower portion of the cribs, below the low water level, would deteriorate more slowly due to low levels of oxygen that help to preserve the wood. It is common for timber cribs continuously submerged under two or three metres of fresh water to perform satisfactorily for over 100 years.

In 1983, a concrete overlay of approximately 350 mm thickness was installed on the deck of the West Pier, from the south end of the pier to Station 0+345.5±. A concrete deck overlay was also constructed on the north end of the East Pier, from Station 0+600± to Station 0+681.5. Concrete patch repairs were implemented for the remainder of the pier decks. Vertical steel dowels, extending from the top of the concrete deck through the coping units, were installed for

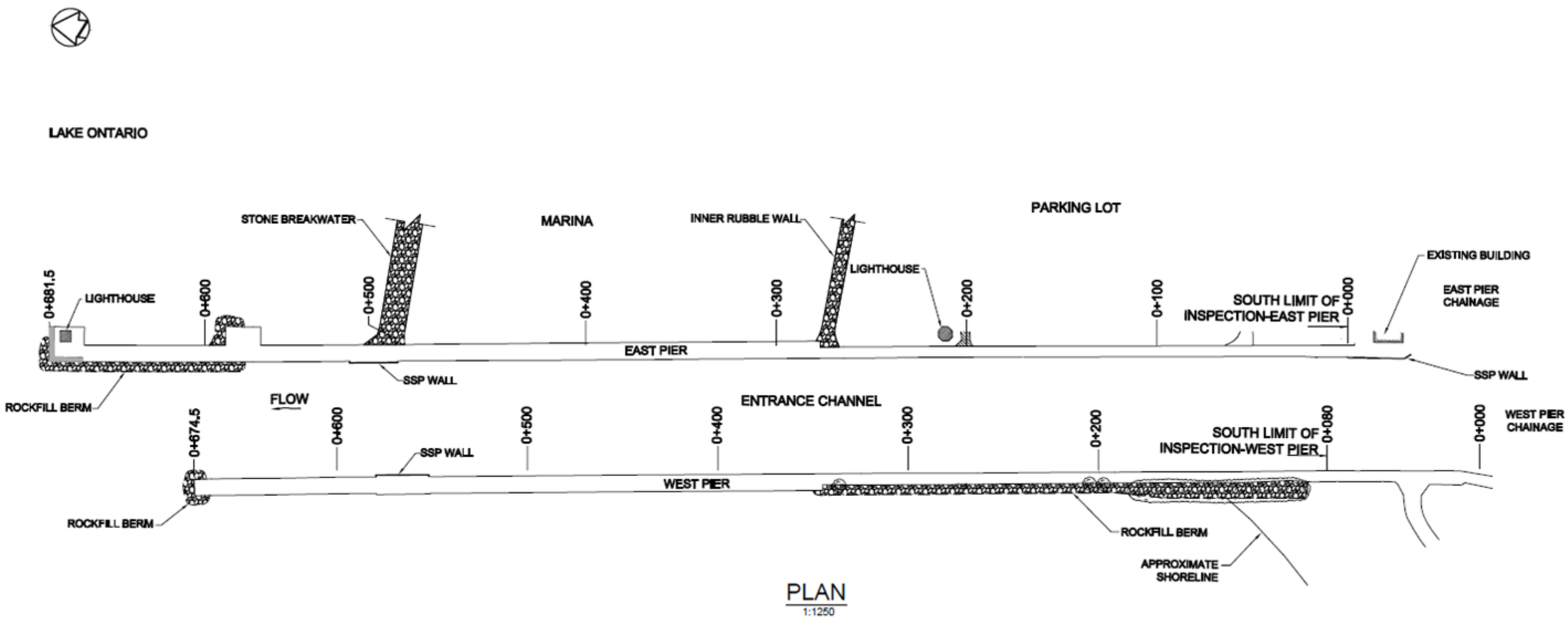


Figure 2: Pier Chainage

the entire length of both piers. Deteriorated concrete in the coping blocks was also patch repaired. Rock fill berms with armour stone protection were constructed at the ends of each pier and along sections of the west side of the West Pier and the west side of the East Pier. Details of these repairs are provided in the 1983 Public Works Canada drawings contained in Appendix A.

In 1991, an inspection of the piers identified a 25 m long section of the west face the West Pier where the timber headers of the cribs had collapsed and rock fill had spilled out. The collapse of the timber cribs had caused some of the coping blocks to settle and portions of the concrete deck to crack and settle. A similar failure of the timber crib headers was identified at a 5 m long section of the west face of the East Pier, although settlement of the deck was not observed.

In 1993, steel sheet pile walls were erected on both sides of the section of the West Pier's timber crib where the timber headers had collapsed, and damaged/misaligned coping blocks were replaced. A steel sheet pile wall was also constructed in front of a 25 ± long section of the inside (west) face of the East Pier opposite the newly constructed breakwater for the marina. On the West Pier, a concrete overlay was placed over the existing deck, extending from Station 0+435± to Station 0+580±. On the East Pier, a concrete overlay was placed from the south limit of the 1983 overlay to Station 0+500±. Both overlays varied in thickness from 200 mm to 350 mm. Also at this time, a 1.5 m ± high rock toe berm was placed at the base of the pier, for a 100 m ± long section of the west side of the East Pier and the area of the steel sheet pile enclosure at the West Pier. Details of these repairs are provided in the 1993 Public Works Canada drawings contained in Appendix A.

Based on a review of the 1991 inspection report and observations made during our recent visual inspections, additional sections of the concrete decks have been replaced or overlaid, beyond what is documented in the 1983 and 1993 drawings and summarized above. Photo No. 3, 4, 9, and 10 from the 1991 inspection report clearly show that the concrete deck between Station 0+343 and Station 0+435 (0+293 to 0+385 based on 1991 chainage) of the West Pier, and between Station 0+220 and Station 0+278 (1+032 to 1+090 for 1991 chainage) of the East Pier, was fairly recent construction at that time. Further, our observations in December 2014 indicate a newer and better condition deck between Station 0+577 and Station 0+674 on the West pier, and between Station 0+000 and Station 0+220 and Station 0+278 and Station 0+500 on the East Pier (current chainages) than was observed during the 1991 inspection. These observations would indicate that either the limits of work of the 1983 and 1993 pier rehabilitations were extended to include additional deck restoration, or there were other rehabilitation contracts implemented between 1983 and 1991 and between 1993 and present. In any event, it appears that the full length of both pier decks have been rehabilitated over the past 30+ years. Our understanding of the chronology of the deck rehabilitations for the East and West Piers is illustrated in Figure 3 on page 5.

Originally, a timber bumper system existed on the channel side of the piers. The bumper system consisted of timber piles driven into the lakebed in front of the piers. The piles extended above the waterline but not above the piers. A timber beam was attached to the channel side of the piles just above water level. Ships moored along the piers would bump and rub against this timber beam instead of against the concrete coping. Remnants of the piles from the bumper system still exist along the East Pier, however no signs that such a bumper system ever existed were found along the West Pier.

Illustrated in Figure 4 and Figure 5 on page 6 are typical sections of the piers within the harbour and within the lake as they existed after the most recent rehabilitation. Illustrated in Figure 6 on page 7 is a typical section of the east pier where steel sheet piling was used to augment the crib facing wall. Illustrated in Figure 7 on page 7 is a typical section of the piers where armour stone was used to augment the crib facing walls.

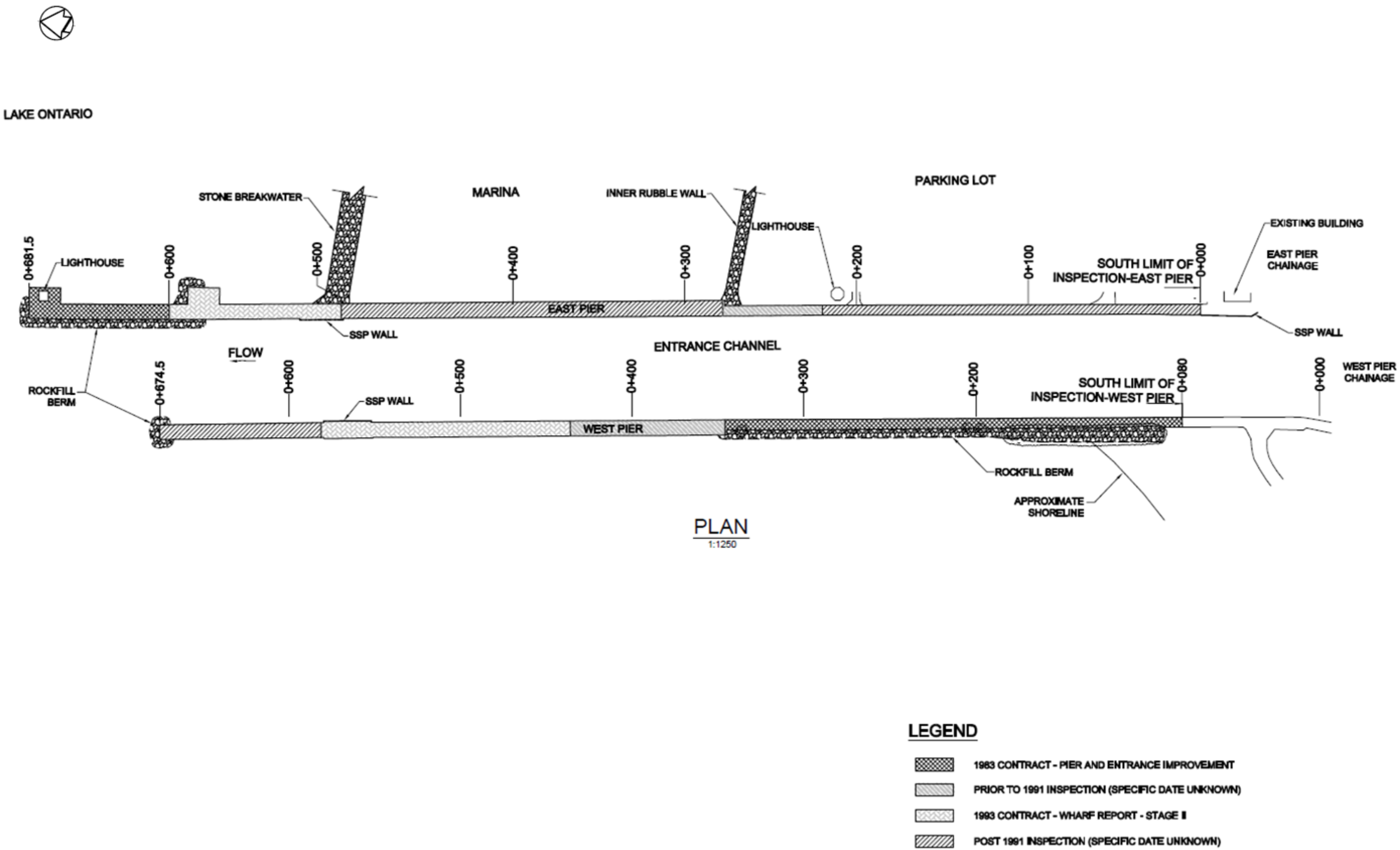


Figure 3: Pier Improvements Map

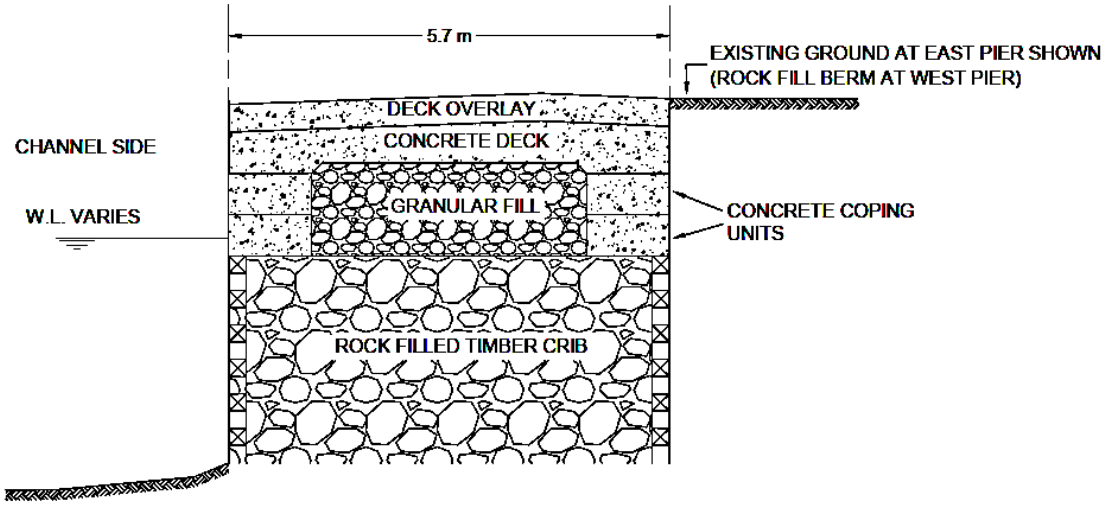


Figure 4: Typical Pier Section within the Harbour
Station 0+000 to Station 0+335 West Pier
Station 0+000 to Station 0+275 East Pier

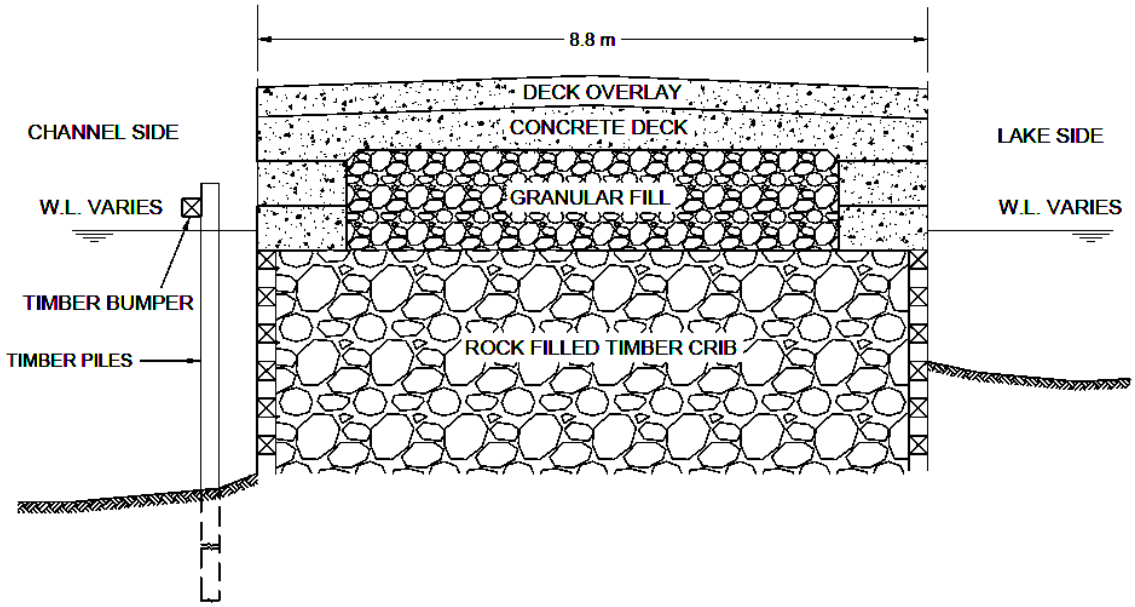


Figure 5: Typical Pier Section within Lake Ontario
Station 0+335 to Station 0+674.5 West Pier
Station 0+275 to Station 0+681.5 East Pier

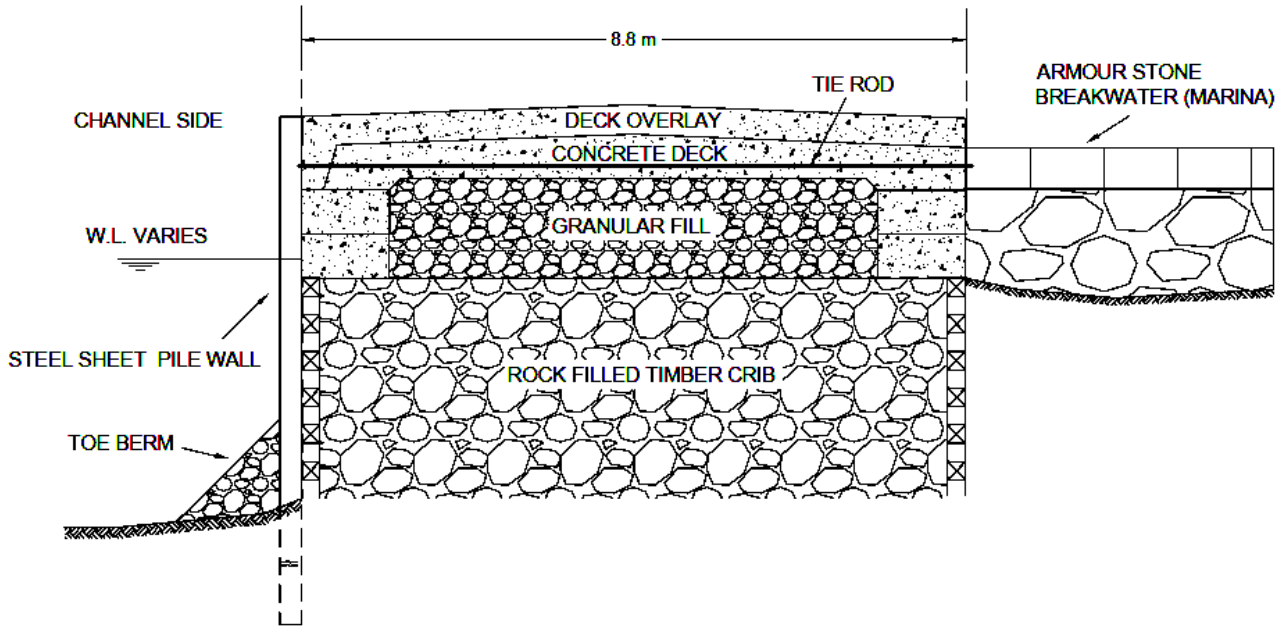


Figure 6: Typical Pier where Augmented with Steel Sheet Piling

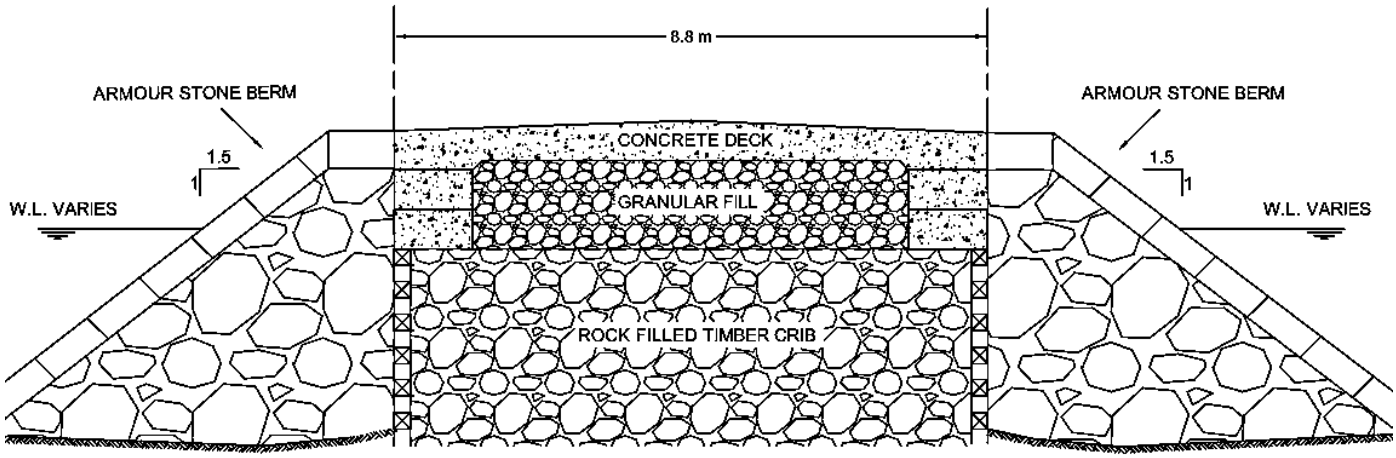


Figure 7: Typical Pier where protected by Armour Stone

3.1 Previous Inspection Reports

The last condition assessment was completed in 1991 by Acres International Ltd. The assessment scope included the entire Port Dalhousie Basin and was not limited to the piers. As such, structures such as the picnic shelter in the park, the marina, the breakwater, and the abandoned bridge are discussed in the report. As the current assignment is limited to the condition assessment of the piers, only sections of the previous report that pertain to the piers will be discussed.

Chainages (Stations) provided in this section refer to the chainages established for the 2014 topographic survey, as discussed in Section 3 of this report. When referring to the 1991 inspection report and the chainages used for that work, the following chainage adjustments must be applied:

- West Pier: 1991 chainage = 2014 chainage - 50 m
- East Pier: 1991 chainage = 2014 chainage + 812.5 m

Concerning the West Pier, the previous condition assessment found that the concrete deck overlay constructed in 1983 was in good condition; however, the surface of the deck from where the previous overlay ended (Station 0+435) to the end of the pier was in a deteriorated condition with movement at transverse joints. A 25 to 30 m long section with many large cracks and settlement was also reported near Station 0+560. The cause of the cracking and settlement near Station 0+560 was attributed to the failure of the timber crib wall on the lake side of the pier. This had allowed some of the rock fill to spill out, causing the coping blocks to settle and leaving the deck unsupported. On the channel side, many of the connections between timber headers and cross-ties in the crib walls were observed to be rotten but the header timbers were still in position. One 5 m long section of crib was observed to be undermined.

Regarding the East Pier, the 1991 condition assessment found that the concrete deck and coping were in poor condition with severe deterioration of the coping surface observed and asphalt patching of the deck. These deteriorated areas were located between Station 0+023 and Station 0+220 and between Station 0+278 and Station 0+470. In addition, a localized area of the deck at Station 0+438 exhibited settlement and cracking. The underwater inspection found that a 5 m long section of headers on the timber crib wall, opposite the recently constructed marina breakwater at Station 0+500, had collapsed and the rock fill had spilled out. Two sections of crib wall, one 35 m long and the other 83 m long, were observed to be undermined. The crib facing at the south end of the pier at the yacht club was observed to be leaning forward.

An evaluation of the piers found that the condition of various sections of the piers varied from unsafe and in need of immediate repair to fair with repair needed within three years. Recommendations for repairs consisted of installing sheet piling or extending riprap to protect the timber cribs and repairing the concrete coping blocks and concrete deck.

The results of the 1991 condition assessment were the basis of the 1993 rehabilitation contract implemented by Public Works Canada. Based on a review of the 1993 drawings, it appears that most of the recommendations of the 1991 inspection report where the condition rating required implementation within 2 years were completed.

4. Condition Assessment

4.1 Inspection of Piers

The piers were visually inspected over three days (November 19th, 24th and 28th, 2014) by James Wallace, P. Eng. (AECOM) and Navid Nikravan, E.I.T. (AECOM; November 19th and 24th only). Justin Munro of AECOM supervised the topographic survey of the piers. James Wallace supervised and directed the underwater inspection completed by ASI Group. Peto MacCallum Ltd completed a geotechnical assessment of the soils underlying the piers, under direct assignment to SCH.

The **visual above-water inspection** consisted of a methodical review of all accessible parts of the pier. The deck surface was examined and any observed cracks, spalls, scaling, and other surface defects were documented. The entire deck surface was chain dragged to identify delaminations and potential future spalls. The concrete coping on the channel side of the pier, where visible above the waterline, was visually examined and photographed from the other pier. The concrete coping on the lake side of the pier was photographed from shore using high power zoom lenses. Refer to Appendices B and C for detailed observations and photographs.

A **topographic survey** was conducted using Total Station equipment. The surveyors recorded measurements at 12.5 m intervals along each pier. At each interval, three points on the top of deck were recorded; one at the inside face, one at the middle, and one at the outside face of the pier. The top of pier elevation, longitude and latitude were measured for each point. The results of the survey were then compared to the proposed top/deck profiles in the

rehabilitation drawings from 1993 to see if there is evidence of possible movement or settlement of the pier in the past 22 years. The surveyors also took soundings of the channel/lake bottom at 25 m intervals along each pier.

An **underwater inspection** of the east and west sides of the East Pier and the east side of the West Pier was conducted by a dive team from ASI Group, working under the direction of James Wallace of AECOM. The planned inspection of the west side of the West Pier was cancelled due to safety concerns when some of the coping blocks were observed to be severely misaligned with potential for collapse during the inspection. AECOM recommends that SCH consider commissioning a sonar investigation of the piers during the Options Analysis phase of this study to supplement the missing underwater inspection data. A sonar investigation will not assess the condition of standing timber cribs but it will identify collapsed crib facing walls and the volume of missing rock fill from within the cribs.

The underwater inspection focused on the condition of the timber cribs. The dive team used two-way radios and underwater cameras to communicate with Mr. Wallace during the inspection. This allowed Mr. Wallace to direct the diver's attention to areas of concern during the inspection. The diver was able to swim along the timber crib facing to look for holes and broken members, as well as using his hands to feel for loose or rotten timbers and gaps between the timbers. The diver carried a metre stick to measure the size of voids and prod into holes and gaps to determine the location of the rock fill behind the crib face.

The results of the underwater inspection are documented in the diver's notes and the inspection drawings contained in Appendix B. Due to the limited visibility in the water (and the difficulty in accurately locating the diver from the surface), all dimensions and measurements recorded during the underwater inspection are approximate. Measurements of the timber cribs indicated on the drawings are accurate to +/- 10%; locations indicated on the drawings are accurate to within 2 metres.

The **geotechnical investigation** consisted of three (3) boreholes. drilled by Peto MacCallum Ltd., in order to establish the subsurface soil and groundwater conditions along the piers. The results are summarized in PML's report, "Geotechnical Investigation, Port Dalhousie Piers," included in Appendix D. The borehole logs indicate that the soil stratigraphy varies dramatically at the site. Borehole 2, located near Station 0+550 on the east side of the West Pier, identified competent founding conditions; 3.1 m overburden consisting of dense sand and dense alluvial silt over weathered shale limestone commencing at 8.4 m below top/deck and 6.8 m below top water. This would suggest that the cribs in this area of the pier might be founded on the shale stratum. However, Boreholes 3 and 4 (located near Station 0+400 on the west side side of the West Pier and near Station 0+190 on the east side of the East Pier, respectively) encountered a deep deposit of loose organic silt below channel level, extending to 21 m to 24 m below top/deck. The loose nature of the deep organic silt stratum could not have supported the piers for 100+ years without extensive settlement and therefore it is anticipated that the cribs in these areas are supported on some form of deep foundation such as battered timber piles.

4.2 Condition of Piers

4.2.1 Concrete Deck Slabs

The concrete deck surfaces appear to be in generally good condition with some areas of localized light concrete spalling, scaling, and map cracking, representing less than 20% of the deck area on the East Pier and less than 5% of the West Pier.

Many hairline to medium width transverse cracks were observed in the East Pier deck. These cracks are relatively straight and extend the full width of the pier. The cracks appear to correspond with joints between coping blocks and/or with joints between timber crib units.

A series of V-shaped grooves were observed in the West Pier. These grooves appear to be attempts at previous repairs where existing cracks were routed and filled with rubber or silicone sealant. The sealant has washed away, leaving the routed crack exposed.

Some localized settlement has occurred at Station 0+002 of the East Pier. A 40 mm vertical step was observed at the expansion joint at this location.

Two (2) delaminated areas were detected in the deck slab of the East Pier at Station 0+350 and Station 0+665. Both delaminations were relatively small and located near expansion joints in the deck. No delaminations were observed in the deck surface of West Pier.

