Toronto Port Lands Company

2015 Dockwall
Structural Assessment

Lower Don Lands

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SUMMARY

Riggs Engineering Ltd. (Riggs) was retained by the Toronto Port Lands Company to carry out a visual assessment of dockwalls within the study area and to provide budget estimates for recommended rehabilitation.

This report is in support of the existing Don Mouth Naturalization Plan of the Port Lands (DMNP) where certain sections of dockwall will require removal, repair, modification, and/or extension to support new grades in the proposed naturalization plans.

Prior to on-site inspection Riggs reviewed the following reports for progression of previously observed conditions:

- SHAL 1996, Dockwall Condition Survey;
- SHAL 2004 Toronto East Harbour Dockwall Condition Inspection;
- SHAL 2009 Eastern Portlands Dockwall Rehabilitation; and
- Riggs Engineering 2009 Dock Wall Condition Survey/Investigation - Lower Don Lands.

Most of the structures within the study area were built between 1912 and 1939. There are three different types of structures. They include timber cribs, timber sheet piling and steel sheet piling. The timber and steel sheet pile walls are secured with tie rods to an anchorage component set inland from the facewall. Some of the timber and steel sheet pile structures have concrete relieving platforms supported on timber piles immediately inland of the facewall.

The visual inspection included top side and waterside investigations of above water components. Where visible, the steel sheet piling and tie rod connections above the waterline are typically in good condition with typical corrosion. The condition of the underwater substructures is expected to be the same condition or worse than those areas inspected in 2009. No significant changes to the top side were observed.

Based on the proposed development, only the following structures will remain as vertical face retaining structures: Marine Terminal 35, Polson Quay and the north side of the Ship Channel. These structures have been analyzed to determine pile embedment needs, pile bending moment stresses and tie rod loads. These analyses are very preliminary in nature and are intended to identify if the existing components are roughly in the right proportion. The analyses should not be construed as a design verification.

- The piling toe embedment factor of safety is typically 2 or more, with the exception of Marine Terminal 35 and Polson Quay.

- Typically the bending moment of the piling is more than the capacity it could resist. The steel sheet piling only