Concrete cracks and spalls were observed along joints on the deck of the East Pier at Station 0+110, Station 0+127, Station 0+211, Station 0+267, Station 0+301, Station 0+321, Station 0+447 and Station 0+466.

The deck elevations measured as part of the topographic survey were compared with the proposed deck crossfall shown on the 1983 and 1993 repair drawings. For the East Pier, both the surveyed and proposed crossfalls indicate a center crown for the deck overlay, constructed in 1983, between Station 0+681.5 and Station 0+600, and the deck sloping to the channel (west) for the deck overlay, constructed in 1993, between Station 0+600 and Station 0+500. This result is an indication that these sections of the East Pier have not undergone any rotation or differential settlement. For the West Pier, the surveyed deck of the sheet pile encased section between Station 0+575 and Station 0+550 has a symmetrical crossfall with a centre crown, as per the 1993 repair drawings. However, the surveyed deck crossfall of the section between Station 0+550 and Station 0+435 indicates that an asymmetric section with the top of deck at the west edge and centerline of the deck are approximately equal and the east edge is lower. As a symmetrical crossfall with a centre crown for this section of deck is indicated on the 1993 drawings, it appears that the cribs may have rotated towards the channel (east) or the east side of the deck may have settled in relation to the west.

4.2.2 Concrete Coping Blocks

Photographs of the above water concrete coping wall face are included in Appendix C. Drawings documenting the results of the above and below water inspections are included in Appendix B.

The exposed surfaces of the concrete coping blocks appear to be in fair-to-poor condition with several severe concrete spalls, large cracks, and exposed reinforcing bars. Given that about half of the coping surface along the East Pier and the entire coping surface along the West Pier are in some state of deterioration, it was concluded that documenting every crack and spall would be impractical. Instead, only the larger spalls were recorded.

An undocumented deck reconstruction of the East Pier was completed sometime after the 1991 inspection, for the areas between Station 0+000 to Station 0+220 and between Station 0+280 and Station 0+500, appears to have included resurfacing the top 1.0 m ± of the coping (i.e. above water level) with concrete. As such, the above-water portions of these coping walls appear to be in good condition (See Photos 29-34 and 36-40 in Appendix C). The interface between the 1983 deck overlay (which did not include resurfacing the coping) and the post-1991 repair can be seen in Photo 34.

In addition, several of the coping blocks were observed to have settled, due to the deterioration/failure of the supporting cribs, and are no longer supporting the concrete deck. This was observed for a 5 m section near Station 0+545 on the east side of the West Pier and south of the sheet pile enclosed section (Station 0+550) on the West Pier. A section of misaligned coping units was also observed on the west side of East Pier north of Station 0+530, however the movement is likely to have occurred prior to 1993, as the concrete 1993 deck repair had been extended down to the top of the misaligned coping units.

4.2.3 Timber Cribs

The majority of the timber cribs inspected by the ASI Group divers were observed to be in fair-to-poor condition. The ends of many of the timber headers (facing members) have decayed to such a degree that they are no longer securely fastened to the timber cross-ties. Ends of both headers and cross-ties have rotted and disintegrated around the steel spikes (See Figures 8 and 9 below, which contain enhanced photos from the underwater inspection). In other locations, the timber ends were found to be intact but severely rotted and easily disintegrated when probed, exposing the steel spikes that hold the crib walls together. During the underwater inspection, a section of crib facing, located at Station 0+465 on the east side of the West Pier, collapsed when a timber was probed by the diver. In many cases, the top two header timbers are missing from the crib (See Figure 10). In many places, the crib headers were observed to be bulging outward into the channel or were completely missing (see Figure 11 on page 13 for an illustrative example). In other places, the remains of the timber piles from the original fender system were observed to be the only thing holding the crib headers in place (see Figure 12 for an illustrative example). No signs of undermining of the timber cribs were observed, although this is likely due to the placement of a toe berm in front of portions of the crib facing during the 1993 repair.

The observed deficiencies are documented on the inspection drawings included in Appendix B.

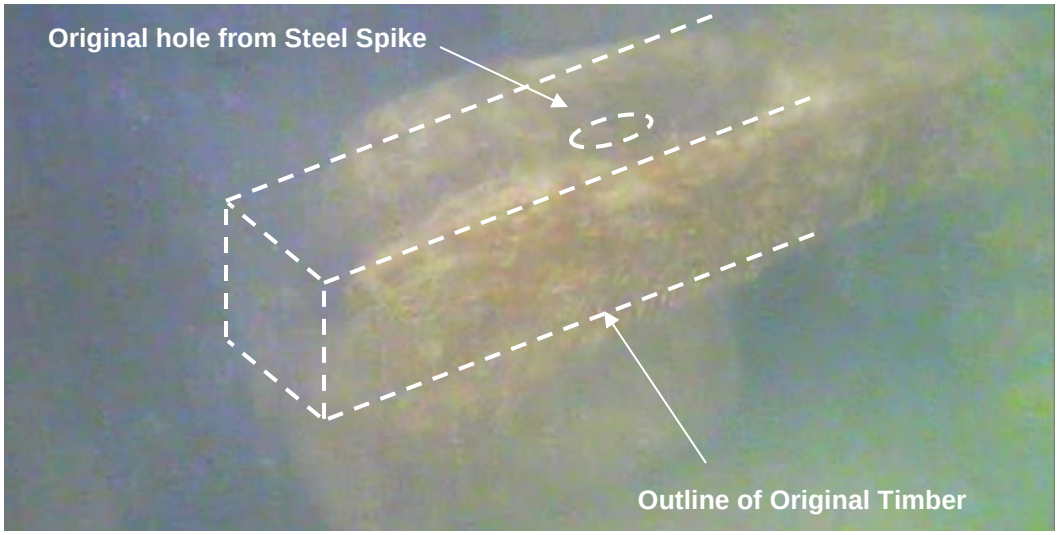


Figure 8: End of Timber Headers has Split and Pulled Free of Connection

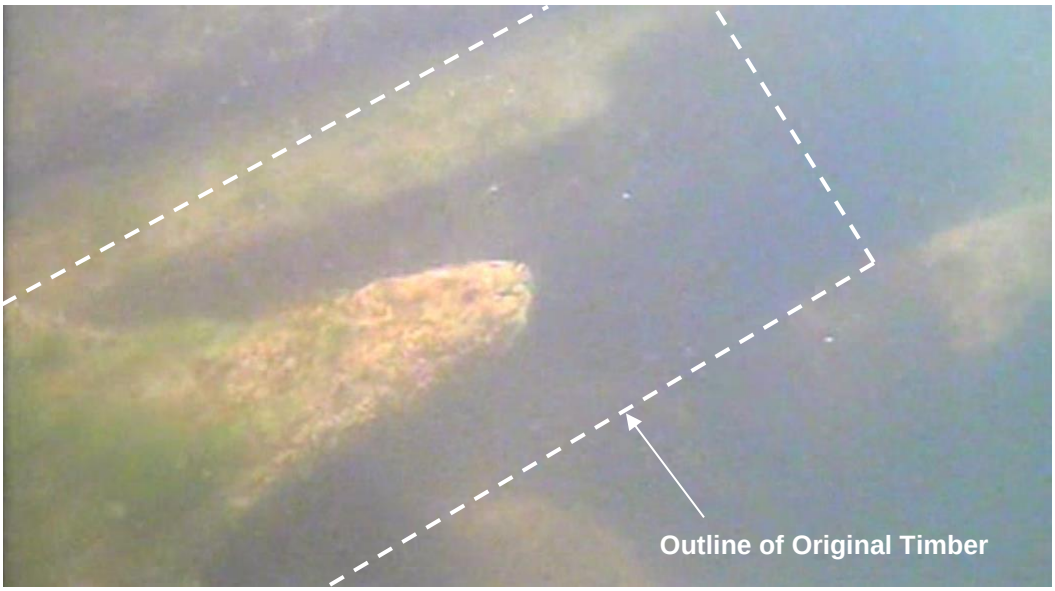


Figure 9: End of Timber Headers has Disintegrated at Connection

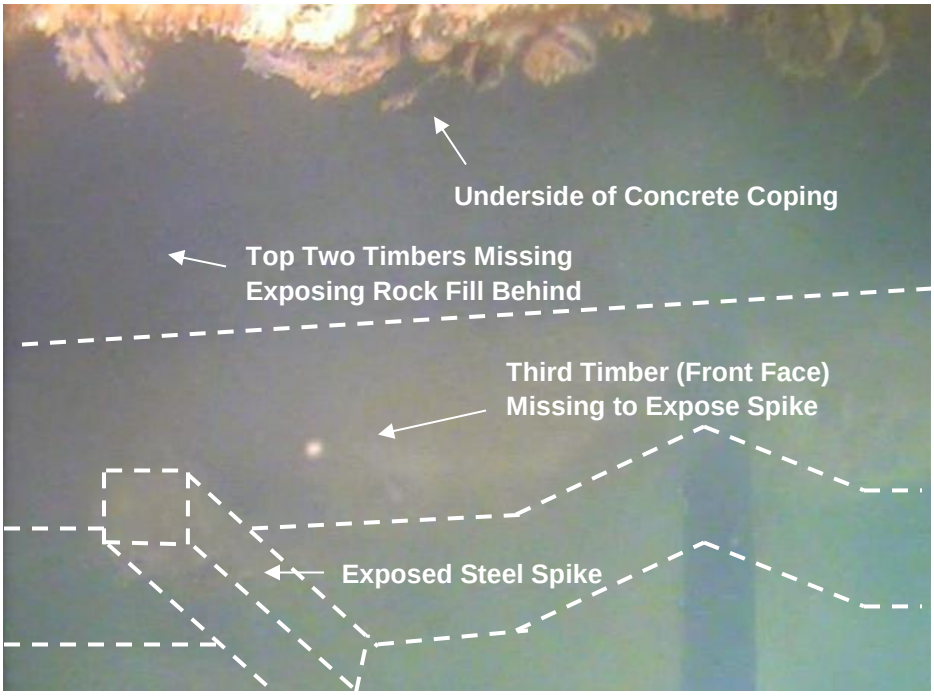


Figure 10: Top of Timber Crib Facing Missing

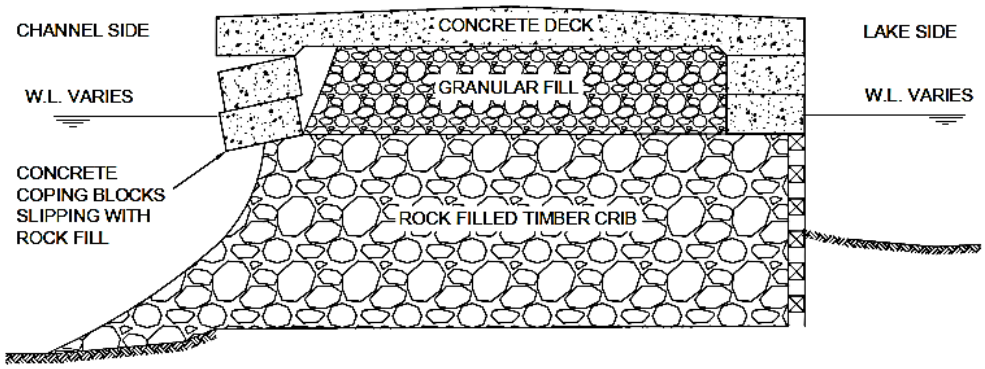


Figure 11: Typical Pier Section Where Timber Crib Facing Has Fallen Away

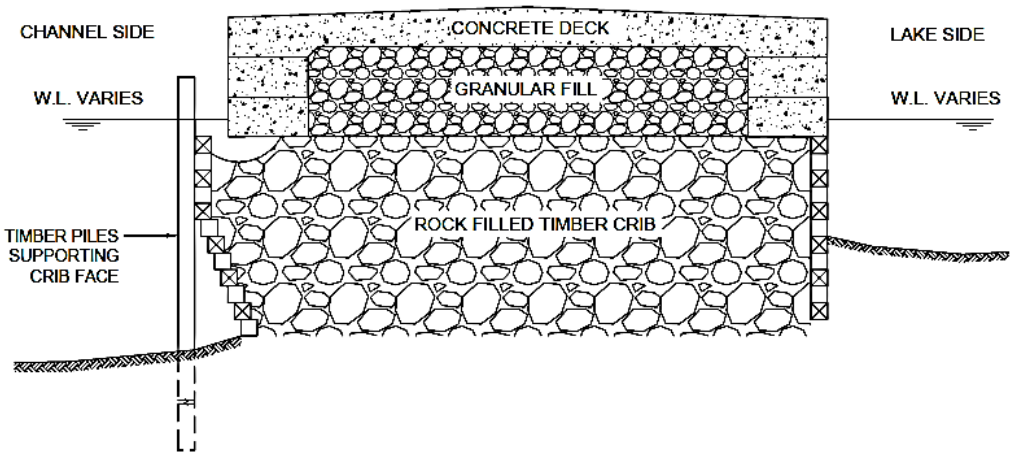


Figure 12: Typical Pier Section with Crib Facing Held in Place by Piles from Bumper System

It is interesting to note that the timber headers were observed to be in fair condition and securely fastened to the transverse cross-tie timbers immediately adjacent to the north (downstream) ends of the areas where steel sheet piling has been installed. This was observed at one location on the East Pier; north of the sheet piling wall near the yacht club (Station 0+000). It was also observed on the east (channel) side of the West Pier, north of the sheet piling at Station 0+575. This improved condition was typically observed for a distance of approximately 50 m from the north end of the sheet piling section. The sheet piling projects about 400 mm beyond the timber crib facing and, being immediately upstream, it may shelter the timber cribs from the causes of the decay.

4.2.4 Steel Sheet Piles

Within the study area, steel sheet piling has been installed in front of the original timber cribs on the east and west sides of the West Pier, between Station 0+550 and Station 0+575, and on the west side of the East Pier, between Station 0+490 and Station 0+515. The steel sheet piling appears to be plumb and in good condition. There was some light surface corrosion. The interlocks on the steel sheet piles were tight with no apparent splits. The waler bolts and tie rods were in place and appeared to be secure. No undermining was observed.

4.2.5 Armour Stone Berms

As part of the 1983 rehabilitation of the piers, rock fill berms with a protective layer of armour stone were constructed along the west side of the West Pier between the lake's shoreline and Station 0+350±, the west side of the East Pier

from the pier's north end to Station 0+590±, and at the ends of both piers. The berm on the west side of the West Pier was extended 22 m to the north in 1993.

The armour stone berms appear to have settled and the stones have become misaligned relative to the construction details shown in the1983 rehabilitation drawings. AECOM does not have as-built drawings or photographs of the stone berm at the time of construction, however, the original design drawings illustrate tight fitting armour stones placed in layers over a rock fill berm. The top of the armour stones was to be at the same elevation as the top of the pier.

AECOM observed armour stone berms that in places are 300 mm to 500 mm lower than the top of the pier and stones that appear to be placed haphazardly. Assuming that the berm was constructed as per the drawings, then the armour stone berms appear to have settled by up to 500 mm and the outer layer of armour stones have shifted randomly.

Due to the precarious arrangement of the stones and the risk that some of the stones could be unstable, no underwater inspection of the berms was undertaken.

Images of the armour stone berms can be seen in Photos 1, 27, 28 and 45 of Appendix C. An illustration of the current condition of the armour stone berms is given in Figure 13.

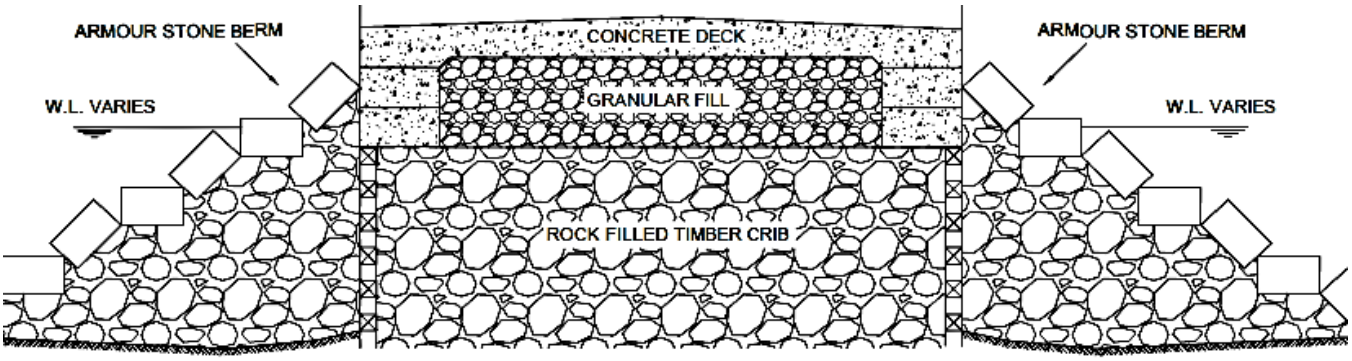


Figure 13: Typical Pier Section at Amour Stone Berm (End of Pier)

5. Load Restrictions and Structural Condition Rating

A conventional structural evaluation of the piers, where the structural stability against anticipated loading conditions is assessed, has not been conducted for either the East or West Pier. The poor condition of the timber cribs, the resultant settlement and displacement of the rock fill within the cribs, and associated uncertainties and inconsistencies regarding the cross section geometry of the structures, prevent completion of a comprehensive and meaningful stability assessment.

However, the results of the 2014 inspection have been used to identify the sections of the pier that are anticipated to be at risk of a structural failure of the concrete deck under the following load conditions:

i) light vehicular live load (i.e. the CHBDC maintenance vehicle);
ii) pedestrian live load (i.e. 4.8 kPa as per Ontario Building Code for a public area); and
iii) mooring forces.

The areas where activity/live loading should be restricted are summarized in Table 1.

Table 1: Recommended Restrictions on Applied Live Load

Location	Vehicular Load Restriction	Boat Mooring Restriction	Pedestrian Load Restriction
East Pier			
Station 0+000 to Station 0+075	✓	✓	
Station 0+150 to Station 0+225	✓	✓	
Station 0+225 to Station 0+275	✓	✓	✓
Station 0+275 to Station 0+325	✓	✓	
Station 0+375 to Station 0+490	✓	✓	
Station 0+515 to Station 0+575	✓	✓	✓
West Pier			
Station 0+000 to Station 0+300	✓	✓	
Station 0+300 to Station 0+350	✓	✓	✓
Station 0+350 to Station 0+450	✓	✓	
Station 0+450 to Station 0+525	✓	✓	✓
Station 0+525 to Station 0+550	✓	✓	

Further, the various components of the piers have been rated in accordance with Small Harbours Condition Rating Scale. The structural condition rating of the piers has been divided based on the various pier components. The condition and residual life of each component will be discussed in the following sections. To simplify the evaluation, AECOM has adopted the SCH rating scale (given in Table 2) to describe the condition of the various components of the piers.

Table 2: Rating Scale for Structural Evaluation

Rating Scale	
1 (unsafe)	Project action must be carried out within the next year
2 (poor)	Project action would have to begin within the next 2 year period
3 (fair)	Project action would have to begin within the next 3 year period
4 (good)	Inspection and minor maintenance within 5 years
5 (very good)	Inspection and minor maintenance within 10 years

5.1.1 Concrete Deck Slabs

The concrete deck slabs are currently in good condition and appear to be performing well. Hairline cracks extending the full width of the pier were observed on the East Pier, typically located near joints in the coping blocks and/or between timber cribs. Similar cracking, but to a lesser degree, was observed in the West Pier. These cracks are attributed to post-construction concrete shrinkage and thermal expansion and contraction of the deck. The cracks and are not a concern with regard to the performance or life expectancy of the deck. However, the locations where the coping blocks have settled or shifted and no longer provide support for the deck are a major concern. The cause of the movement of the coping blocks is discussed in Section 5.1.3, Timber Cribs. If the cause of the movement of

the coping blocks and subsequent loss of support for the deck is corrected soon, then the concrete decks can be expected to continue to perform well with little to no maintenance for the next five to ten years.

The concrete deck is given a Condition Rating of 4, with the requirement that the deteriorated condition of the timber cribs be addressed immediately.

5.1.2 Concrete Coping Blocks

The condition of the concrete coping blocks varies from good to poor, depending on their location on the piers.

The coping blocks on the west side of the East Pier, from Station 0+000 to 0+220 and Station 0+280 to Station 0+500, appear to be in good condition with little to no maintenance expected for the next five years. The rest of the coping blocks on the East Pier are in fair condition with some localized large spalls.

The coping blocks on the West Pier are in fair-to-poor condition. The block faces are eroded and spalling. Exposed rebar was observed. In several locations, coping blocks have settled and shifted due to the advanced deterioration of the timber crib and resultant loss of support.

In a similar manner as discussed above for the deck, the residual life of the coping is dependent on the condition of the supporting timber cribs. Where the header timbers have fallen away or are in such a deteriorated state that collapse of the facing wall is imminent, the coping blocks have experienced (or are at risk of experiencing) major displacement and misalignment with potential for collapsing into the channel.

The coping of the East Pier is given a Condition Rating of 4, with the requirement that the deteriorated condition of the timber cribs be addressed immediately.

The coping of the West Pier is given a Condition Rating of 3, with the requirement that the deteriorated condition of the timber cribs be addressed immediately.

5.1.3 Timber Cribs

The condition of the timber cribs varies from fair to unsafe, depending on their location.

Significant areas of the crib facing timbers on the channel sides of the East and West Piers have partially or completely collapsed. The ends of the timber members making up the facing walls are rotten and the connections have failed. Where the timber facing of the cribs has failed, the rock fill supporting the piers is spilling into the channel, undermining the coping blocks and allowing them to settle. While it has not been confirmed to-date by underwater inspection, the visible settlement of coping blocks indicates that similarly poor conditions exist on sections of the lake side (west) facing of the cribs of the West Pier.

As the rock fill spills into the channel, the unsupported coping blocks and deck will begin to settle. This will result in cracking of the deck. As the rock fill continues to be lost from the cribs, the rate of coping block misalignment and deck settlement will accelerate, in a similar manner as was observed near Station 0+560 on the West Pier during the 1991 pier inspection. The timber cribs in this area were subsequently encapsulated with steel sheet piling as part of the 1993 rehabilitation of the piers.

The piers cannot be considered stable where the crib facing walls have collapsed. To remain stable, the rock fill must be contained. Strong winds or ice could destabilize the piers and cause further displacement of the coping blocks, resulting in severe settlement and cracking of sections of the deck. Ice is capable of lifting the coping blocks and the deck, and could increase spillage of the rock fill and related settlement of the coping and deck. Strong winds

could also be of concern in the summer when vessels are moored to the piers. Not only does the wind push on the pier, but it pushes on the vessels, which in turn transfers the load to the piers. If a vessel were to be moored to a section of the deck, and subsequently that section were to collapse, it would likely capsize the vessel.

Summarized in Table 3 are the areas of the cribs where the timber headers have either i) collapsed; ii) exhibited forward displacement due to failure of the connections to the cross-ties; or iii) are still in position in the crib but the cross-tie connections are significantly deteriorated.

The sections of the cribs where the facing timbers have collapsed or separated from the cross-ties are considered to have no remaining life expectancy. The residual life of the cribs where the timbers at the crib connection points are exhibiting significant rot/disintegration is less than one year. Therefore, the overall Condition Rating of the cribs is 1.

5.1.4 Steel Sheet Pile Walls

The steel sheet piles appear to be in good condition and performing as intended.

Therefore, the sections of the piers with steel sheet pile facing are given a Condition Rating of 5.

Table 3: Summary of Timber Crib Deterioration

Location	Crib Face Condition
1. East Pier/West Side	
0+040 to 0+160	Cross-tie Connections Deteriorated
0+160 to 0+240	Headers Displaced
0+250 to 0+270	**Headers Collapsed**
0+270 to 0+ 290	Headers Displaced
0+300 to 0+325	Cross-tie Connections Deteriorated
0+370 to 0+425	Cross-tie Connections Deteriorated
0+510 to 0+550	Headers Displaced
2. East Pier/East Side	
0+515 to 0+570	Cross-tie Connections Deteriorated
0+550 to 0+570	Headers Displaced
3. West Pier/East Side	
0+085 to 0+160	Cross-tie Connections Deteriorated
0+160 to 0+330	Headers Displaced
0+330 to 0+345	**Headers Collapsed**
0+345 to 0+460	Headers Displaced
0+355 to 0+460	Cross-tie Connections Deteriorated
0+460 to 0+515	**Headers Collapsed**
0+515 to 0+550	Cross-tie Connections Deteriorated
0+515 to 0+550	Headers Displaced
0+575 to 0+595	Headers Displaced
0+595 to 0+620	Cross-tie Connections Deteriorated
4. West Pier/West Side	
Unsafe conditions; underwater inspection was not conducted	unknown

5.1.5 Armour Stone Berms

The armour stone berms may have settled since they were installed in 1983. While individual armour stones appear misaligned and unstable, the berms as a whole appear to be stable and performing as intended. Because some of the stones may move, it is recommended that the public not be permitted to climb on the berms and vessels not be permitted to moor adjacent to the berms.

The armour stone berms are given a Condition Rating of 4.

6. Summary of Findings and Recommendations

AECOM has reviewed the existing piers at Port Dalhousie and found them to be in overall poor condition. This is due to the deteriorated state of the timber cribs. The concrete deck generally appears to be in good condition and the concrete coping blocks appear to be in fair condition. However, the individual members of the timber cribs are deteriorating at their connections. Large sections of the crib facing walls have collapsed or collapse appears to be imminent. The failure of the crib headers allows the rock fill within the cribs to shift and settle. As the rock fill settles, the concrete coping units lose their support and become misaligned. This in turn removes the support of the concrete deck, destabilizing the entire structure.

If the rock fill is not encapsulated and stabilized, then in time the combined forces of gravity, waves, ice, and wind will cause the collapse of sections of the piers' superstructures.

Without rehabilitation, the life expectancy of both piers is less than five years.

To extend the useful life of the piers, AECOM recommends encapsulating both piers with either steel sheet piling or armour stone berms. This should be done at the earliest opportunity in order to minimize any further spillage and settlement of the rock fill within the timber cribs and subsequent undermining of the superstructure.

Installing sheet piling will also protect the coping blocks from further deterioration. Armour stone berms would also serve to contain the rock fill in the cribs, making the timber facing redundant. However, the construction of rockfill berms on the channel sides of the piers would eliminate the ability to moor boats at the piers.

Alternative methods of containing the rock fill and rehabilitating the piers will be developed and evaluated in detail in the next phase of the assignment; Options Analysis.

The concrete decks do not require significant remedial work at this time, however failure to contain the rock fill with sheet piles or armour stone berms will allow the rock fill to spill and settle and undermine the superstructure. This could cause the superstructure to settle and crack. If the rock fill is not contained, then the decks could quickly deteriorate from good condition to poor condition.

Additional investigation, using sonar, is recommended. Sonar readings can be used to determine the volume of rock fill has spilled out from the cribs. This volume is difficult to determine using divers because it is not safe for the divers to work under the suspected coping blocks. It is necessary to determine the volume of missing material as this material must be replaced once the piers are encapsulated to prevent the decks from settling in the future. Sonar readings can also be used to determine if any of the timber crib facings have collapsed on the west side of the west pier (that was unsafe to inspect using divers).

Appendix A

Port Dalhousie, ON – East and West Piers
Condition and Structural Evaluation Report

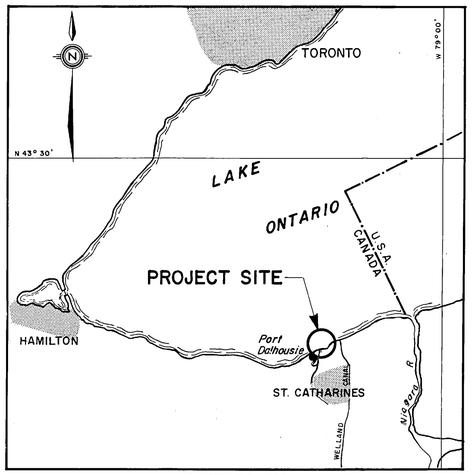
- Reference Drawings
  - Pier Entrance Improvements, 1983
  - Wharf Repairs-Stage II, 1993

Public Works Canada
Ontario Region

PORT DALHOUSIE
HARBOUR PIER AND ENTRANCE
IMPROVEMENTS AND HARBOUR DEVELOPMENT

PIER AND ENTRANCE IMPROVEMENTS
PROJECT NO. 180129

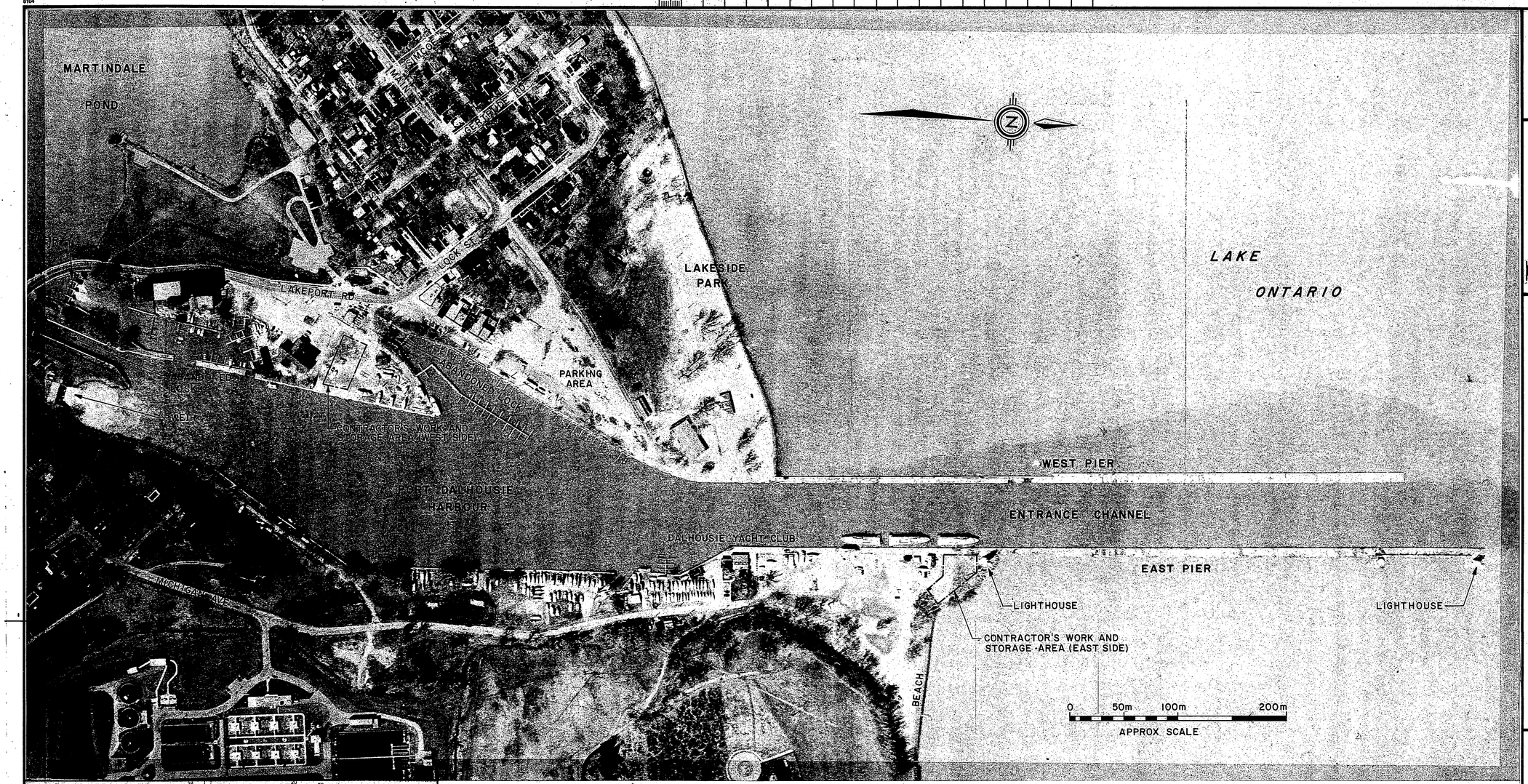
SWAN WOOSTER
ENGINEERING CO. LTD.

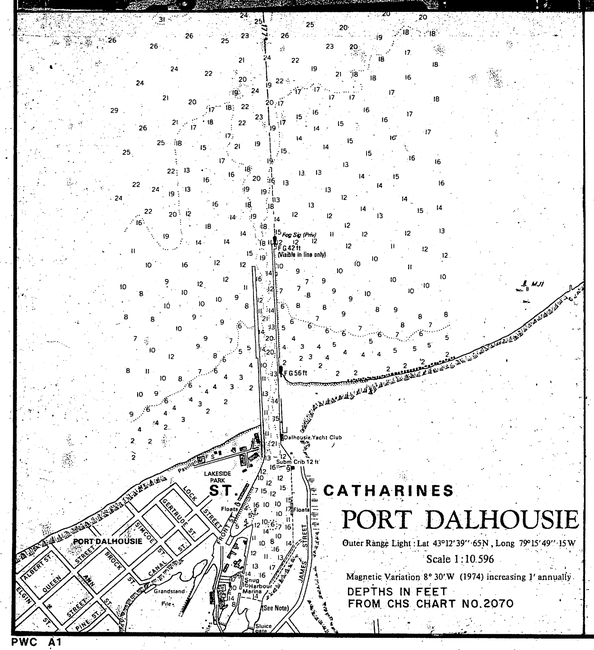


KEY PLAN
SCALE – 1: 506880

LIST OF DRAWINGS

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 millimetres





GENERAL NOTES

1. ALL ELEVATIONS REFER TO GEODETIC SURVEY OF CANADA DATUM.
2. WATER DEPTHS REFER TO CHART DATUM 74.0m ABOVE MWL.
3. EXACT LIMITS AND EXTENT OF CONTRACTOR'S WORK AND STORAGE AREAS TO BE DETERMINED BY THE ENGINEER IN THE FIELD.
4. THE ABOVE MAP IS BASED ON PHOTOGRAPH GRS 80020-2, 1981-09-30.
5. THE CURRENT IN THE ENTRANCE CHANNEL IS STRONG WHEN THE SLUICE GATES ARE OPEN.

Public Works Canada / Travaux publics Canada
Ontario Region / Région de l'Ontario

SWAN WOOSTER ENGINEERING CO. LTD.
ST. CATHARINES ONTARIO

revisions | date

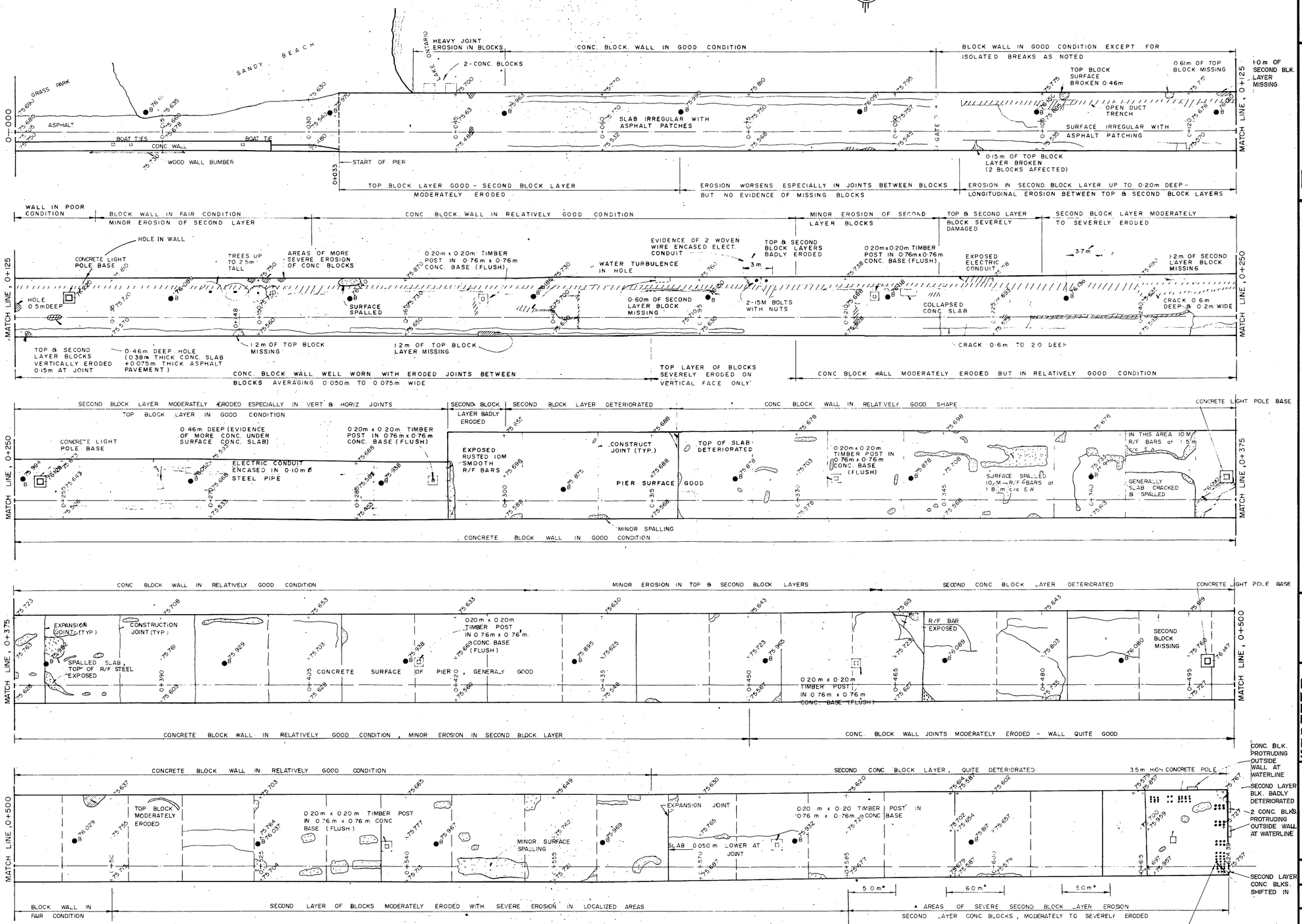
A detail no. / no. du détail
B drawing no. – where detail required / dessin no. – où détail exigé
C drawing no. – where detailed / dessin no. – où détaillé

project title / titre du projet
PORT DALHOUSIE ONTARIO
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
GENERAL LAYOUT

designed by / conçu par: B. SKALMSTAD
drawn by / dessiné par: P. SUGRUE
reviewed by / examiné par: Eugene Schmidt
approved by / approuvé par: B. Skalmstad
project date / date du projet: 1983-08-22
project no. / no. du projet: 180129
drawing no. / dessin no.: C-1

PWC A1



NOTE:
ALL BARS ARE 25 M AND HAVE BEEN BURNED OFF FLUSH WITH PIER SURFACE

NOTES

1. THE INFORMATION ON DWG NO. C-1 & C-2 IS BASED ON A GENERAL SURVEY CONDUCTED IN JULY 1983.
2. ALL DIMENSIONS AND COMMENTS SHOWN ARE FOR THE CONTRACTOR'S INFORMATION ONLY; THEY ARE NOT THE RESULT OF A DETAILED ANALYSIS AND SHOULD THEREFORE BE CONSIDERED INDICATIVE ONLY OF THE GENERAL CONDITION OF THE PIERS.
3. FOR A PROBABLE CROSS SECTION THROUGH THE PIERS, SEE DWG NOS. C-3 & C-4.
4. FOR ADDITIONAL GENERAL NOTES, SEE DWG NO. C-1.

LEGEND

- SPALLING IN SURFACE
- HOLE(S) IN SURFACE
- CRACK(S) IN SURFACE
- ● B STEEL BOLLARD
- +75.650 SPOT ELEVATION

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

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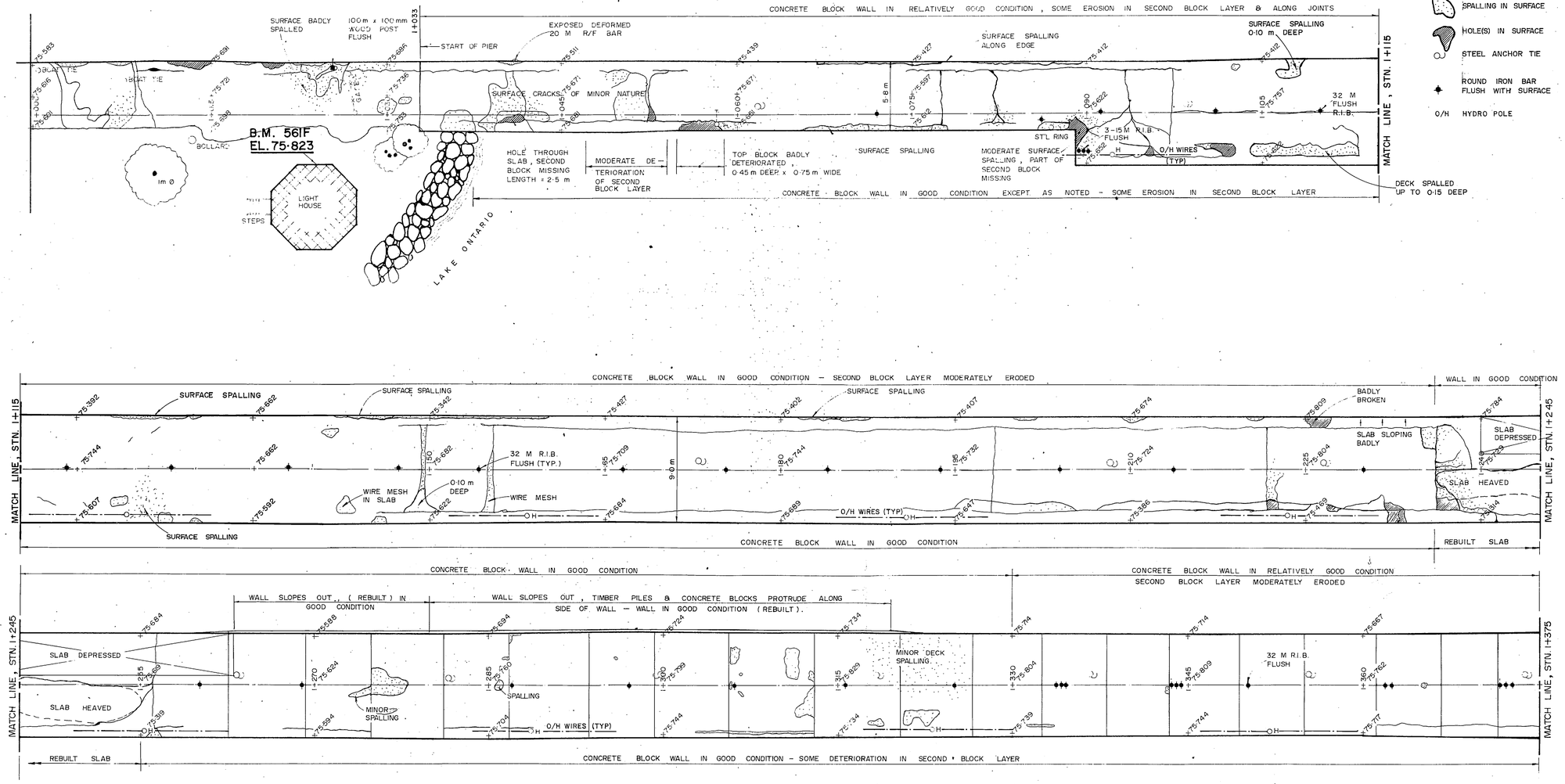
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
EXISTING SURFACE CONDITIONS WEST PIER

designed by / conçu par: ——
drawn by / dessiné par: J. NEILL
reviewed by / examiné par:
approved by / approuvé par:
project date / date du projet: 1983-08-22
project no. / no. du projet: 180129
drawing no. / dessin no.: C-2

PWC A1



LEGEND

- CRACK(S) IN SURFACE
- SPALLING IN SURFACE
- HOLE(S) IN SURFACE
- STEEL ANCHOR TIE
- ROUND IRON BAR FLUSH WITH SURFACE
- O/H HYDRO POLE

NOTE

1. FOR NOTES SEE DWG NO. C-2.

TYPICAL SECTION THROUGH PIERS SHOWING PROBABLE CONSTRUCTION

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

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SWAN WOOSTER ENGINEERING CO., LTD.
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A detail no. / no. du détail
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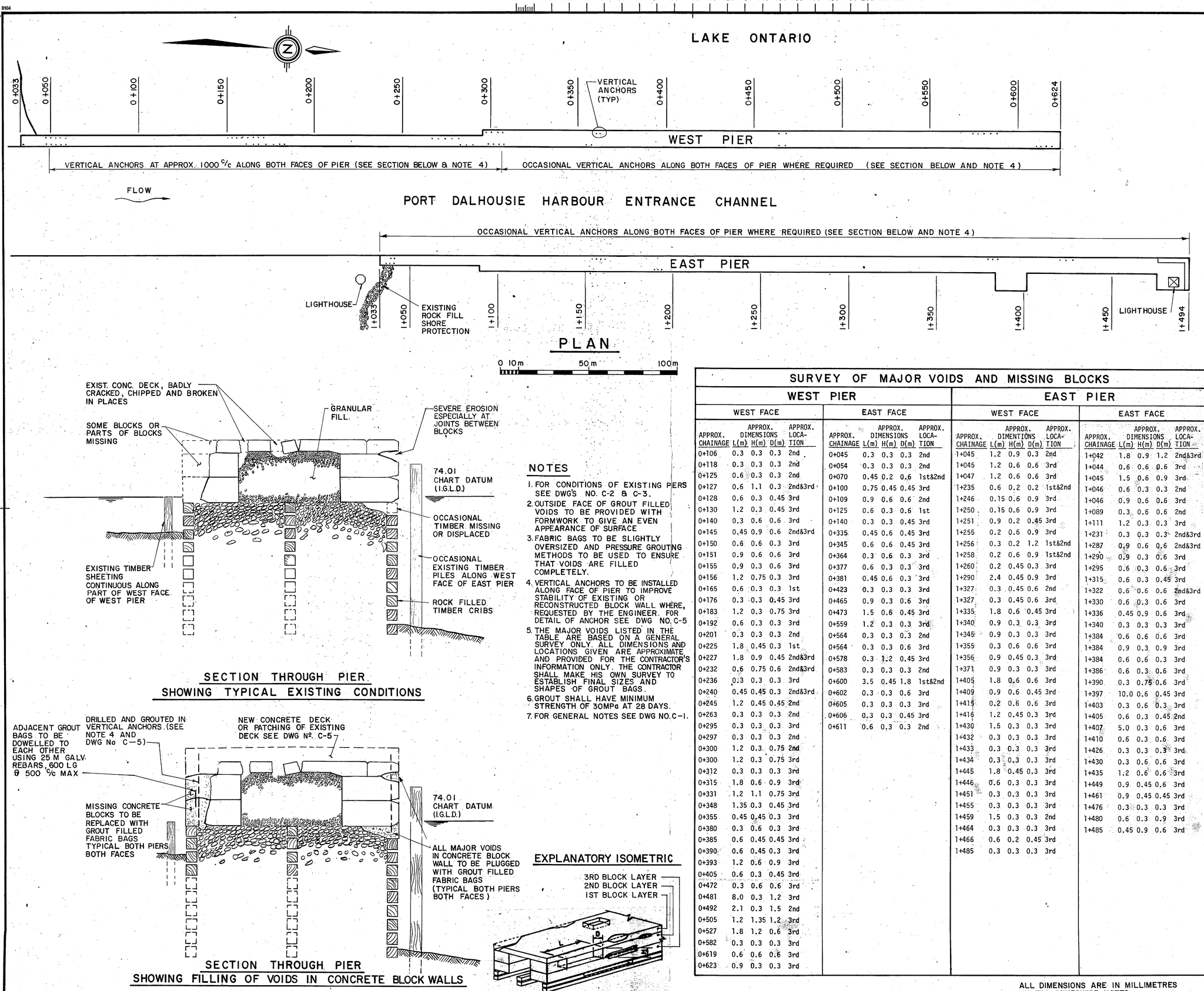
C drawing no. – where detailed / dessin no. – où détaillé

project title / titre du projet
PORT DALHOUSIE ONTARIO
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
EXISTING SURFACE CONDITIONS EAST PIER

designed by / conçu par: ———
drawn by / dessiné par: J. NEILL
reviewed by / examiné par:
approved by / approuvé par:
project date / date du projet: 1983-08-22
project no. / no. du projet: 180129
drawing no. / dessin no.: C-3

PWC A1



NOTES

1. FOR CONDITIONS OF EXISTING PIERS SEE DWG'S NO. C-2 & C-3.
2. OUTSIDE FACE OF GROUT FILLED VOIDS TO BE PROVIDED WITH FORMWORK TO GIVE AN EVEN APPEARANCE OF SURFACE
3. FABRIC BAGS TO BE SLIGHTLY OVERSIZED AND PRESSURE GROUTING METHODS TO BE USED TO ENSURE THAT VOIDS ARE FILLED COMPLETELY.
4. VERTICAL ANCHORS TO BE INSTALLED ALONG FACE OF PIER TO IMPROVE STABILITY OF EXISTING OR RECONSTRUCTED BLOCK WALL WHERE, REQUESTED BY THE ENGINEER. FOR DETAIL OF ANCHOR SEE DWG NO. C-5
5. THE MAJOR VOIDS LISTED IN THE TABLE ARE BASED ON A GENERAL SURVEY ONLY. ALL DIMENSIONS AND LOCATIONS GIVEN ARE APPROXIMATE AND PROVIDED FOR THE CONTRACTOR'S INFORMATION ONLY. THE CONTRACTOR SHALL MAKE HIS OWN SURVEY TO ESTABLISH FINAL SIZES AND SHAPES OF GROUT BAGS.
6. GROUT SHALL HAVE MINIMUM STRENGTH OF 30MPa AT 28 DAYS.
7. FOR GENERAL NOTES SEE DWG NO. C-1.

SURVEY OF MAJOR VOIDS AND MISSING BLOCKS

WEST PIER

WEST FACE				
APPROX. CHAINAGE	APPROX. DIMENSIONS L(m)	H(m)	D(m)	APPROX. LOCATION
0+106	0.3	0.3	0.3	2nd
0+118	0.3	0.3	0.3	2nd
0+125	0.6	0.3	0.3	2nd
0+127	0.6	1.1	0.3	2nd&3rd
0+128	0.6	0.3	0.45	3rd
0+130	1.2	0.3	0.45	3rd
0+140	0.3	0.6	0.6	3rd
0+145	0.45	0.9	0.6	2nd&3rd
0+150	0.6	0.6	0.3	3rd
0+151	0.9	0.6	0.6	3rd
0+155	0.9	0.3	0.6	3rd
0+156	1.2	0.75	0.3	3rd
0+165	0.6	0.3	0.3	1st
0+176	0.3	0.3	0.45	3rd
0+183	1.2	0.3	0.75	3rd
0+192	0.6	0.3	0.3	3rd
0+201	0.3	0.3	0.3	2nd
0+225	1.8	0.45	0.3	1st
0+227	1.8	0.9	0.45	2nd&3rd
0+232	0.6	0.75	0.6	2nd&3rd
0+236	0.3	0.3	0.3	3rd
0+240	0.45	0.45	0.3	2nd&3rd
0+245	1.2	0.45	0.45	2nd
0+263	0.3	0.3	0.3	2nd
0+295	0.3	0.3	0.3	3rd
0+297	0.3	0.3	0.3	2nd
0+300	1.2	0.3	0.75	2nd
0+300	1.2	0.3	0.75	3rd
0+312	0.3	0.3	0.3	3rd
0+315	1.8	0.6	0.9	3rd
0+331	1.2	1.1	0.75	3rd
0+348	1.35	0.3	0.45	3rd
0+355	0.45	0.45	0.3	3rd
0+380	0.3	0.6	0.3	3rd
0+385	0.6	0.45	0.45	3rd
0+390	0.6	0.45	0.3	3rd
0+393	1.2	0.6	0.9	3rd
0+405	0.6	0.3	0.45	3rd
0+472	0.3	0.6	0.6	3rd
0+481	8.0	0.3	1.2	3rd
0+492	2.1	0.3	1.5	2nd
0+505	1.2	1.35	1.2	3rd
0+527	1.8	1.2	0.6	3rd
0+582	0.3	0.3	0.3	3rd
0+619	0.6	0.6	0.6	3rd
0+623	0.9	0.3	0.3	3rd

EAST FACE				
APPROX. CHAINAGE	APPROX. DIMENSIONS L(m)	H(m)	D(m)	APPROX. LOCATION
0+045	0.3	0.3	0.3	2nd
0+054	0.3	0.3	0.3	2nd
0+070	0.45	0.2	0.6	1st&2nd
0+100	0.75	0.45	0.45	3rd
0+109	0.9	0.6	0.6	2nd
0+125	0.6	0.3	0.6	1st
0+140	0.3	0.3	0.45	3rd
0+335	0.45	0.6	0.45	3rd
0+345	0.6	0.6	0.45	3rd
0+364	0.3	0.6	0.3	3rd
0+377	0.6	0.3	0.3	3rd
0+381	0.45	0.6	0.3	3rd
0+423	0.3	0.3	0.3	3rd
0+465	0.9	0.3	0.6	3rd
0+473	1.5	0.6	0.45	3rd
0+559	1.2	0.3	0.3	3rd
0+564	0.3	0.3	0.3	2nd
0+564	0.3	0.3	0.6	3rd
0+578	0.3	1.2	0.45	3rd
0+583	0.3	0.3	0.3	2nd
0+600	3.5	0.45	1.8	1st&2nd
0+602	0.3	0.3	0.6	3rd
0+605	0.3	0.3	0.3	3rd
0+606	0.3	0.3	0.45	3rd
0+611	0.6	0.3	0.3	2nd

EAST PIER

WEST FACE				
APPROX. CHAINAGE	APPROX. DIMENTIONS L(m)	H(m)	D(m)	APPROX. LOCATION
1+045	1.2	0.9	0.3	2nd
1+045	1.2	0.6	0.6	3rd
1+047	1.2	0.6	0.6	3rd
1+235	0.6	0.2	0.2	1st&2nd
1+246	0.15	0.6	0.9	3rd
1+250	0.15	0.6	0.9	3rd
1+251	0.9	0.2	0.45	3rd
1+255	0.2	0.6	0.9	3rd
1+256	0.3	0.2	1.2	1st&2nd
1+258	0.2	0.6	0.9	1st&2nd
1+260	0.2	0.45	0.3	3rd
1+290	2.4	0.45	0.9	3rd
1+327	0.3	0.45	0.6	2nd
1+327	0.3	0.45	0.6	3rd
1+335	1.8	0.6	0.45	3rd
1+340	0.9	0.3	0.3	3rd
1+345	0.9	0.3	0.3	3rd
1+355	0.3	0.6	0.6	3rd
1+356	0.9	0.45	0.3	3rd
1+371	0.9	0.3	0.3	3rd
1+405	1.8	0.6	0.6	3rd
1+409	0.9	0.6	0.45	3rd
1+415	0.2	0.6	0.6	3rd
1+416	1.2	0.45	0.3	3rd
1+430	1.5	0.3	0.3	3rd
1+432	0.3	0.3	0.3	3rd
1+433	0.3	0.3	0.3	3rd
1+434	0.3	0.3	0.3	3rd
1+445	1.8	0.45	0.3	3rd
1+446	0.6	0.3	0.3	3rd
1+451	0.3	0.3	0.3	3rd
1+455	0.3	0.3	0.3	3rd
1+459	1.5	0.3	0.3	2nd
1+464	0.3	0.3	0.3	3rd
1+466	0.6	0.2	0.45	3rd
1+485	0.3	0.3	0.3	3rd

EAST FACE				
APPROX. CHAINAGE	APPROX. DIMENSIONS L(m)	H(m)	D(m)	APPROX. LOCATION
1+042	1.8	0.9	1.2	2nd&3rd
1+044	0.6	0.6	0.6	3rd
1+045	1.5	0.6	0.9	3rd
1+046	0.6	0.3	0.3	2nd
1+046	0.9	0.6	0.6	3rd
1+089	0.3	0.6	0.6	2nd
1+111	1.2	0.3	0.3	3rd
1+231	0.3	0.3	0.3	2nd&3rd
1+287	0.9	0.6	0.6	2nd&3rd
1+290	0.9	0.3	0.6	3rd
1+295	0.6	0.3	0.6	3rd
1+315	0.6	0.3	0.45	3rd
1+322	0.6	0.6	0.6	2nd&3rd
1+330	0.6	0.3	0.6	3rd
1+336	0.45	0.9	0.6	3rd
1+340	0.3	0.3	0.3	3rd
1+384	0.6	0.6	0.6	3rd
1+384	0.9	0.3	0.9	3rd
1+384	0.6	0.6	0.3	3rd
1+386	0.6	0.3	0.6	3rd
1+390	0.3	0.75	0.6	3rd
1+397	10.0	0.6	0.45	3rd
1+403	0.3	0.6	0.3	3rd
1+405	0.6	0.3	0.45	2nd
1+407	5.0	0.3	0.6	3rd
1+410	0.6	0.3	0.6	3rd
1+426	0.3	0.3	0.3	3rd
1+430	0.3	0.6	0.6	3rd
1+435	1.2	0.6	0.6	3rd
1+449	0.9	0.45	0.6	3rd
1+461	0.9	0.45	0.45	3rd
1+476	0.3	0.3	0.3	3rd
1+480	0.6	0.3	0.9	3rd
1+485	0.45	0.9	0.6	3rd

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

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SWAN WOOSTER ENGINEERING CO. LTD.
ST. CATHARINES ONTARIO

revisions | date

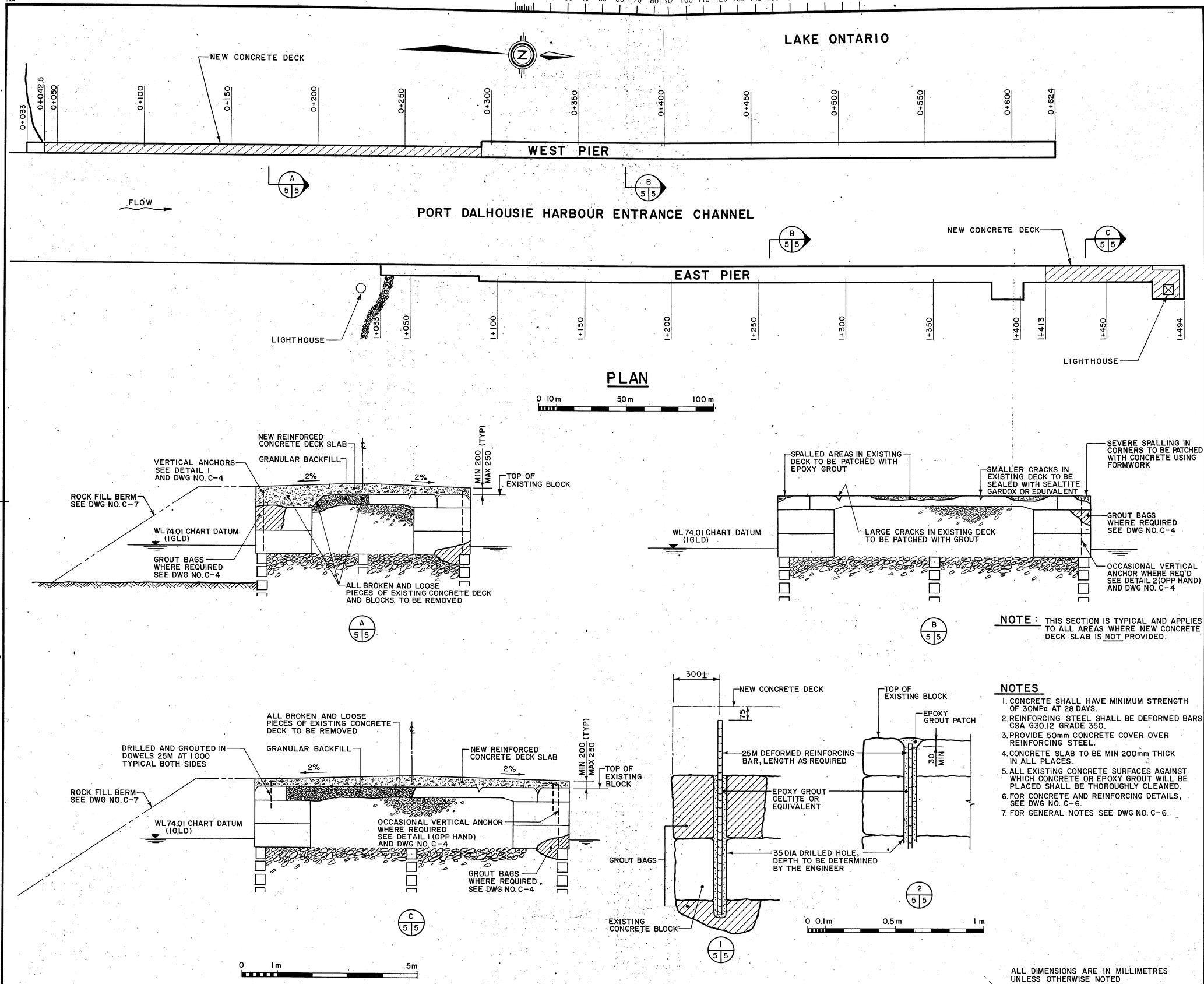
A detail no. / no. du détail
B drawing no. – where detail required / dessin no. – où détail exigé
C drawing no. – where detailed / dessin no. – où détaillé

project title / titre du projet
PORT DALHOUSIE ONTARIO
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
CONCRETE BLOCK WALL FILLING OF VOIDS

designed by / conçu par: E. SCHMIDT
drawn by / dessiné par: D. WILSON
reviewed by / examiné par: Eugene Schmidt
approved by / approuvé par: B. Stachel
project date / date du projet: 1983-08-22
project no. / no. du projet: 180129
drawing no. / dessin no.: C-4

PWC A1



NOTE: THIS SECTION IS TYPICAL AND APPLIES TO ALL AREAS WHERE NEW CONCRETE DECK SLAB IS NOT PROVIDED.

NOTES

1. CONCRETE SHALL HAVE MINIMUM STRENGTH OF 30MPa AT 28 DAYS.
2. REINFORCING STEEL SHALL BE DEFORMED BARS CSA G30.12 GRADE 350.
3. PROVIDE 50mm CONCRETE COVER OVER REINFORCING STEEL.
4. CONCRETE SLAB TO BE MIN 200mm THICK IN ALL PLACES.
5. ALL EXISTING CONCRETE SURFACES AGAINST WHICH CONCRETE OR EPOXY GROUT WILL BE PLACED SHALL BE THOROUGHLY CLEANED.
6. FOR CONCRETE AND REINFORCING DETAILS, SEE DWG NO. C-6.
7. FOR GENERAL NOTES SEE DWG NO. C-6.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

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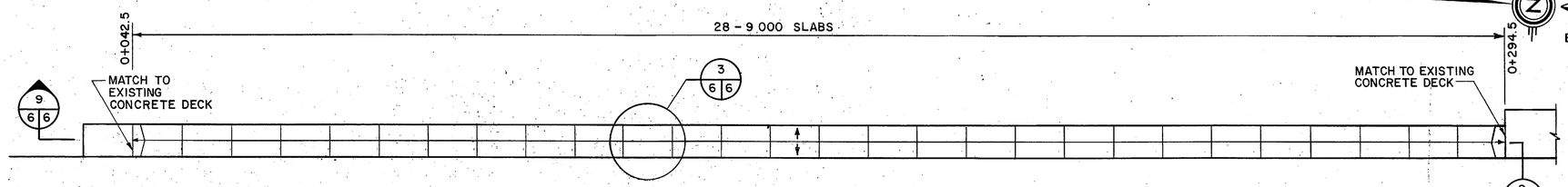
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
CONCRETE DECK PLAN, SECTIONS AND DETAILS

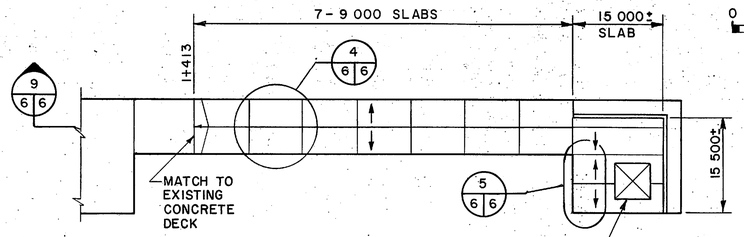
designed by / conçu par: E. SCHMIDT
drawn by / dessiné par: P. SUGRUE
reviewed by / examiné par: Eugene Schmidt
approved by / approuvé par: B. Shell
project date / date du projet: 1983-08-22
project no. / no. du projet: 180129
drawing no. / dessin no.: C-5

PWC A1

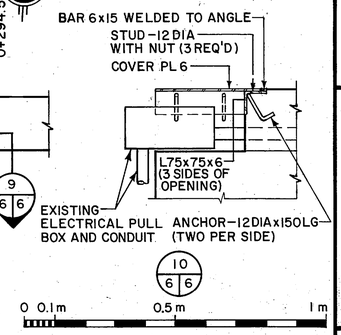


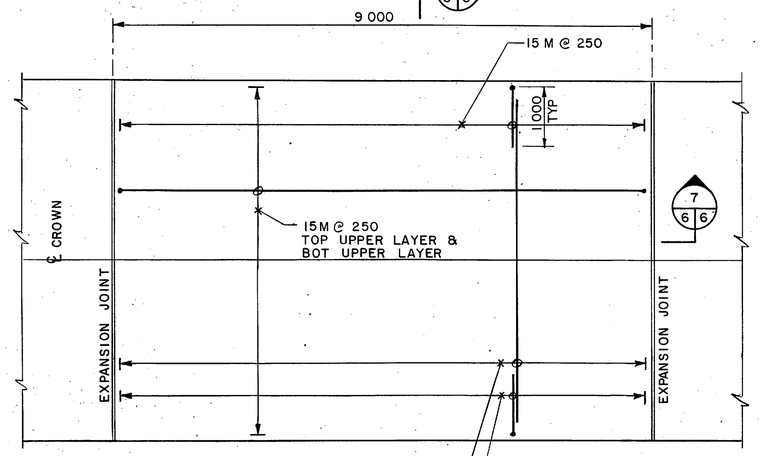
PLAN-NEW CONCRETE DECK-WEST PIER

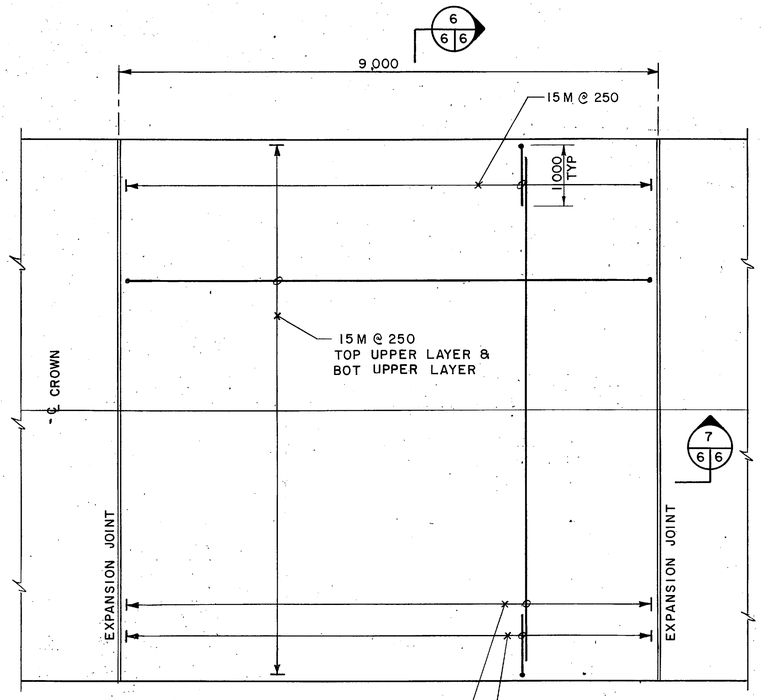
0 10m 50m



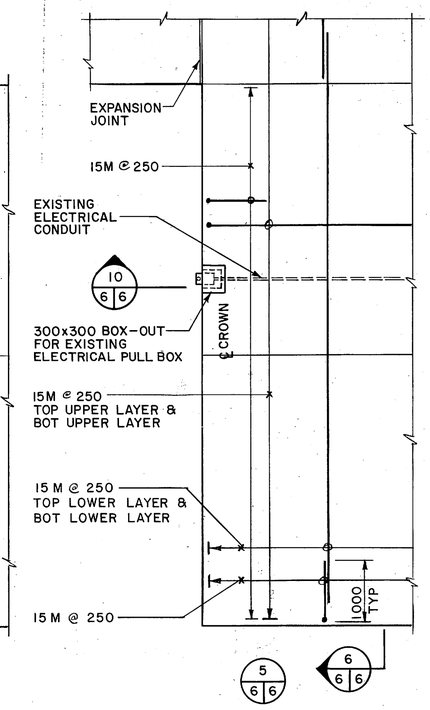
PLAN-NEW CONCRETE DECK-EAST PIER

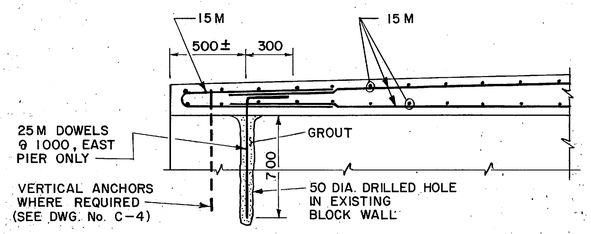


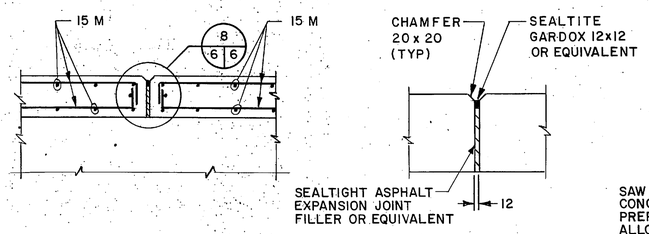


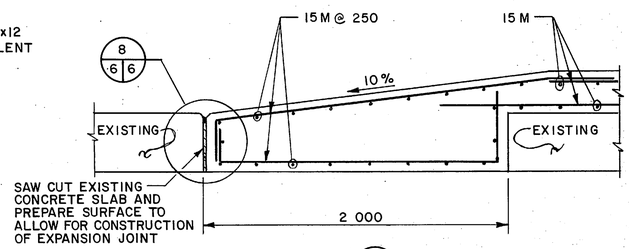


0 1m 5m









0 0.5m 1m 2m

NOTES

1. FOR GENERAL NOTES SEE DWG. No. C-5.
2. STRUCTURAL STEEL SHALL BE HOT DIPPED GALVANIZED AND CONFORM TO CSA G40.21-GRADE 260W.

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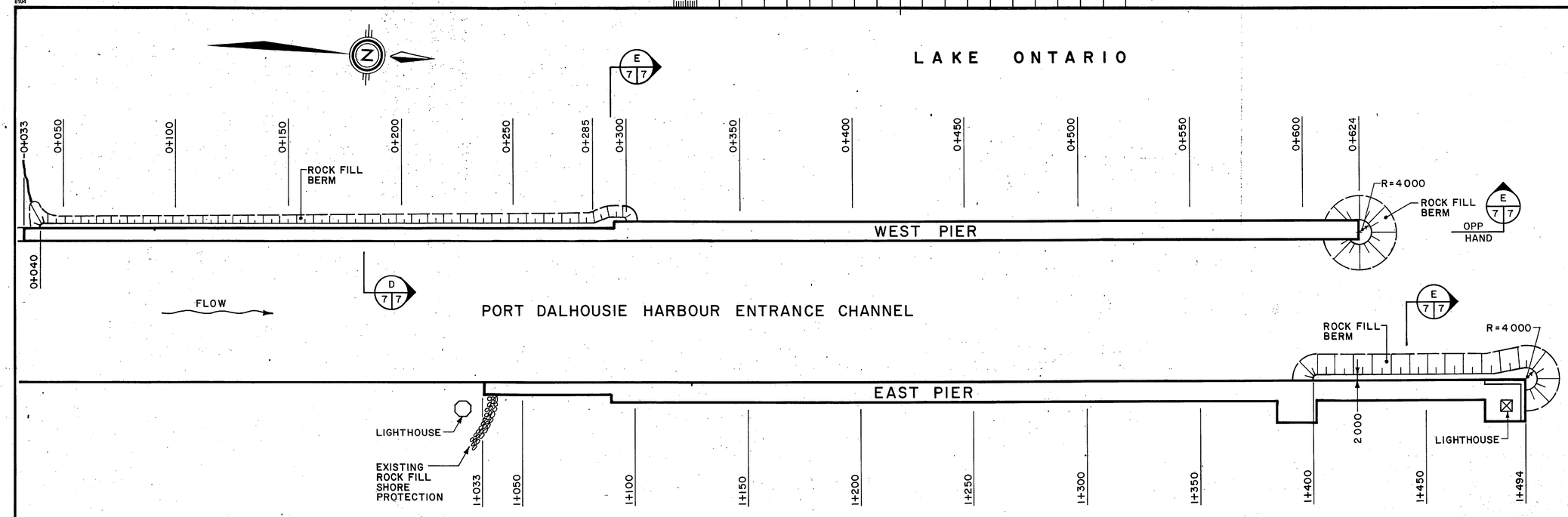
project title / titre du projet
PORT DALHOUSIE ONTARIO
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
CONCRETE DECK DETAILS

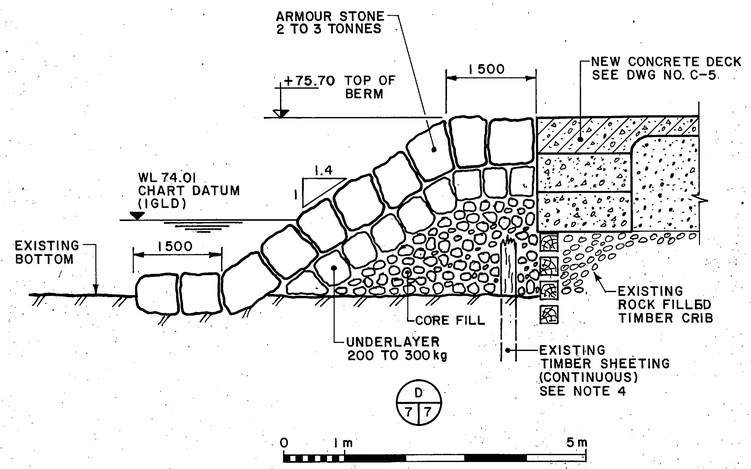
designed by / conçu par: E. SCHMIDT
drawn by / dessiné par: P. SUGRUE
reviewed by / examiné par: Eugene Schmidt
approved by / approuvé par: B. Schmidt
project date / date du projet: 1983-08-22
project no. / no. du projet: 180129
drawing no. / dessin no.: C-6

PWC A1

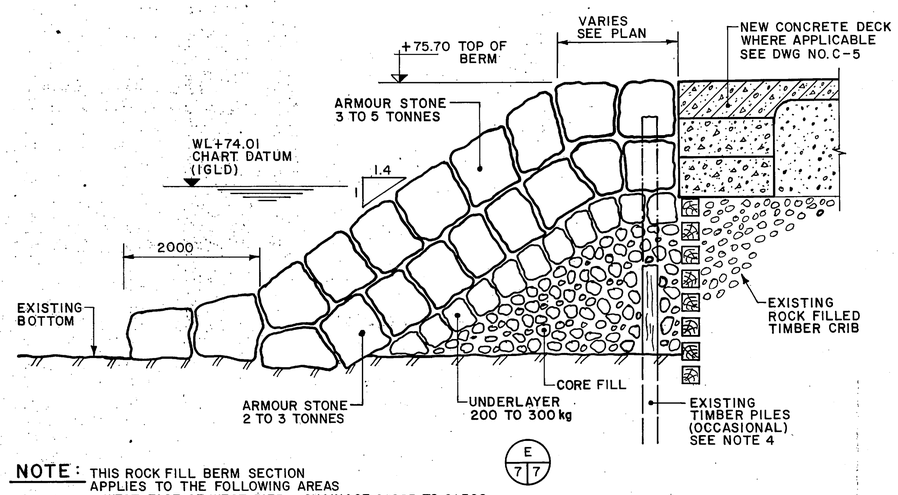


PLAN

0 10 m 50 m 100 m



NOTE: THIS ROCK FILL BERM SECTION APPLIES TO WEST FACE OF WEST PIER CHAINAGE 0+040 TO 0+285



NOTE: THIS ROCK FILL BERM SECTION APPLIES TO THE FOLLOWING AREAS
WEST FACE OF WEST PIER – CHAINAGE 0+285 TO 0+300
OUTER END OF WEST PIER
WEST FACE AND OUTER END OF EAST PIER

NOTES

1. FOR ORIGIN OF CHAINAGES SEE DWG NO. C-2 AND C-3.
2. VOIDS IN CONCRETE BLOCK WALL TO BE FILLED WITH GROUT BEFORE PLACING ROCK FILL AND ARMOUR AGAINST PIERS, SEE DWG NO. C-4.
3. TO GREATEST EXTENT POSSIBLE, ROCK FILL BERMS TO BE PLACED BEFORE NEW CONCRETE DECK HAS BEEN POURED.
4. WHERE EXISTING TIMBER SHEETING AND TIMBER PILING EXTENDS INTO ARMOUR LAYER, SUCH TIMBERS SHALL BE REMOVED OR CUT OFF BELOW LEVEL OF ARMOUR.
5. FOR GENERAL NOTES SEE DWG NO. C-1.

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project title / titre du projet
PORT DALHOUSIE ONTARIO
HARBOUR PIER AND ENTRANCE IMPROVEMENTS AND HARBOUR DEVELOPMENT
FOR:
DEPT. OF FISHERIES AND OCEANS SMALL CRAFT HARBOURS BRANCH

drawing title / titre du dessin
ROCK FILL BERMS
PLAN AND SECTIONS

designed by / conçu par	K. MULLERBECK
drawn by / dessiné par	M. HAAS
reviewed by / examiné par	
approved by / approuvé par	
project date / date du projet	1983-08-22
project no. / no. du projet	180129
drawing no. / dessin no.	C-7

PWC A1

PUBLIC WORKS CANADA

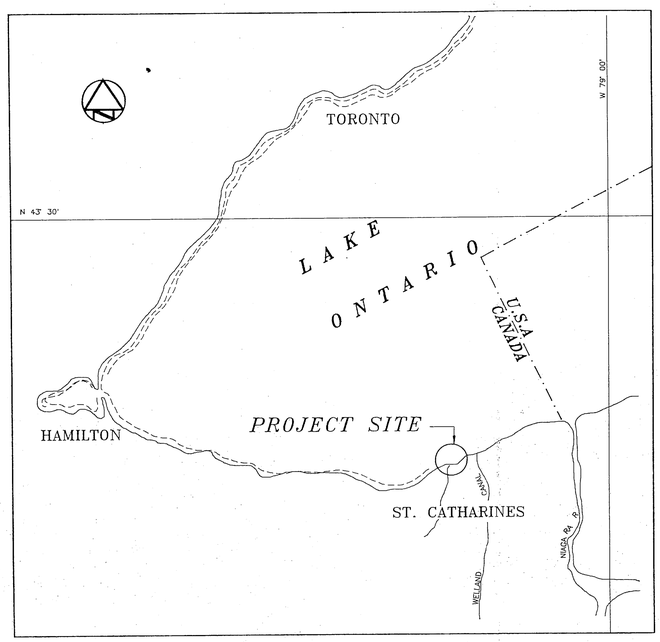
ONTARIO REGION

FOR

FISHERIES & OCEANS CANADA
SMALL CRAFT HARBOURS BRANCH

PORT DALHOUSIE ,ST. CATHARINES ONTARIO

WHARF REPAIRS – STAGE II



Public Works Canada

Travaux publics Canada

DRAWING INDEX

NO.	TITLE
MA000	COVER SHEET
MA001	LOCATION PLAN, EXISTING SECTIONS & DEMOLITION
MA002	PROFILE OF GRADES
MA003	PLAN LAYOUT – WEST AND EAST PIERS
MA004	PLANS, SECTIONS, DETAILS
MA005	PLANS, SECTIONS, DETAILS

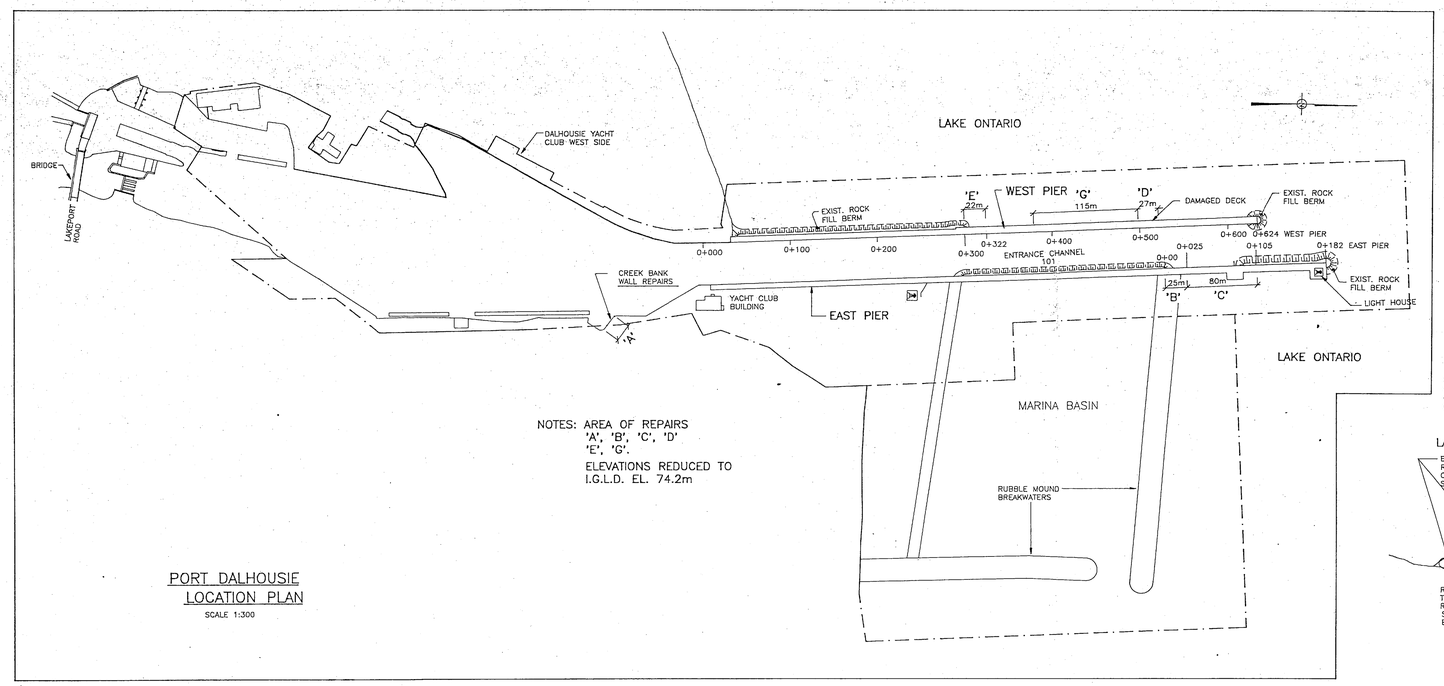
project date / date du projet	93-04-30
project no. / no. du projet	686041
drawing no. / dessine no.	MA000
CADD No.	

PWC B1

PLOT SCALE: 1:100

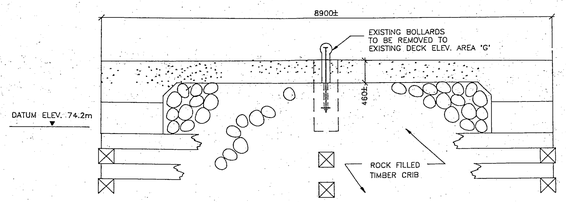
90 06

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 millimetres

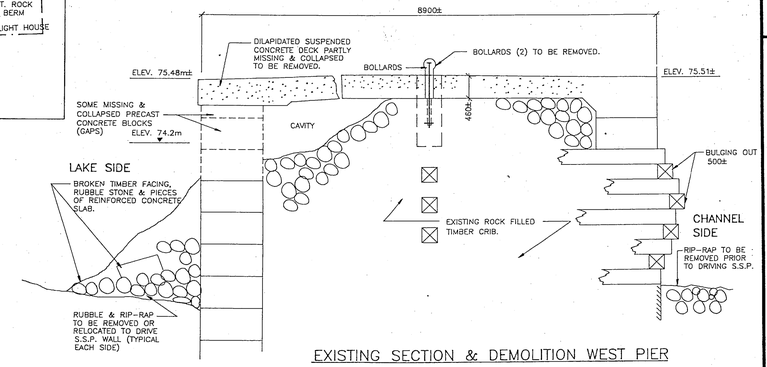


NOTES: AREA OF REPAIRS
'A', 'B', 'C', 'D'
'E', 'G'.
ELEVATIONS REDUCED TO
I.G.L.D. EL. 74.2m

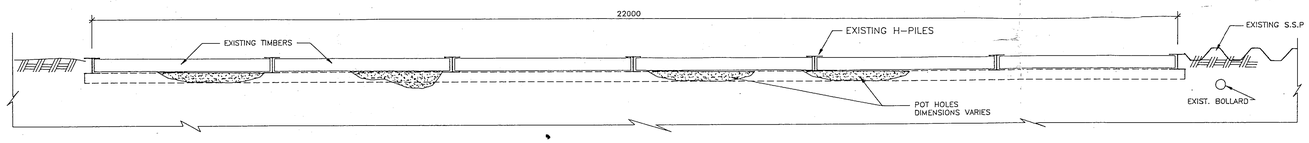
PORT DALHOUSIE
LOCATION PLAN
SCALE 1:300



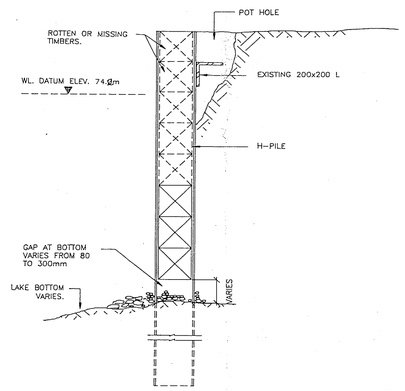
TYPICAL EXISTING SECTION AREA 'E' AND 'G'
SCALE 1:50



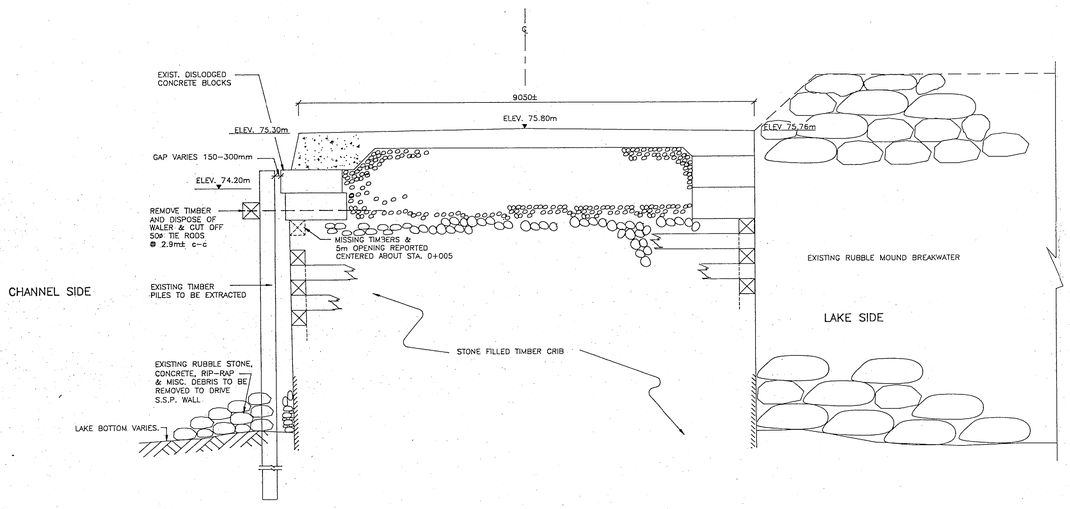
EXISTING SECTION & DEMOLITION WEST PIER
AREA 'D' @ STATION 0+515
SCALE 1:50



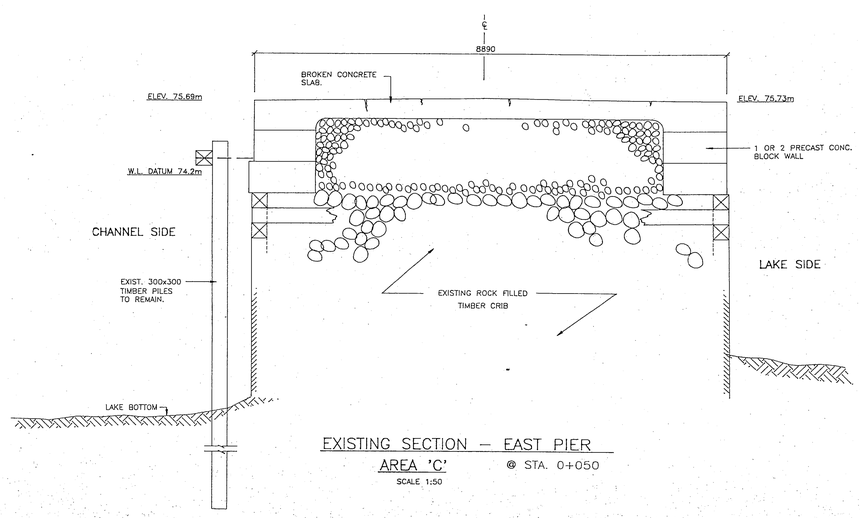
EXISTING PLAN AREA 'A'
SCALE 1:50



EXISTING SECTION—AREA 'A'
SCALE 1:20



EXISTING SECTION & DEMOLITION – EAST PIER
AREA 'B' @ STA. 0+015
SCALE 1:50



EXISTING SECTION – EAST PIER
AREA 'C' @ STA. 0+050
SCALE 1:50

Public Works Canada / Travaux publics Canada
Architectural and Engineering Services / Services d'architecture et de génie
Ontario Region / Région de l'Ontario

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

SMALL CRAFT HARBOURS

Revisions	Date

A B C
A Detail No. / No. du detail
B drawing no. – where detail required / dessin no. – ou detail exige
C drawing no. – where detailed / dessin no. – ou detaille

project title / titre du projet
PORT DALHOUSIE ONTARIO

WHARF REPAIRS STAGE II

drawing title / titre du dessin
LOCATION PLAN
EXISTING SECTIONS
AND DEMOLITION

designed by / conc par: ERIC PULLERITS
drawn by / dessine par: K.PHAM
reviewed by / examine par:
approved by / approuve par:
project date / date du projet: 93-04-30
project no. / no. du projet: 686041
drawing no. / dessine no.: MA001

PWC B1

FILE: V:\686041\86041MA0.DWG UPDATED: 93.07.02 PLOT SCALE:1:100

90.06

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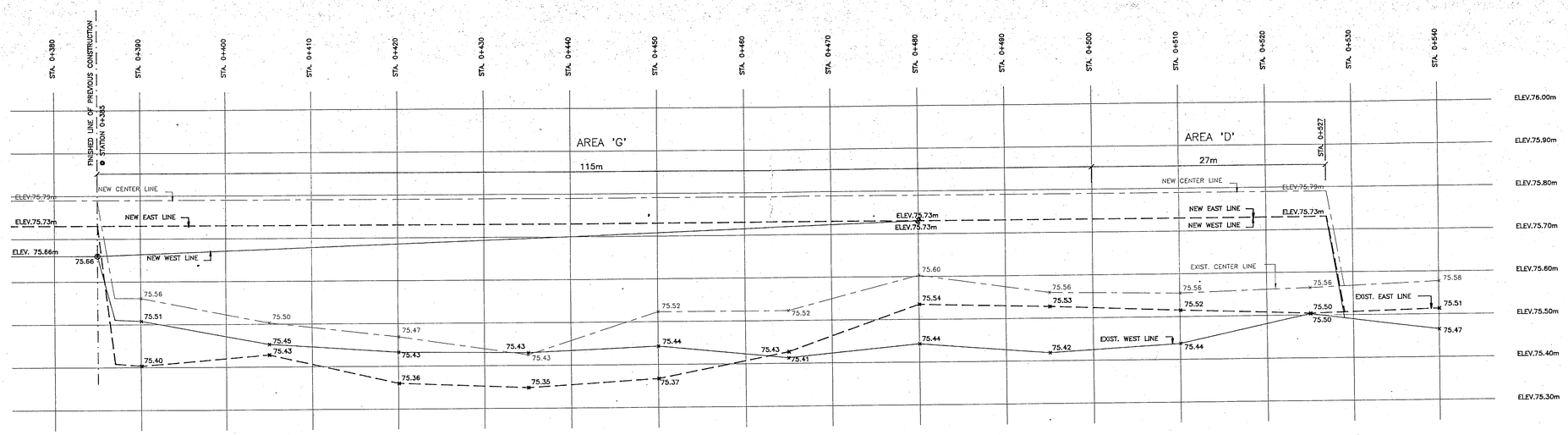
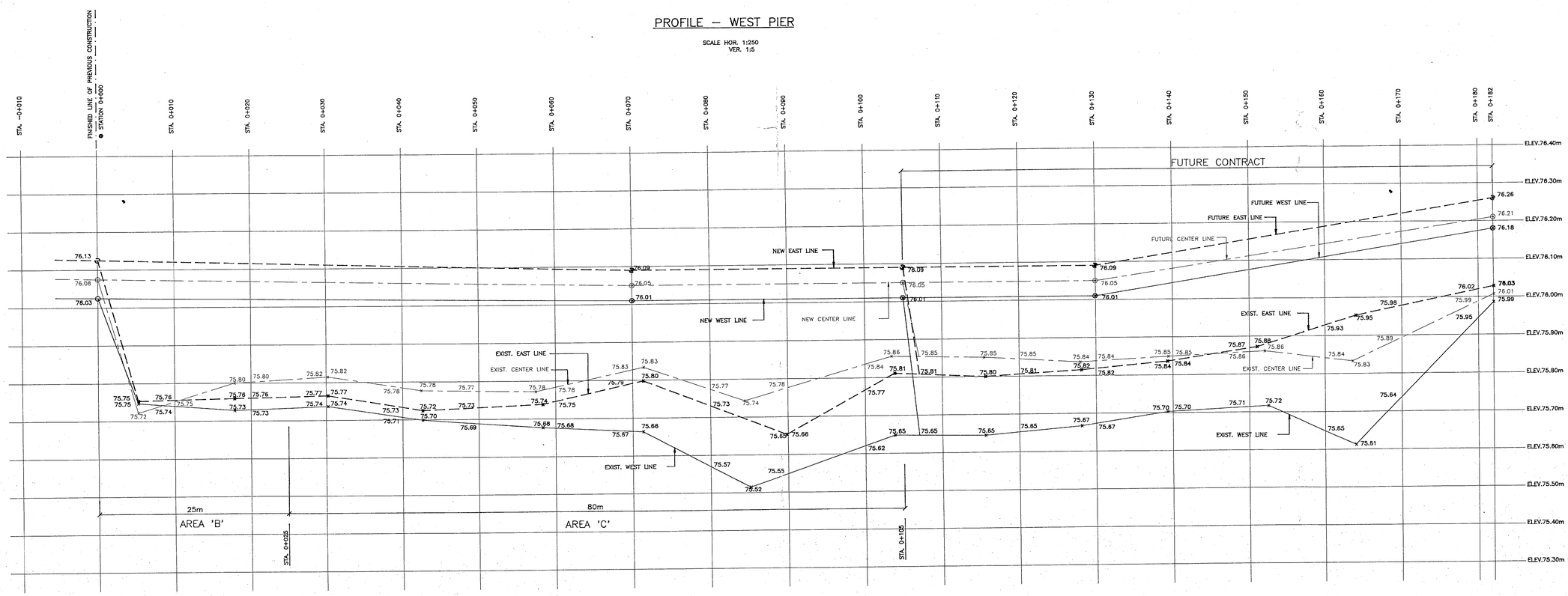


PROFILE – WEST PIER

SCALE HOR. 1:250
VER. 1:5



PROFILE – EAST PIER

SCALE HOR. 1:250
VER. 1:5

⊙ 76.23	NEW ELEVATIONS
x 75.67	ELEVATIONS BASE ON SANDWELL INC.'S (SEPT. 30, 1992)
75.45	ELEVATIONS AT GRID LINES, INTERPOLATED FROM SANDWELL INC.'S

ELEVATIONS SHOWN ARE TO INTERNATIONAL GREAT LAKES DATUM, 1985 WHICH FOR LAKE ONTARIO IS 74.2m

Public Works Canada / Travaux publics Canada
Architectural and Engineering Services / Services d'architecture et de génie
Ontario Region / Région de l'Ontario

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

SMALL CRAFT HARBOURS

Revisions | Date

A B C
A Detail No. / No. du detail
B drawing no. – where detail required / dessin no. – ou detail exige
C drawing no. – where detailed / dessin no. – ou detaille

project title / titre du projet
PORT DALHOUSIE ONTARIO

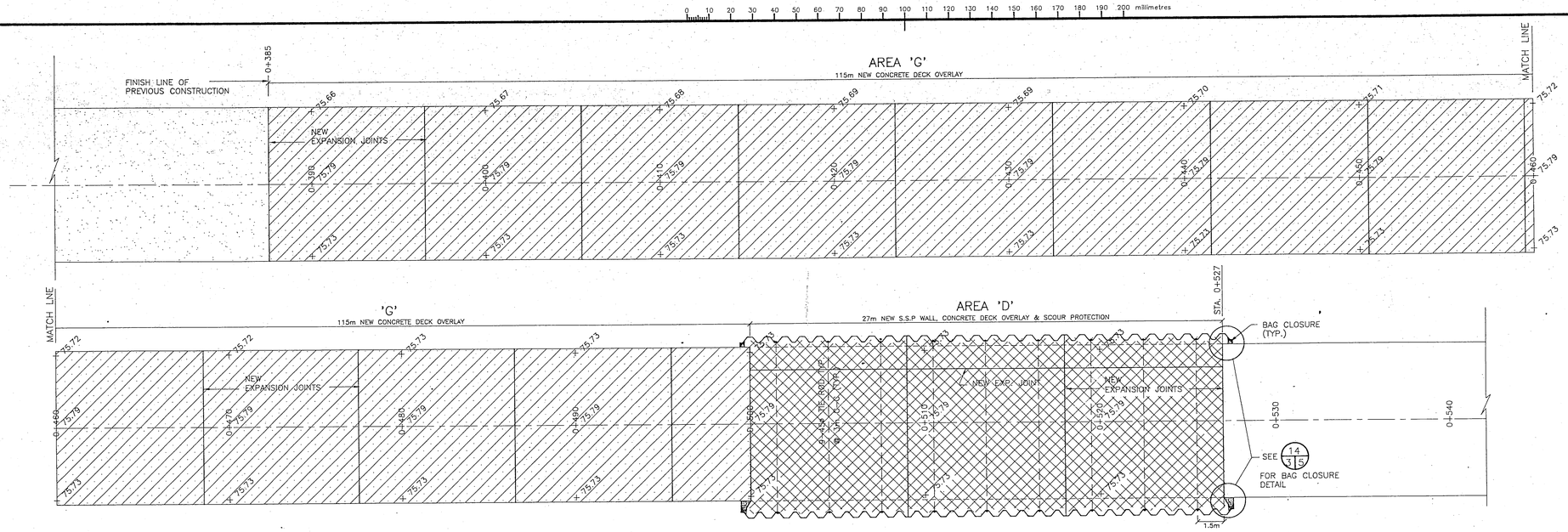
WHARF REPAIR STAGE II

drawing title / titre du dessin
PROFILE OF GRADES
AREAS 'B', 'C', 'D' & 'G'

designed by / conc par	ERIC PULLERITS
drawn by / dessine par	K. PHAM
reviewed by / examine par	
approved by / approuve par	
project date / date du projet	93-04-30
project no. / no. du projet	686041
drawing no. / dessine no.	MA002

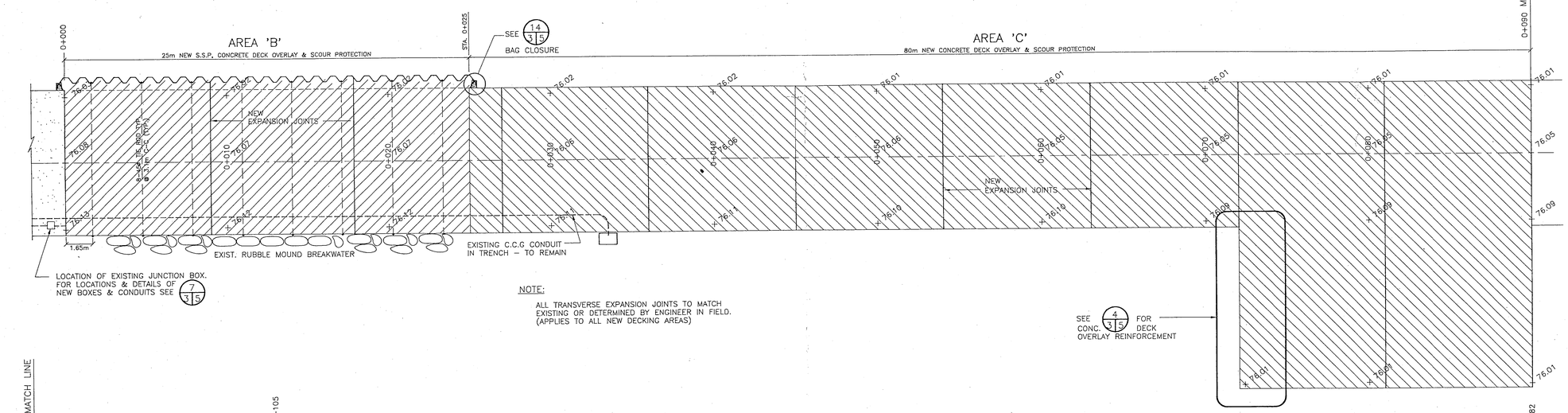
PWC B1

FILE: D:\------\------.DWG UPDATED: 93-06-30 PLOT SCALE:1:100



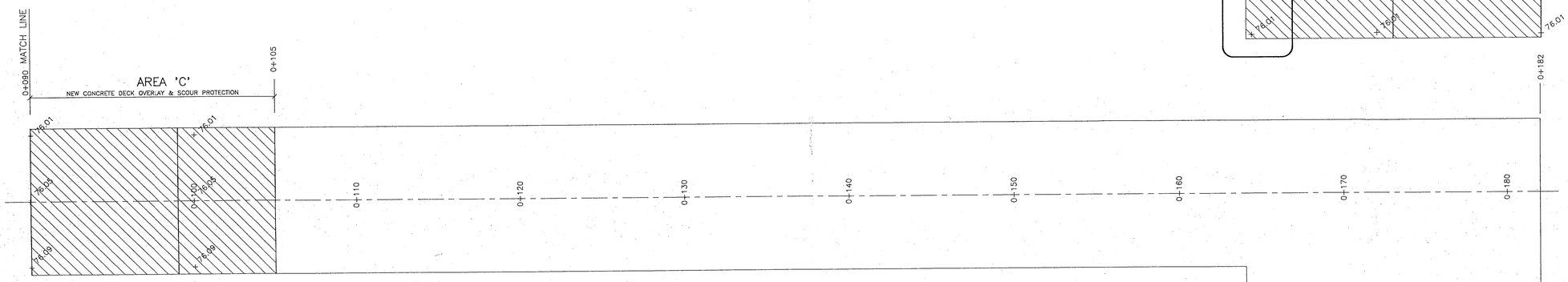
PLAN LAYOUT – WEST PIER

scale 1:125



NOTE:

ALL TRANSVERSE EXPANSION JOINTS TO MATCH EXISTING OR DETERMINED BY ENGINEER IN FIELD. (APPLIES TO ALL NEW DECKING AREAS)



PLAN LAYOUT – EAST PIER

scale 1:125

LEGEND

- EXISTING STRUCTURE
- AREA 'B'
- AREA 'C'
- AREA 'D'
- AREA 'G'
- JUNCTION BOX
- 76.01 ELEVATIONS SHOWN REPRESENT FINAL GRADE

LIGHT HOUSE

Public Works Canada / Travaux publics Canada
Architectural and Engineering Services / Services d'architecture et de génie
Ontario Region / Région de l'Ontario

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Revisions | Date

A Detail No. / No. du detail
B drawing no. – where detail required / dessin no. – ou detail exige
C drawing no. – where detailed / dessin no. – ou detaillé

project title / titre du projet
PORT DALHOUSIE ONTARIO

WHARF REPAIR STAGE II

drawing title / titre du dessin
PLAN LAYOUT–
EAST PIER & WEST PIER
(AREA 'B', 'C', 'D', 'G')

designed by / conc par: ERIC PULLERITS
drawn by / dessine par: K. PHAM
reviewed by / examine par:
approved by / approuve par:
project date / date du projet: 93–04–30
project no. / no. du projet: 686041
drawing no. / dessine no.: MA003

FILE: D:\----\----.DWG UPDATED: 93–06–30 PLOT SCALE: 1:100

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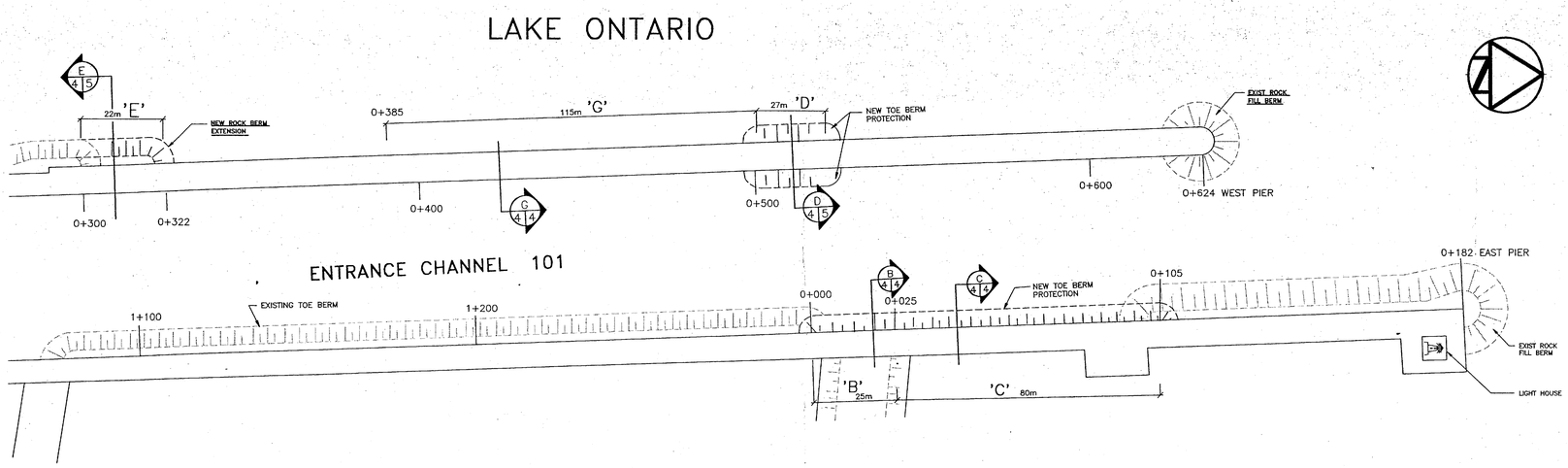
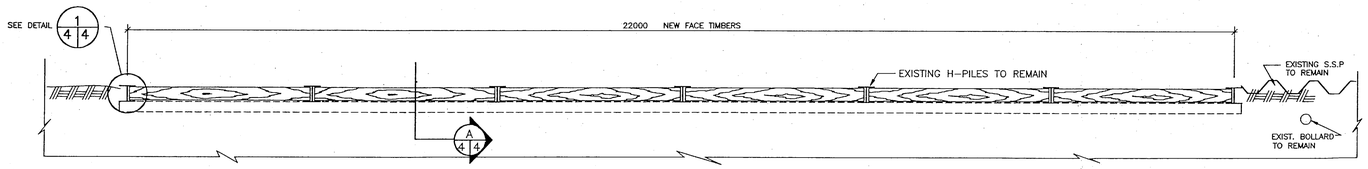
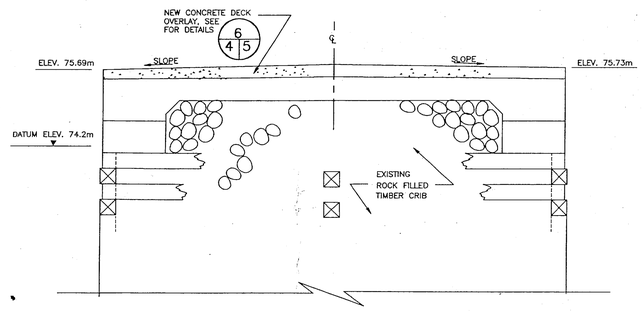


LAYOUT PLAN
SCALE 1:75

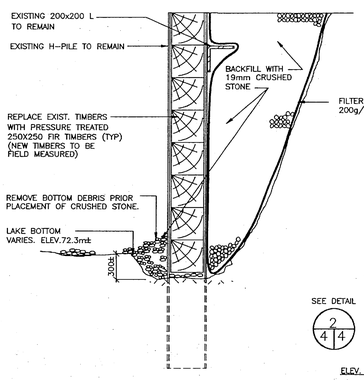


PLAN OF CREEK BANK WALL REPAIRS AREA 'A'
SCALE 1:50

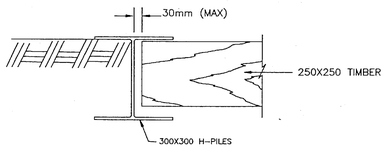


G 4 4 SECTION REPAIRS – AREA 'G'
SCALE 1:50
(ELEVATIONS SHOWN @ STA. 0+420)

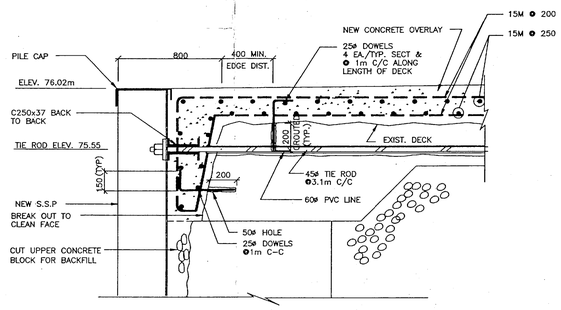
NOTE:
EXISTING FENCE TO BE TEMPORARILY REMOVED DURING CONSTRUCTION AND REPLACED TO SUIT.



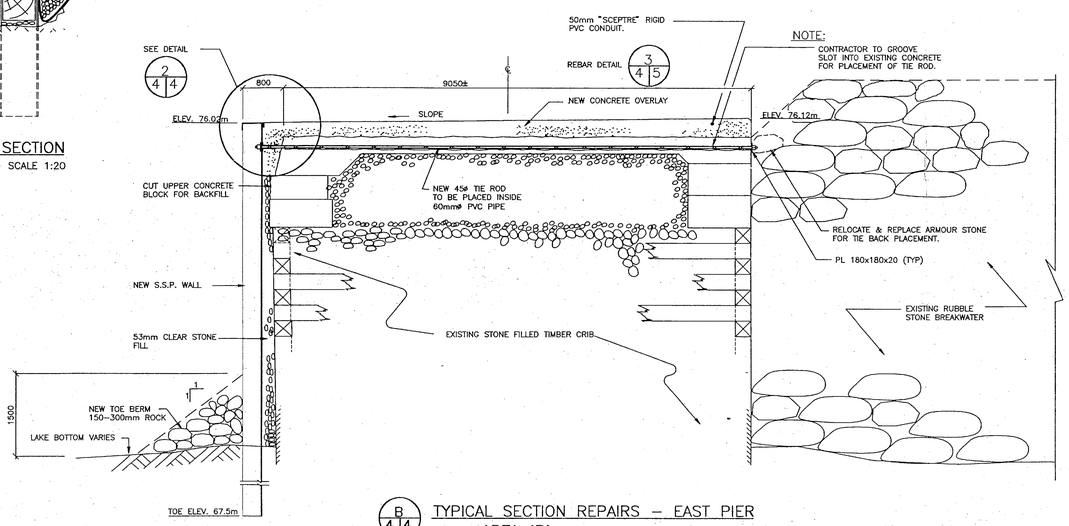
A 4 4 SECTION
SCALE 1:20



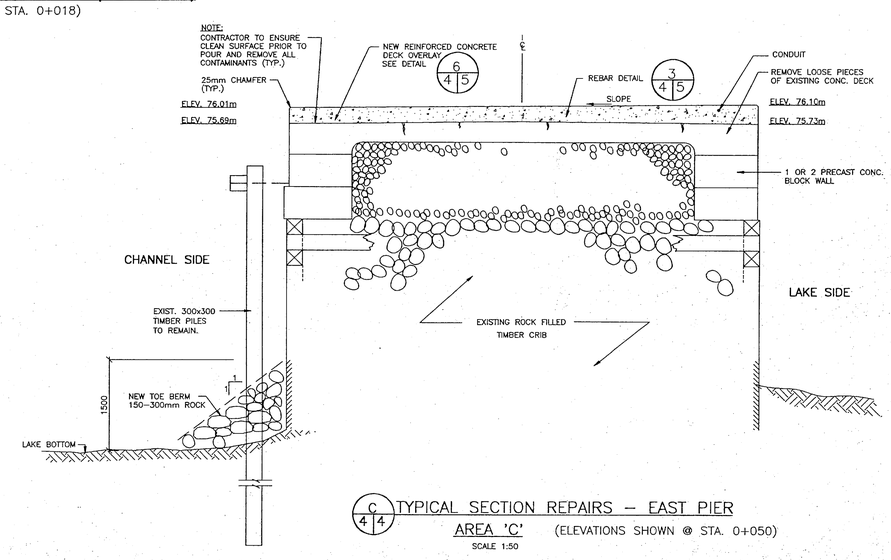
1 4 4 DETAIL
SCALE 1:10



2 4 4 DETAIL CONCRETE DECK – AREA 'B' (WEST SIDE)
SCALE 1:20 (ELEVATIONS SHOWN @ STA. 0+018)



B 4 4 TYPICAL SECTION REPAIRS – EAST PIER
AREA 'B' (ELEVATIONS SHOWN @ STA. 0+018)
SCALE 1:50



C 4 4 TYPICAL SECTION REPAIRS – EAST PIER
AREA 'C' (ELEVATIONS SHOWN @ STA. 0+050)
SCALE 1:50

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FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

SMALL CRAFT HARBOURS

Revisions	Date

GENERAL NOTES: (APPLY FOR ALL AREAS)

1. 75mm COVER FOR ALL REINFORCEMENTS (TYP.) EXPOSED FACE
2. STAMPED CONCRETE PATTERN TO MATCH EXISTING PATTERN.
3. ALL ANCHOR DOWELS TO BE GROUTED INTO EXISTING CONCRETE.
5. LAKE ONTARIO W.L. DATUM 74.2m

A B C
A Detail No. No. du detail
B drawing no. – where detail required dessin no. – ou detail exige
C drawing no. – where detailed dessin no. – ou detaille

project title / titre du projet
PORT DALHOUSIE ONTARIO

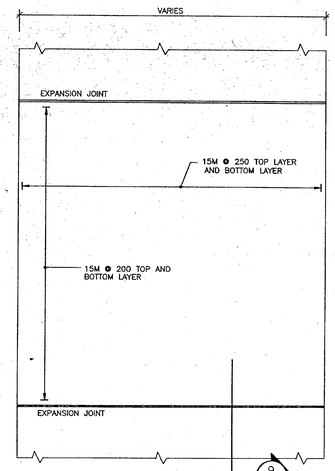
WHARF REPAIRS STAGE II

drawing title / titre du dessin
PLANS
SECTIONS
DETAIL

designed by / conc par: ERIC PULLERITS
drawn by / dessine par: K.P
reviewed by / examine par:
approved by / approuve par:
project date / date du projet: 93-04-30
project no. / no. du projet: 686041
drawing no. / dessine no.: MA004

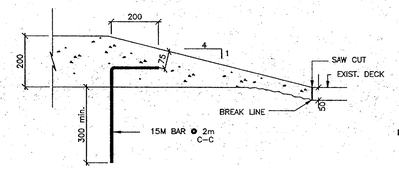
PWC B1

FILE: D:\----\----.DWG UPDATED: 93-06-30 PLOT SCALE: 1:100

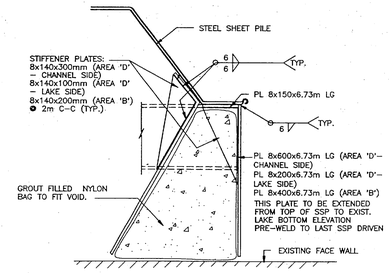


PLAN
SCALE 1:75

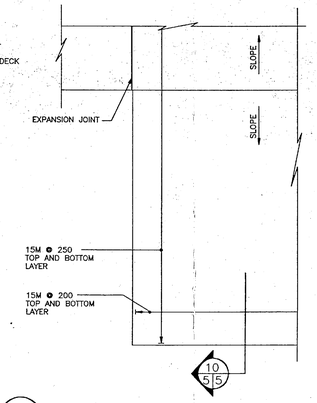
3/4 5 CONC. DECK OVERLAY REINFORCEMENT
WEST PIER – EAST PIER



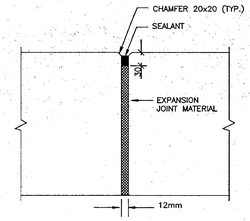
8/5 5 RAMP DOWN AT LIMITS OF CONC. OVERLAY (TYP.)
SCALE 1:10



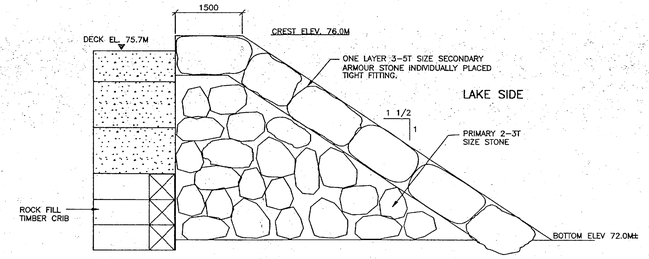
16/5 5 DETAIL
SCALE 1:10



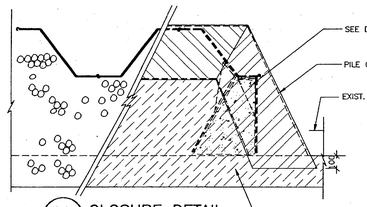
4/3 5 CONCRETE DECK OVERLAY REINFORCEMENT
SCALE 1:100



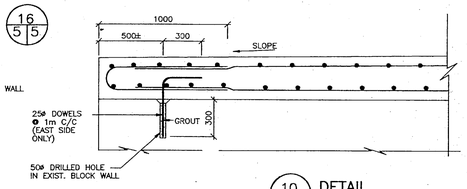
9/5 5 DETAIL
N.T.S.



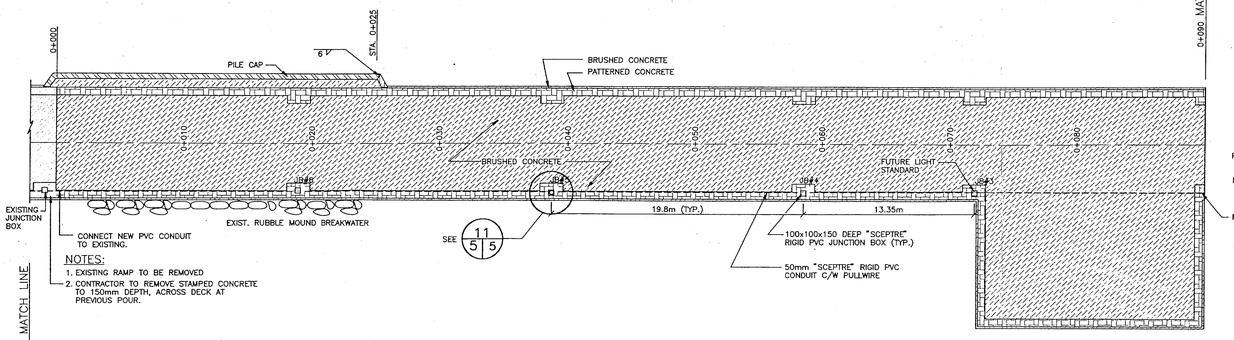
E/4 5 WEST PIER – RUBBLE MOUND BERM
AREA 'E'



14/3 5 CLOSURE DETAIL
SCALE 1:20

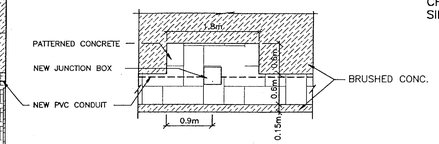


10/5 5 DETAIL
SCALE 1:20

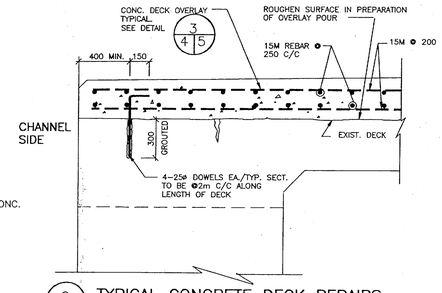


NOTES:
1. EXISTING RAMP TO BE REMOVED
2. CONTRACTOR TO REMOVE STAMPED CONCRETE TO 150mm DEPTH, ACROSS DECK AT PREVIOUS POUR.

7/3 5 PLAN DETAIL OF PATTERNED CONCRETE AND NEW JUNCTION BOX LOCATIONS – EAST PIER
SCALE 1:200

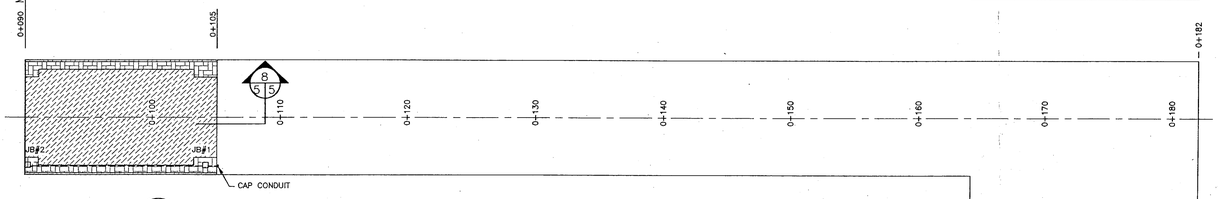


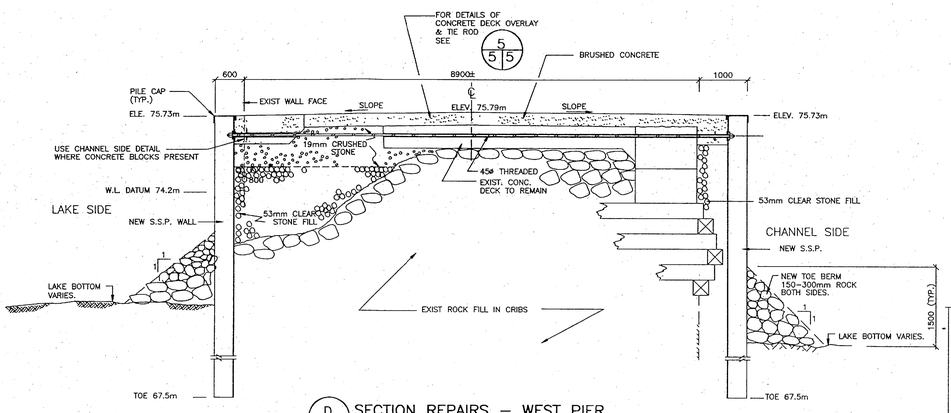
11/5 5 DETAIL (TYP.)
SCALE 1:50



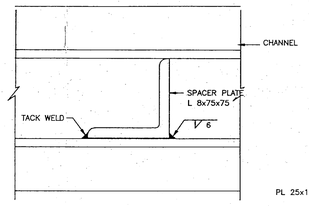
6/4 5 TYPICAL CONCRETE DECK REPAIRS
AREA 'C' & 'G'
SCALE 1:20

NOTES:
1. CONFIRM WITH THE ENGINEER EXACT LOCATIONS OF CONDUITS AND JUNCTION BOXES AT TIME OF INSTALLATION
2. PROVIDE CONDUIT EXPANSION JOINTS ON ALL CONDUITS CROSSING WHARF CONSTRUCTION AND EXPANSION JOINTS
3. SAW-CUT AND CHIP OUT ADDITIONAL CHANNEL FOR CONDUIT AND JUNCTION BOX PLACEMENT IN CONCRETE DECK, FILL WITH CONCRETE. PLACE JOINT MATERIAL AROUND CONDUIT TO MAINTAIN EXPANSION JOINT.

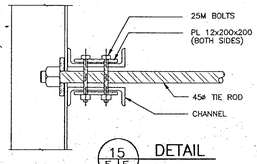




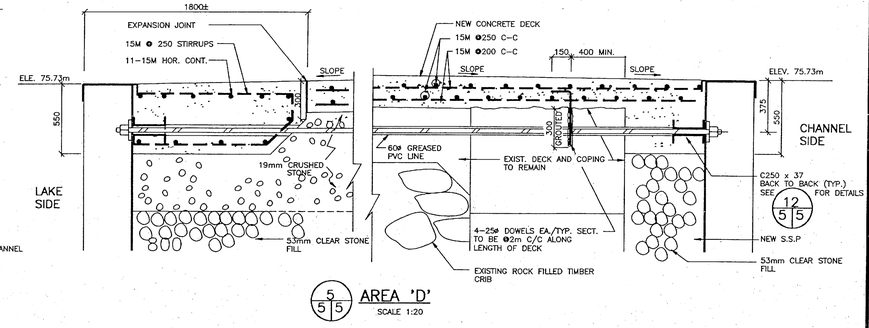
D/4 5 SECTION REPAIRS – WEST PIER
AREA 'D' (ELEVATIONS SHOWN @ STA. 0+515)
SCALE 1:50



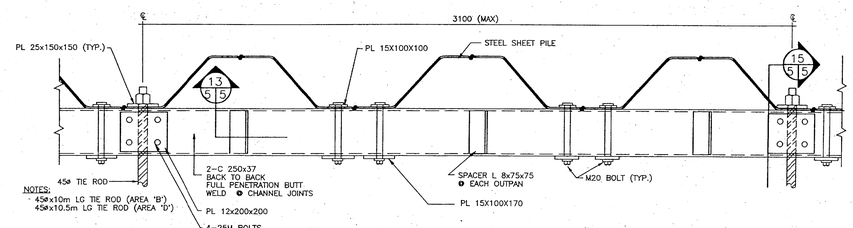
13/5 5 DETAIL
N.T.S.



15/5 5 DETAIL
N.T.S.



5/5 5 AREA 'D'
SCALE 1:20



NOTES:
45ø x10m LG TIE ROD (AREA 'B')
45ø x10.5m LG TIE ROD (AREA 'D')

12/5 5 NEW S.S.P. WALL DETAIL – TYPICAL
N.T.S.

Public Works Canada / Travaux publics Canada
Architectural and Engineering Services / Services d'architecture et de génie
Ontario Region / Région de l'Ontario

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Revisions | Date

A/B C
A Detail No. No. du detail
B drawing no. – where detail required dessin no. – ou detail exige
C drawing no. – where detailed dessin no. – ou detaille

project title / titre du projet
PORT DALHOUSIE ONTARIO

WHARF REPAIRS STAGE II

drawing title / titre du dessin
PLANS
SECTIONS
DETAILS

designed by / conc par: ERIC PULLERITS
drawn by / dessine par: K.P
reviewed by / examine par:
approved by / approuve par:
project date / date du projet: 93–04–26
project no. / no. du projet: 686041
drawing no. / dessine no.: MA005

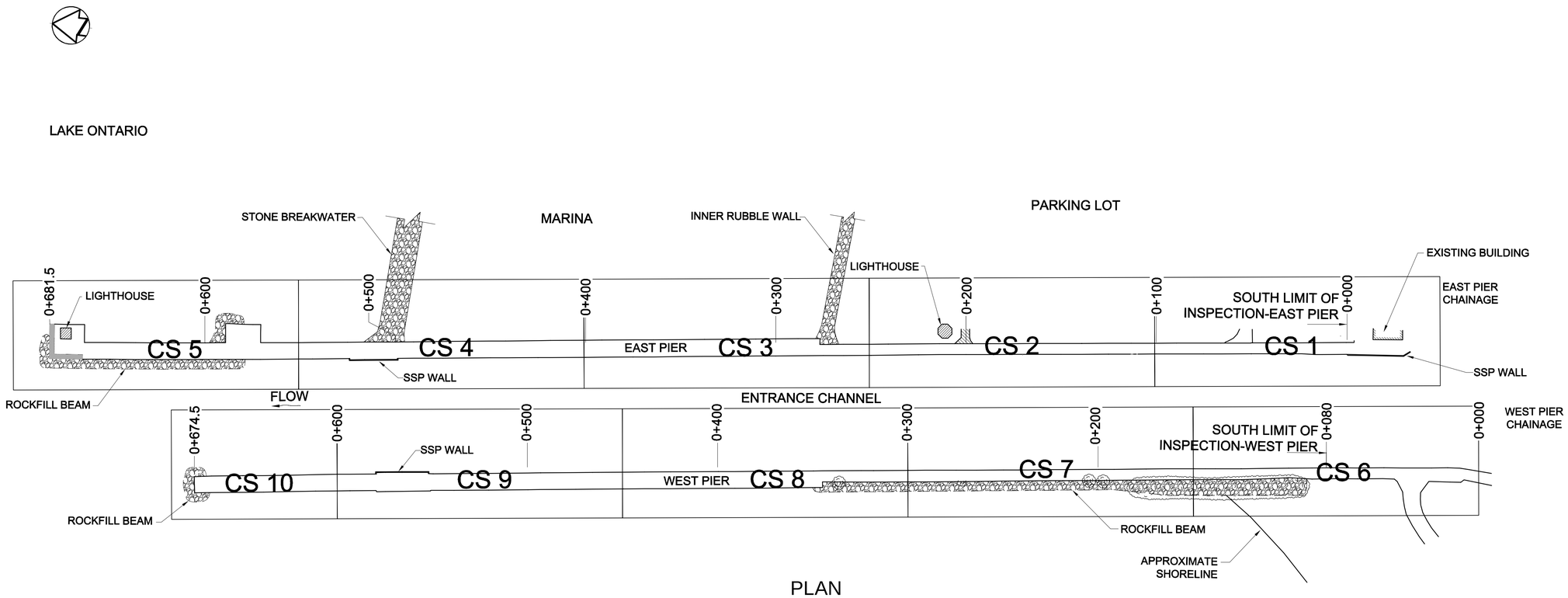
PWC B1

FILE: D:\-----\-----.DWG UPDATED: 93.06.30 PLOT SCALE: 1:100

Appendix B

Port Dalhousie, ON –East and West Piers
Draft Condition and Structural Evaluation Report

- Condition Survey Drawings
- Diver's Notes



PLAN
1:1250

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

project title
titre du projet

PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title
titre du dessin

DRAWING INDEX

drawn by
dessine par: K.K.

designed by
conc par:

approved by
approuve par: J.W.

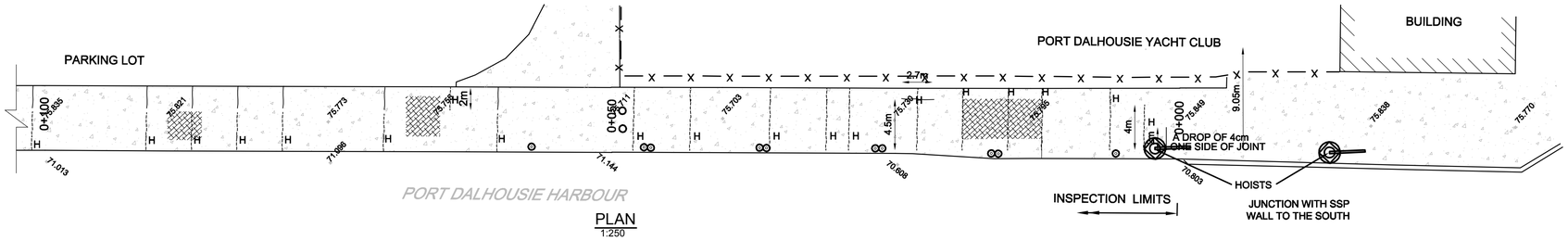
bid
offre

project manager
administrateur de projets

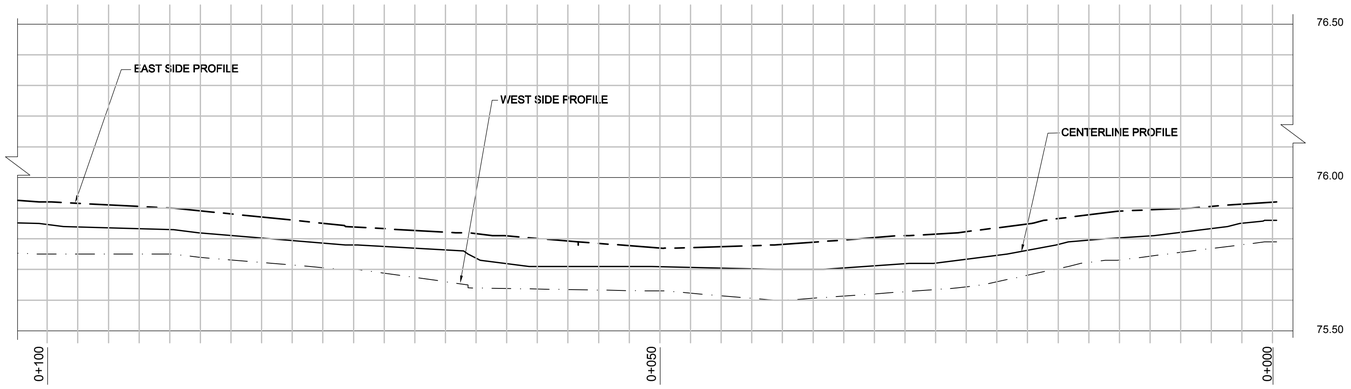
project date
date du projet: 2015-01-07

project no.
no. du projet: 60334134

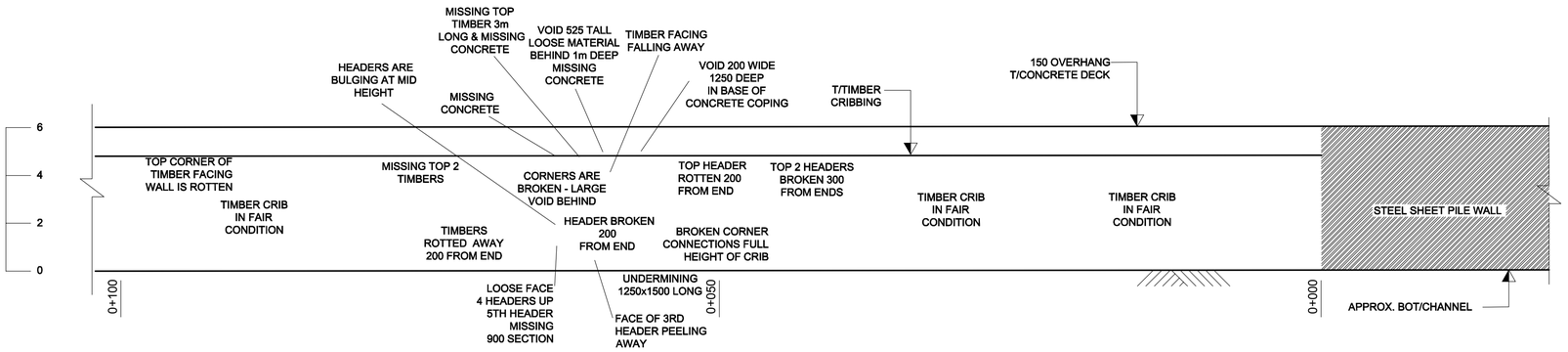
drawing no.
dessine no.: CS 0



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



WEST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
— X —	CHAINLINK FENCE
75.795	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

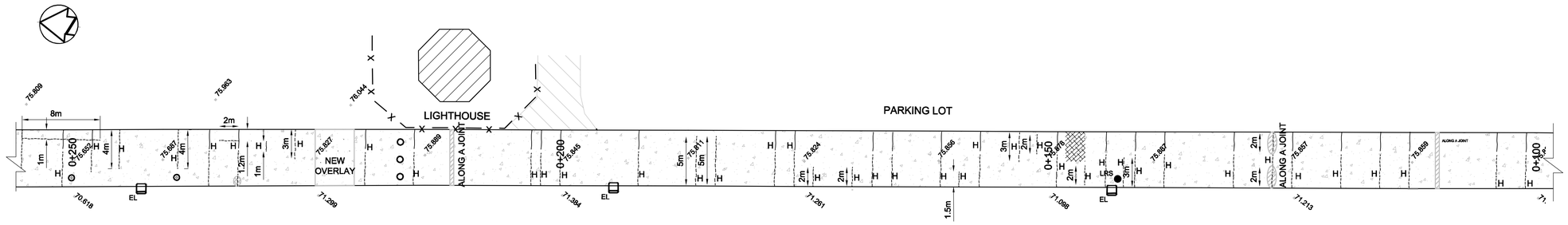
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

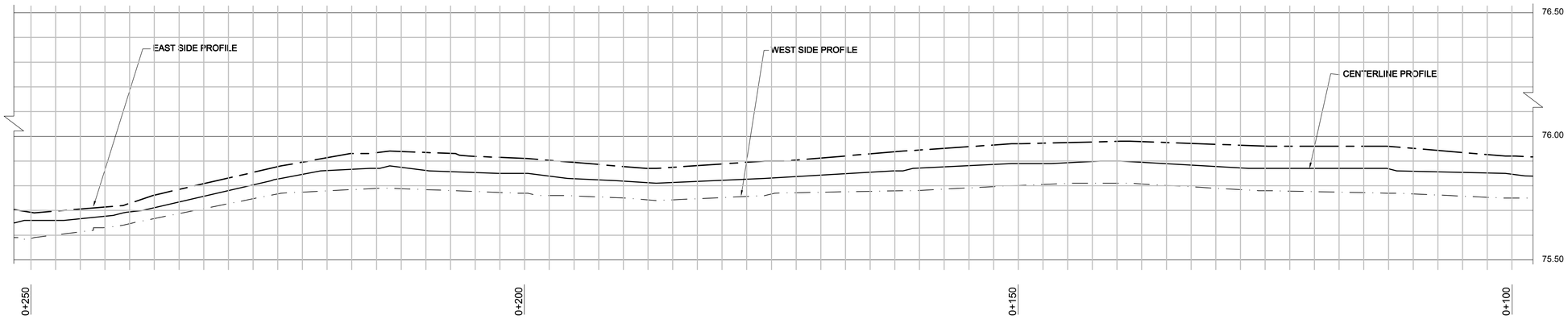
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
EAST PIER
PLAN, PROFILE AND ELEVATION
STA. 0+000 TO 0+100

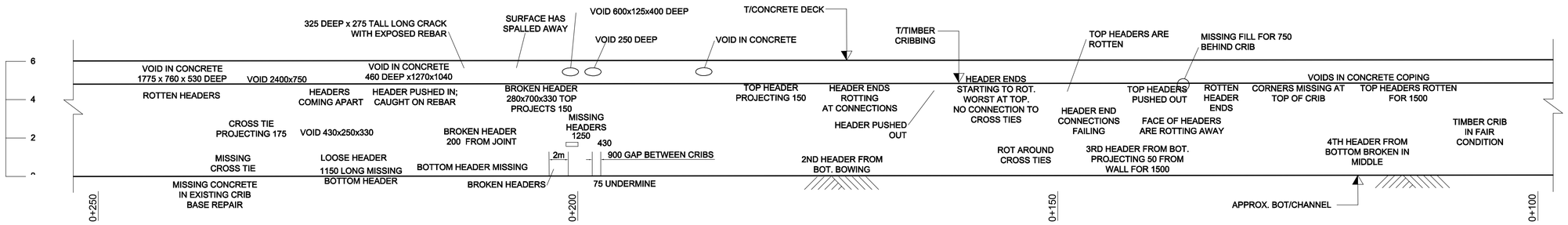
drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre
project manager / administrateur de projets
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 1



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



WEST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

- BOLLARD
- HP — HYDRO POLE
- JB — JUNCTION BOX
- EL — EMERGENCY LADDER
- LRS — LIFE RING STATION
- POST
- PP — POWER PEDESTAL
- CHAINLINK FENCE
- 75.795 — SPOT ELEVATION
- EAST SIDE PROFILE
- WEST SIDE PROFILE
- CENTERLINE PROFILE
- M — MEDIUM CRACKS IN CONCRETE
- H — HAIRLINE CRACKS IN CONCRETE
- MAP CRACKING
- SPALLS
- DELAMINATIONS
- HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

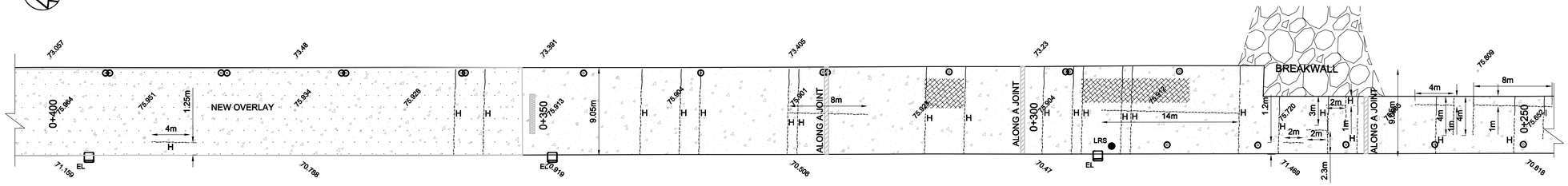
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

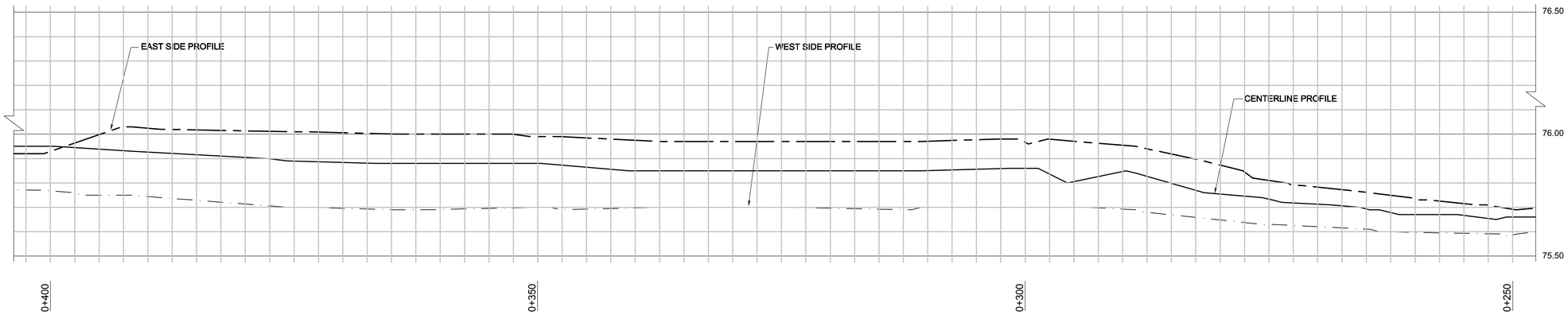
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
EAST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+100 TO 0+250

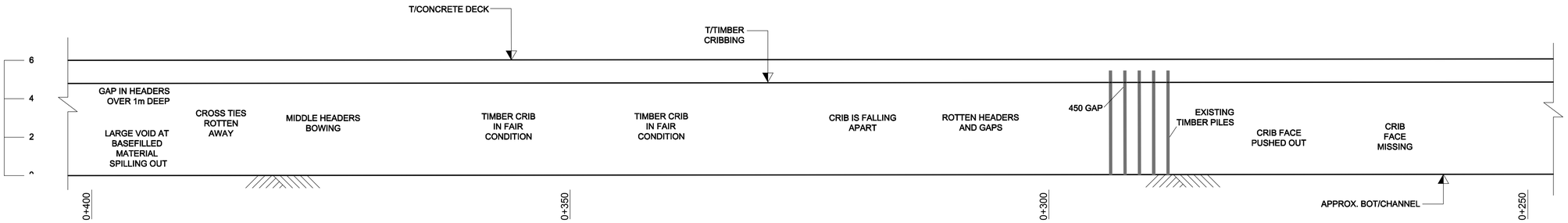
drawn by / dessine par: K.K
designed by / conc par:
approved by / approuve par: J.W.
bid / offre:
project manager / administrateur de projets:
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 2



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



WEST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
— X —	CHAINLINK FENCE
75.795	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

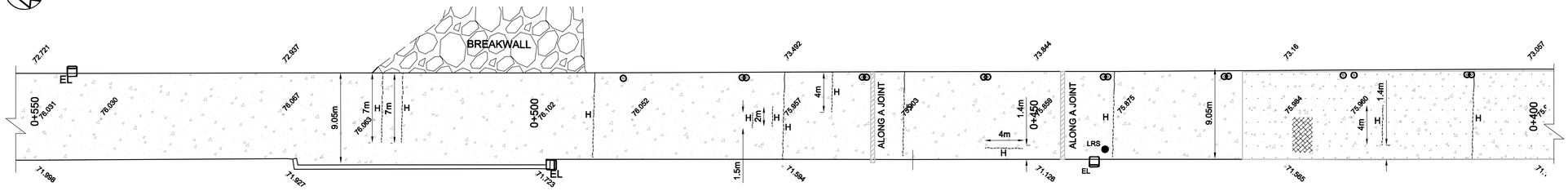
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

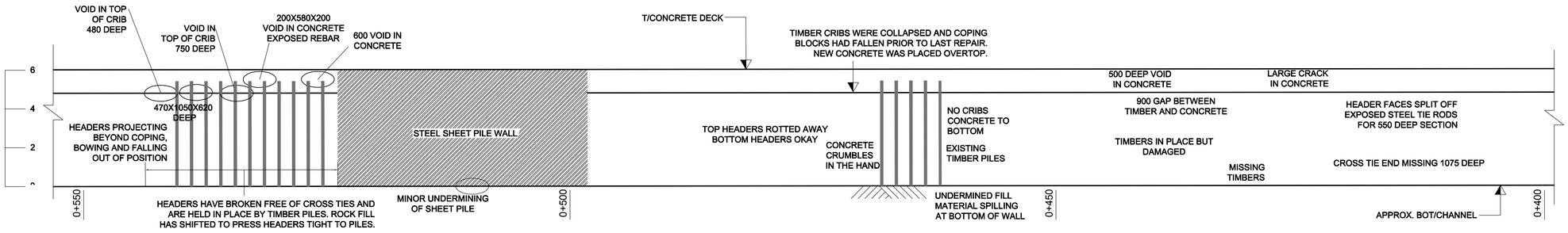
drawing title / titre du dessin
EAST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+250 TO 0+400

drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre
project manager / administrateur de projets
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 3



PLAN
1:250

TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



WEST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

- BOLLARD
- HP — HYDRO POLE
- JB — JUNCTION BOX
- EL — EMERGENCY LADDER
- LRS — LIFE RING STATION
- POST
- PP — POWER PEDESTAL
- CHAINLINK FENCE
- 75.795 — SPOT ELEVATION
- EAST SIDE PROFILE
- WEST SIDE PROFILE
- CENTERLINE PROFILE
- M — MEDIUM CRACKS IN CONCRETE
- H — HAIRLINE CRACKS IN CONCRETE
- MAP CRACKING
- SPALLS
- DELAMINATIONS
- HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

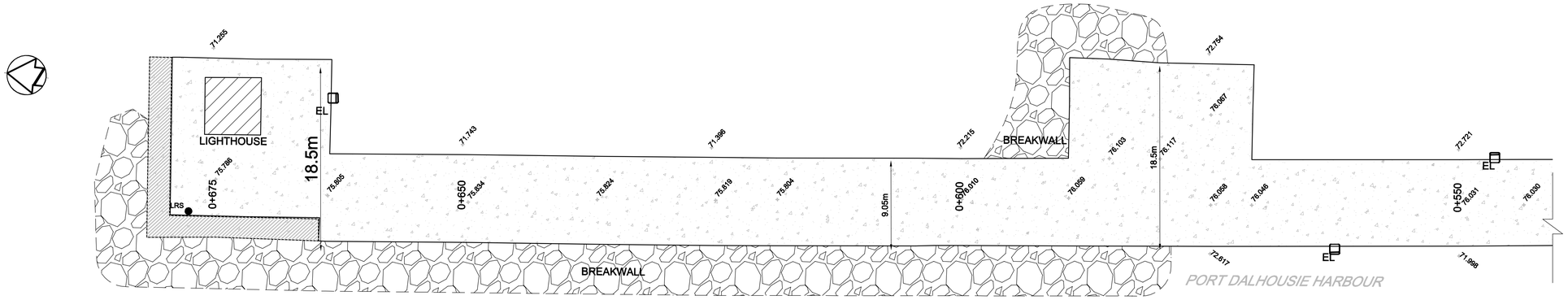
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
EAST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+400 TO 0+550

drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre:
project manager / administrateur de projets:
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 4



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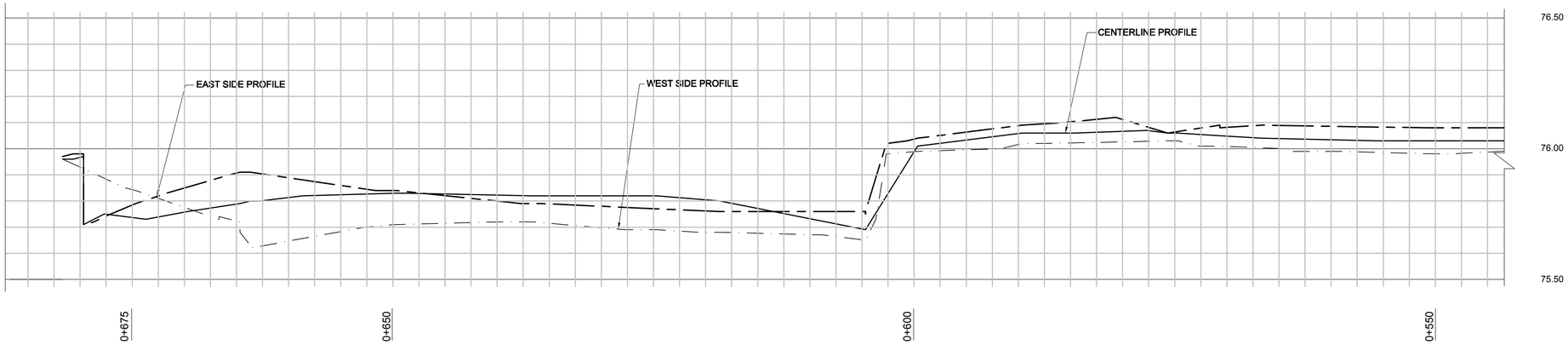
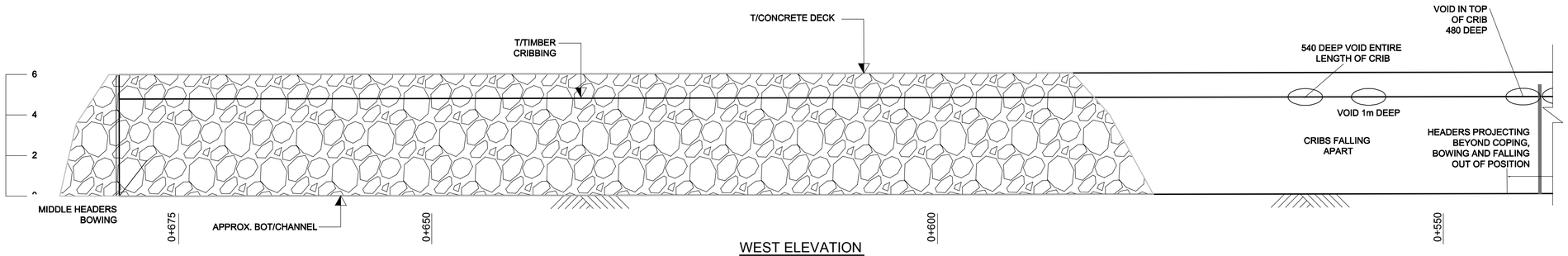


TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



WEST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

- BOLLARD
- HP — HYDRO POLE
- JB — JUNCTION BOX
- EL — EMERGENCY LADDER
- LRS — LIFE RING STATION
- POST
- PP — POWER PEDESTAL
- CHAINLINK FENCE
- 75.786 — SPOT ELEVATION
- EAST SIDE PROFILE
- WEST SIDE PROFILE
- CENTERLINE PROFILE
- M — MEDIUM CRACKS IN CONCRETE
- H — HAIRLINE CRACKS IN CONCRETE
- MAP CRACKING
- SPALLS
- DELAMINATIONS
- HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

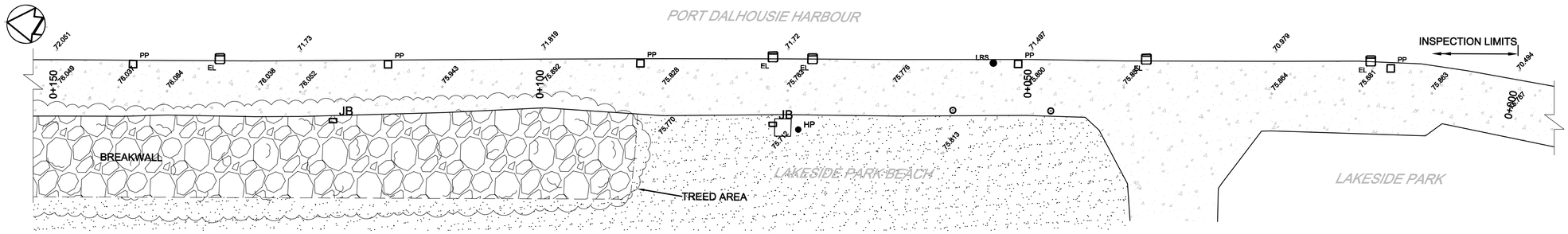
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

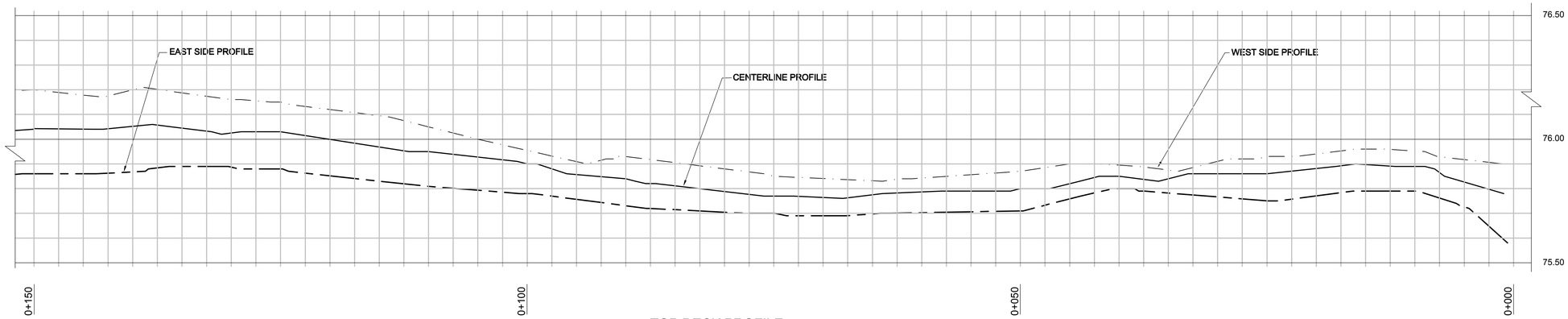
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
EAST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+550 TO 0+681.5

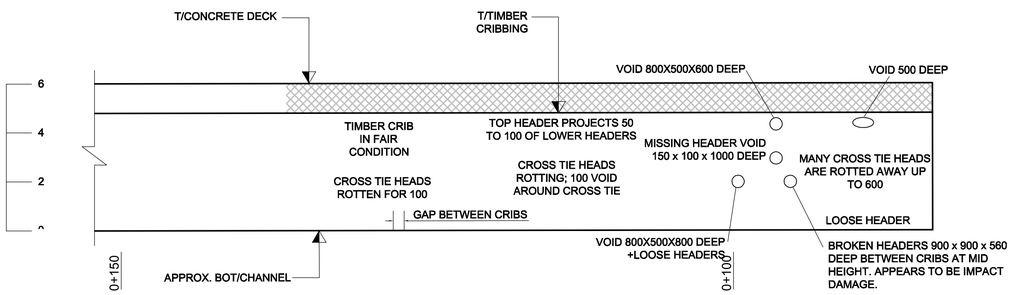
drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre:
project manager / administrateur de projets:
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 5



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



EAST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
— X —	CHAINLINK FENCE
75.786	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

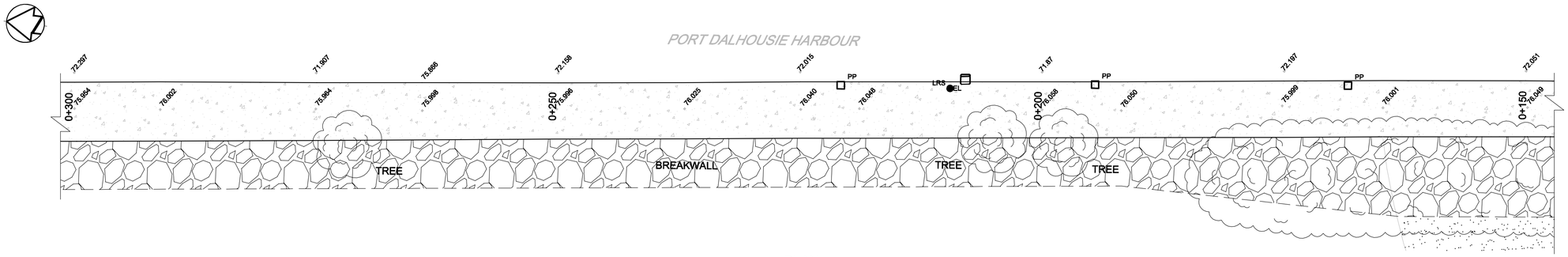
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

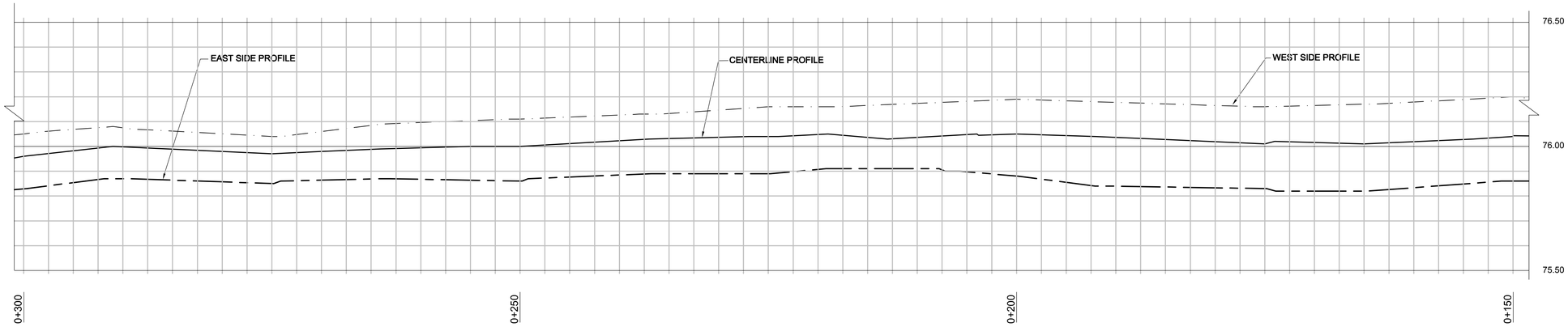
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
WEST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+000 TO 0+150

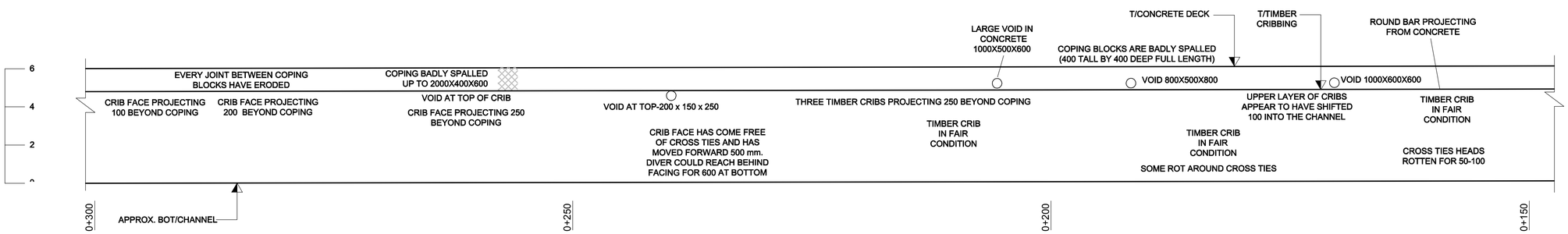
drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre:
project manager / administrateur de projets:
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 6



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



EAST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
— x —	CHAINLINK FENCE
75.795	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

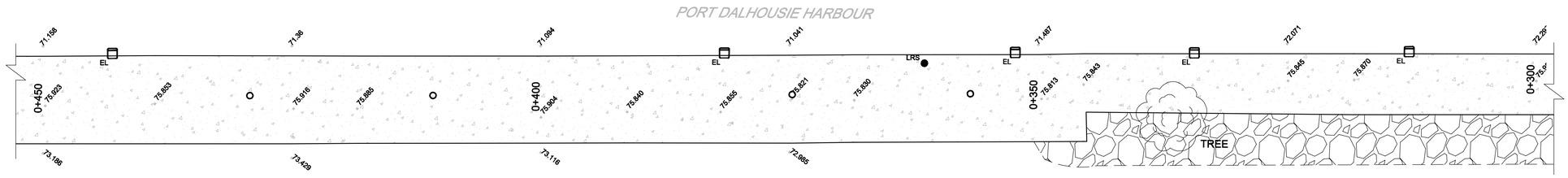
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

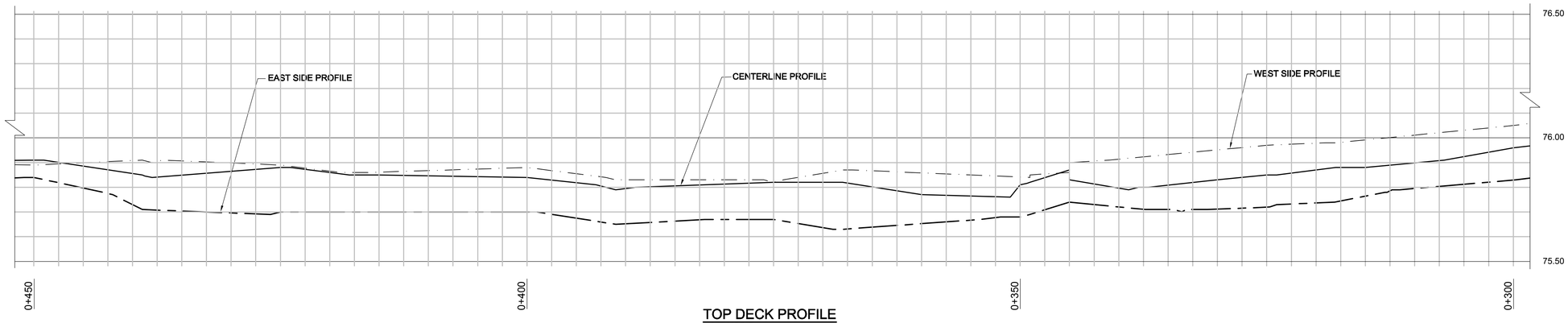
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
WEST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+150 TO 0+300

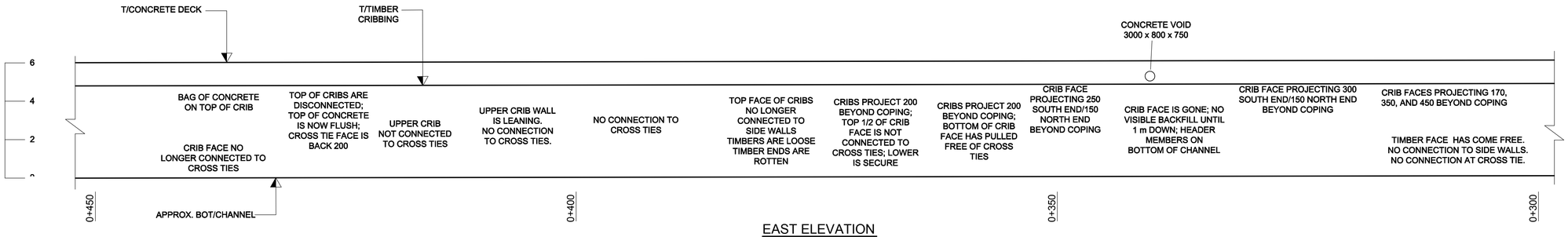
drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre:
project manager / administrateur de projets:
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 7



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



EAST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
— x —	CHAINLINK FENCE
75.785	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

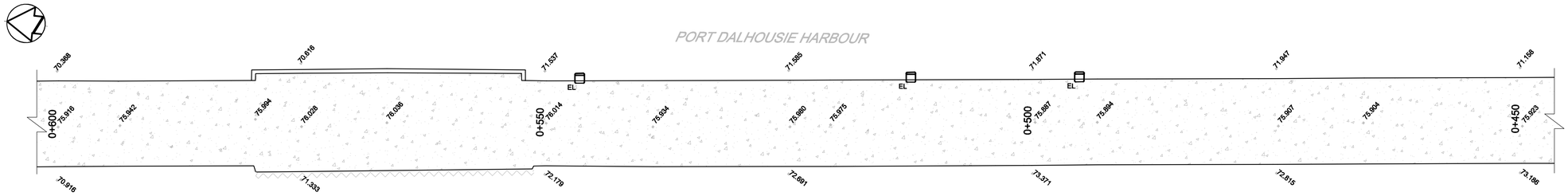
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

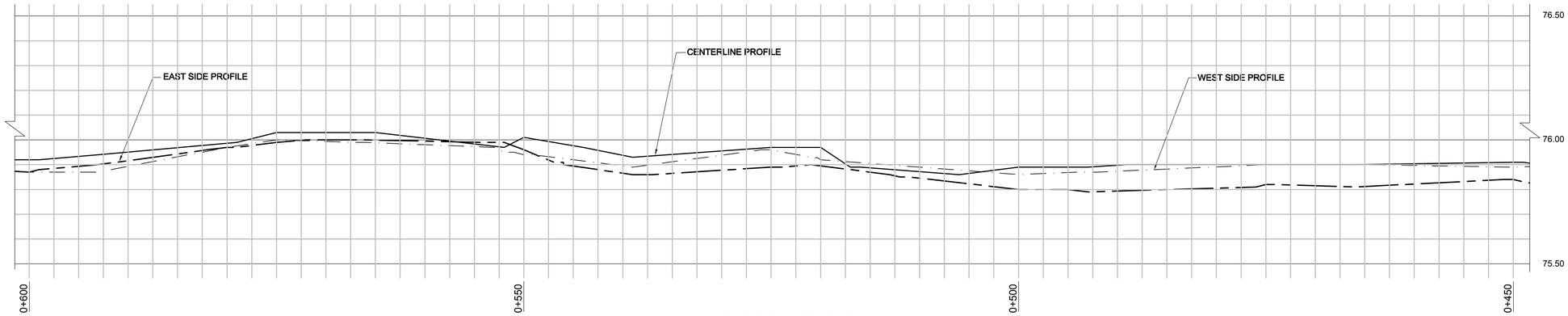
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
WEST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+300 TO 0+450

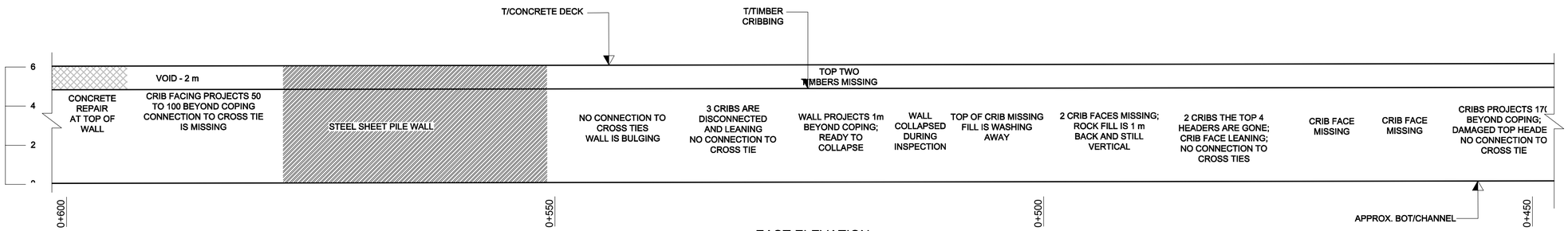
drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre:
project manager / administrateur de projets:
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 8



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



EAST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
— X —	CHAINLINK FENCE
75.795	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

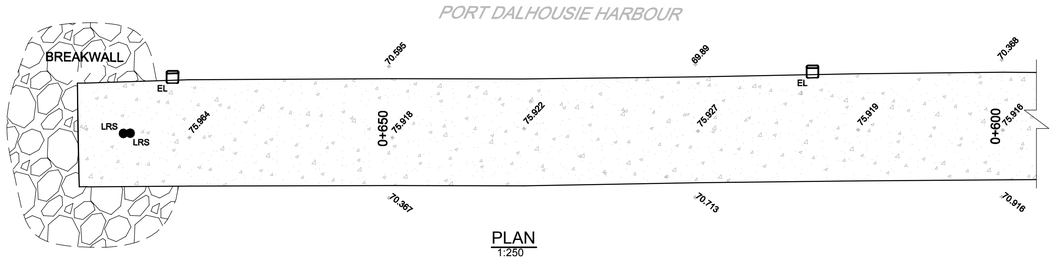
Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

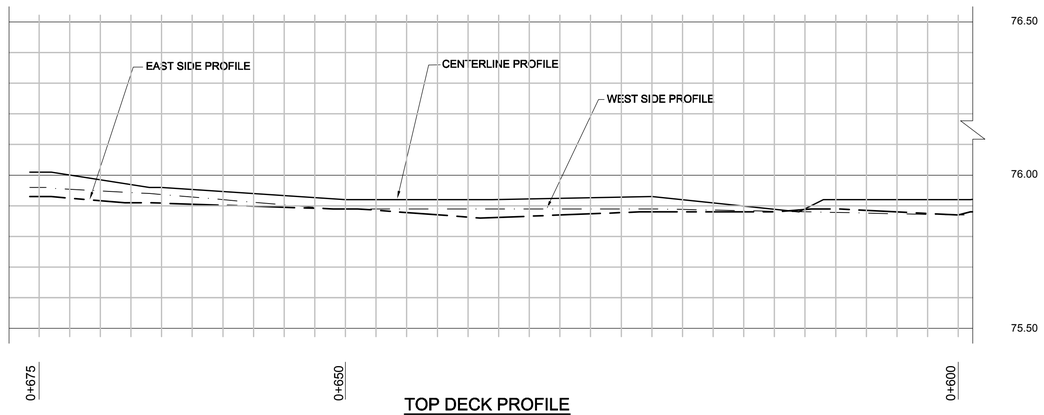
project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
WEST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+450 TO 0+600

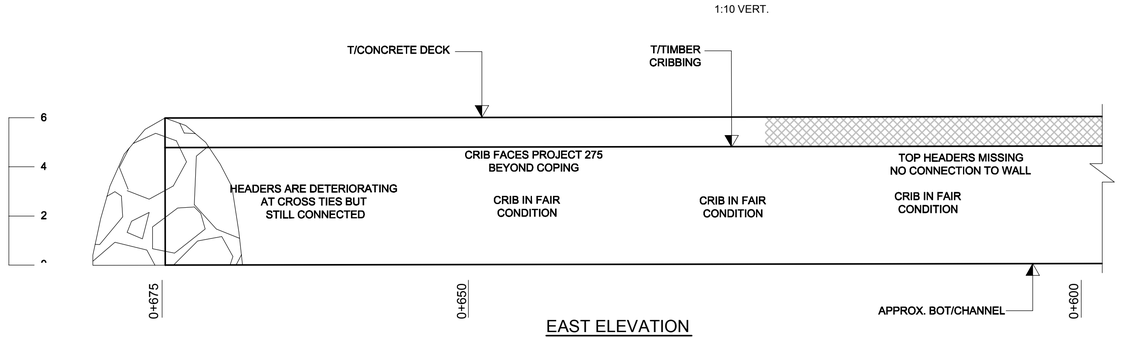
drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre
project manager / administrateur de projets
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 9



PLAN
1:250



TOP DECK PROFILE
1:250 HORIZ.
1:10 VERT.



EAST ELEVATION
1:250 HORIZ.
1:125 VERT.

NOTE:
ELEVATIONS BASED UPON CGVD MONUMENT 0011954U5561F LOCATED AT WEST CONCRETE FOUNDATION WALL OF INNER LIGHTHOUSE. ELEVATION = 75.822mASL

LEGEND

	BOLLARD
HP	HYDRO POLE
JB	JUNCTION BOX
EL	EMERGENCY LADDER
LRS	LIFE RING STATION
	POST
PP	POWER PEDESTAL
X	CHAINLINK FENCE
75.785	SPOT ELEVATION
	EAST SIDE PROFILE
	WEST SIDE PROFILE
	CENTERLINE PROFILE
M	MEDIUM CRACKS IN CONCRETE
H	HAIRLINE CRACKS IN CONCRETE
	MAP CRACKING
	SPALLS
	DELAMINATIONS
	HONEYCOMBED AREAS

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

SMALL CRAFT HARBOURS
CENTRAL AND ARCTIC REGION

Small Craft Harbours
Ports pour petits bateaux

revision		date
04		
03		
02		
01		

Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

AECOM

project title / titre du projet
PORT DALHOUSIE
EAST AND WEST PIERS
ENGINEERING INSPECTION

drawing title / titre du dessin
WEST PIER
PLAN, PROFILE AND ELAVATION
STA. 0+600 TO 0+674.5

drawn by / dessine par: K.K.
designed by / conc par:
approved by / approuve par: J.W.
bid / offre
project manager / administrateur de projets
project date / date du projet: 2015-01-07
project no. / no. du projet: 60334134
drawing no. / dessine no.: CS 10

ASI Group

Inspection Data Sheet

Date:	November 19, 2014	ASI Project #: DH14-091	
Client:	AECOM		
Location:	Port Dalhousie		
Facility:	East Pier		
Supervisor:		Diver:	
Video: ☐ Yes ☐ No		Video Unit #:	
Digital Still Camera: ☐ Yes ☐ No		Camera Unit #:	
Visual Inspection: ☐ Yes ☐ No			
Note: be specific and clear with location, direction and use objects of known size for scale as required			

Observations

		Description	
	1+000	3″ undermining	
	1+015	Void 10″ Deep Missing timber 35″ gap between cribs Void 17″ deep	
	1+025	Broken timber, top proud 6″ Coping missing	
	1+032	Exposed rebar, long crack	
	1+040	Timber coming apart Void 8″ x 30″ Void 17″ x 10″ x 13″ Loose Timber Missing Timber	
	1+045	Tieback rotten 6″ back	
	1+050	Rotten Timbers	
	1+055	Damaged crib for 20m	
	1+075	Cribs start again 1+075 to 1+090 cribs are pushed out	
	1+100	Timber piles start	
	1+110	18″ gap between cribs	
	1+118	Rotten timbers at gaps	
	1+125	Cribs falling apart	
	1+180	Middle timber bowing out	
	1+200	Tiebacks corroded away	
	1+210	Gap in timbers over 40″ deep Large void at base, fill material spilling out	
	1+220	Timbers splitting Tiebacks corroded, 45″ deep	
	1+245	Missing timbers	
	1+255	36″ gap between timber and concrete	
	1+280	Bottom timbers okay, top timbers corroded away	
	1+305	Sheet pile starts	
	1+320	Undermining of sheet pile	
	1+330	24″ Void	
	1+340	Void top of crib 25″ in deep Timbers are shifting	

	1+350	Void 47cm x 105cm x 620cm deep Void 48cm deep	
	1+355	Timbers starting to fall out	
	1+360	Timbers falling apart Void 1m deep	
	1+380	540cm deep void Void 1m deep Cribs falling apart	

ASI Group

Inspection Data Sheet

Date:	November 19, 2014	ASI Project #: DH14-091	
Client:	AECOM		
Location:	Port Dalhousie		
Facility:	West Pier		
Supervisor:		Diver:	
Video: ☐ Yes ☐ No		Video Unit #:	
Digital Still Camera: ☐ Yes ☐ No		Camera Unit #:	
Visual Inspection: ☐ Yes ☐ No			
Note: be specific and clear with location, direction and use objects of known size for scale as required			

Observations

		Description	
	0+25 to 0+33	Crib in good shape Timber in good shape	
	0+040	Multiple tieback heads are corroded away up to 600mm Loose timbers near bottom Void 500mm deep	
	0+045	Void 800mm x 500mm x 600mm Void 150mm x 600mm x 600mm	
	0+047	800mm x 500mm x 800mm void & lose timbers	
	0+65	Good shape, tieback heads corroded Void around 100mm all around Top of crib is 50-100mm proud of lower part of crib	
	0+075	Timbers in good shape, tieback heads corroded away	
	0+110	Timber in good shape, tiebacks missing 50-100mm of material	
	0+125	Large void in concrete 1000mm x 600mm wide x 600mm deep Top layer of cribs appears to have sloped into the channel	
	0+135	Timbers in good shape, some corroded tiebacks	
	0+140	Cribs are spalled 400mm tall by 400mm deep full length Void 800mm x 500mm x 800mm	
	0+155	Void in concrete 1000mm x 500mm x 600mm Void top of cribs 300mm x 100mm x 2000mm	
	0+160	Timbers in good shape Timbers leaning 250mm	
	0+180	Void at top 2000mm x 150mm x 250mm Timbers in good shape, tieback ends missing	
	0+185	Crib face has come proud and has moved 500mm forward Can reach behind; 600mm at bottom	
	0+205	Coping badly spalled up to 200mm x 400mm x 600mm Crib face 250mm proud, one crib only Void at top of crib 100mm x 500mm x 300mm Most cribs in good shape	
	0+235	Crib face 200mm proud one crib only	
	0+245	Crib face 100mm proud one crib only	
	0+250	Crib 170mm proud	
	0+257	Crib 350mm proud	
	0+265	Crib 400mm proud; all cribs have come proud	
	0+280	Crib 300mm proud southern, 50mm proud northern	

	0+290	Crib face is gone, no visible backfill Timbers on bottom of channel	
	0+290	Concrete void 300mm x 800mm x 250mm	
	0+291	Void 3000mm x 1000mm x 3000mm	
	0+293	No crib face, no support for pier	
	0+295	Crib proud 250mm	
	0+310	Crib proud 150mm	
	0+316	Crib proud 200mm at top level Level at base Crib face is pulled free of side	
	0+318	Crib 200mm proud top; ½ of crib face is free, Lower crib is secure Undermining of cribs	
	0+325	Top face of crib is no longer connected to side walls Timbers are loose Timber ends are rotten	
	0+342	Timber appear good but no connection to sides	
	0+355	Upper crib walls leaning, no connection to sides	
	0+360	Upper crib not connected	
	0+385	Top of cribs are disconnected Pier may have drifted Tieback face is back 700mm	
	0+392	Crib face no longer connected	
	0+405	Crib 170mm proud Top timber damaged No connection to tiebacks	
	0+412	Entire crib face missing	
	0+415	Crib face missing	
	0+425	Top 4 timbers gone Crib face leaning No connection with tiebacks (x2)	
	0+437	Entire face missing (x2)	
	0+460	Top of crib missing 7 or 8 timbers missing Fill is deteriorating	
	0+465	Wall collapsed during inspection	
	0+470	Wall is proud by 1000mm of concrete and appears ready to collapse	
	0+478	Top 2 timbers missing	
	0+480	Crib is disconnected and leaning No connection of tiebacks (x3) No missing timbers	
	0+485	No connections to tiebacks	
	0+517	Opening in sheet pile wall 17″ x 11″ x 7″	
	0+525	Crib walls still intact	
	0+535	Void 2000mm deep Crib is proud 50mm to 100mm Connection of tieback is missing Tiebacks in good shape on bottom	
	0+550	Concrete repair on top of wall	

	0+520	Top timbers missing No connection to wall Good connection at bottom	
	0+575	Crib in good condition	
	0+595	Cribs are proud at top 275mm, still connected Cribs in good shape	
	0+600	Timbers are deteriorating at tiebacks but still connected Cribs are in good condition	

Appendix C

Port Dalhousie, ON – East and West Piers
Condition and Structural Evaluation Report

- **Photographs of Concrete Coping Wall Above Water**

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+630 to 0+675

Photo 1, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+590 to 0+630

Photo 2, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+530 to 0+590

Photo 3, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+490 to 0+545

Photo 4, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+450 to 0+500

Photo 5, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+400 to 0+460

Photo 6, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+360 to 0+400

Photo 7, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+315 to 0+365

Photo 8, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+275 to 0+325

Photo 9, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+230 to 0+280

Photo 10, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+185 to 0+230

Photo 11, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+140 to 0+190

Photo 12, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+095 to 0+145

Photo 13, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+050 to 0+100

Photo 14, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

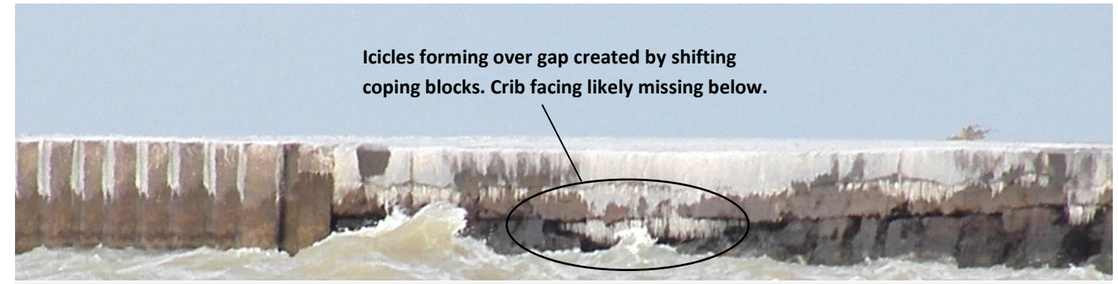
Station 0+000 to 0+050

Photo 15, Concrete Coping Above Water
Port Dalhousie, ON - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+600 to 0+575

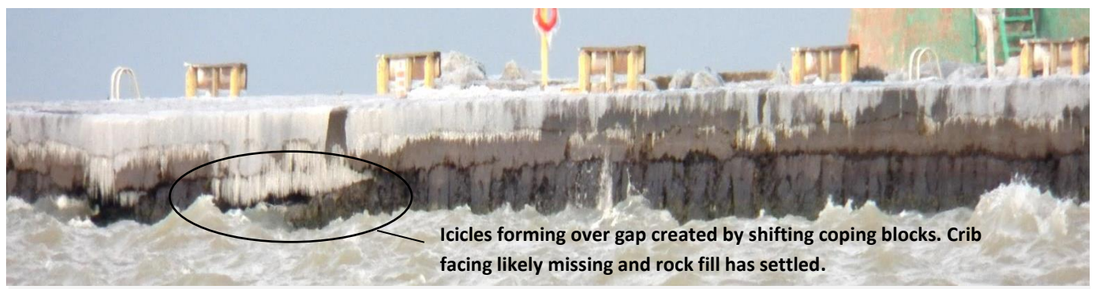
Photo 16, Concrete Coping Above Water
Port Dalhousie - West Pier (Lake Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+560 to 0+525

Photo 17, Concrete Coping Above Water
Port Dalhousie - West Pier (Lake Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+520 to 0+480

Photo 18, Concrete Coping Above Water
Port Dalhousie - West Pier (Lake Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

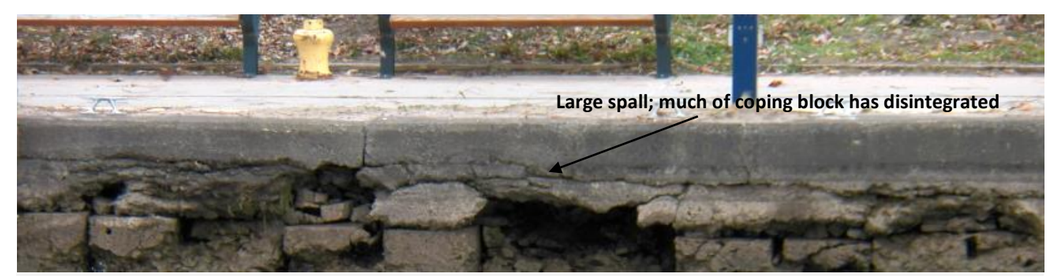
Station 0+400 to 0+360

Photo 19, Concrete Coping Above Water
Port Dalhousie - West Pier (Lake Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+520

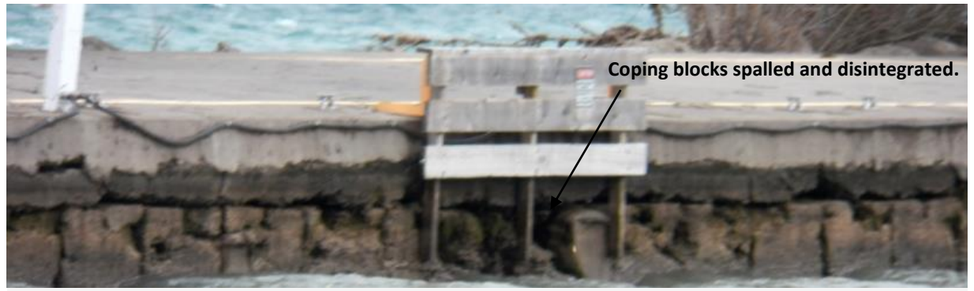
Photo 20, Close up – See Photo 4
Port Dalhousie - West Pier (Channel Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

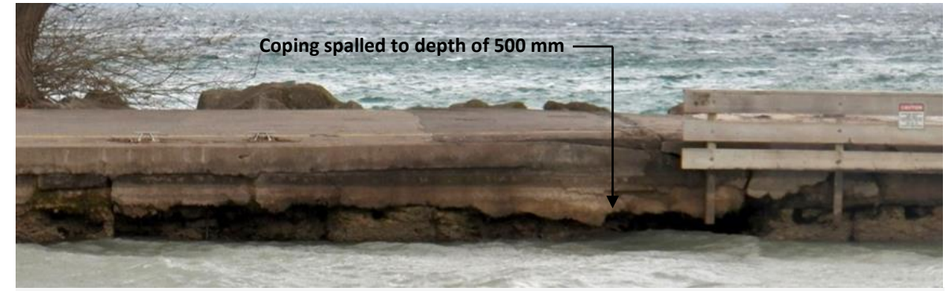
Station 0+020

Photo 21, Concrete Coping Above Water – See Photo 15
Port Dalhousie - West Pier (Channel Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada, **Station 0+170**
Central and Arctic Region

Photo 22, Concrete Coping – See Photo 12
Port Dalhousie - West Pier (Channel Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada, **Station 0+335**
Central and Arctic Region

Photo 23, Concrete Coping – See Photo 8
Port Dalhousie - West Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+400
West Pier Looking South

Photo 24, Concrete Deck
Port Dalhousie - West Pier
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+345

Photo 25, Concrete Deck
Port Dalhousie - West Pier
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+475

Photo 26, Concrete Deck
Port Dalhousie - West Pier
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

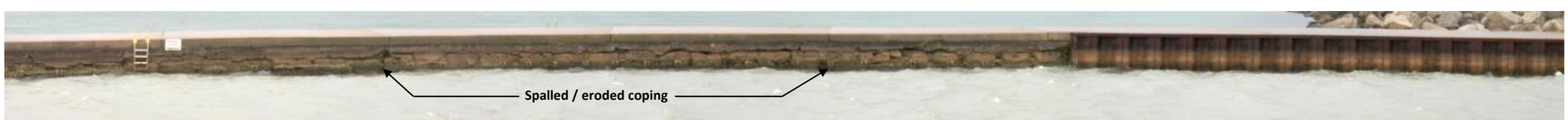
Station 0+680 to 0+300

Photo 27, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+610 to 0+560

Photo 28, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+570 to 0+510

Photo 29, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+520 to 0+470

Photo 30, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

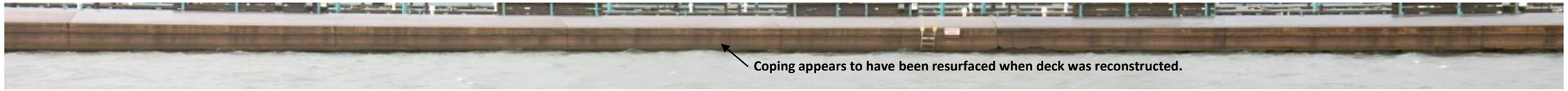
Station 0+480 to 0+420

Photo 31, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+430 to 0+370

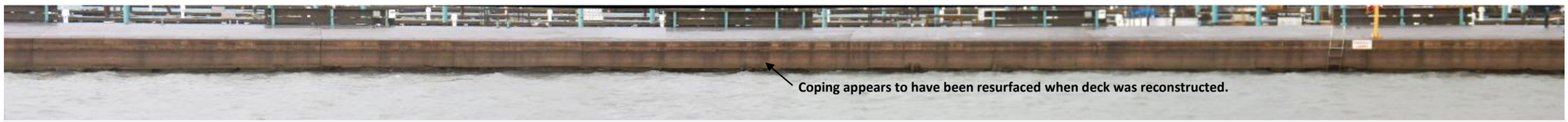
Photo 32, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+380 to 0+330

Photo 33, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014



Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+335 to 0+280

Photo 34, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+300 to 0+250

Photo 35, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+270 to 0+220

Photo 36, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+220 to 0+160

Photo 37, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+170 to 0+110

Photo 38, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+120 to 0+070

Photo 39, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+090 to 0+040

Photo 40, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+050 to 0+000

Photo 41, Concrete Coping Above Water
Port Dalhousie, ON - East Pier (Channel Side)
December 2014

Small Craft Harbours, **Photo 42, Concrete Coping Above Water, See photo 32**
Fisheries and Oceans Canada, **Station 0+420 to 0+400** **Port Dalhousie - East Pier (Channel Side)**
Central and Arctic Region December 2014

Small Craft Harbours, **Photo 43, Concrete Coping Above Water, See photo 36**
Fisheries and Oceans Canada, **Station 0+240 to 0+230** **Port Dalhousie -East Pier (Channel Side)**
Central and Arctic Region December 2014

Small Craft Harbours, **Photo 44, Delaminated Surface, Concrete Deck**
Fisheries and Oceans Canada, **Station 0+235** **Port Dalhousie - East Pier**
Central and Arctic Region December 2014

Small Craft Harbours, **Photo 45, Delaminated Surface, Concrete Deck**
Fisheries and Oceans Canada, **Station 0+350** **Port Dalhousie - East Pier**
Central and Arctic Region December 2014

Small Craft Harbours, **Photo 46, Existing Rock Fill Berm**
Fisheries and Oceans Canada, **Station 0+590** **Port Dalhousie - East Pier (Lake Side)**
Central and Arctic Region **East Pier Looking South** December 2014

Small Craft Harbours, **Photo 47, Concrete Coping Above Water**
Fisheries and Oceans Canada, **Station 0+665** **Port Dalhousie - East Pier (Lake Side)**
Central and Arctic Region December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+665

Photo 48, Delaminated Surface, Concrete Deck
Port Dalhousie - East Pier
December 2014

Small Craft Harbours,
Fisheries and Oceans Canada,
Central and Arctic Region

Station 0+681

Photo 49, Delaminated Surface, Concrete Deck
Port Dalhousie - East Pier
December 2014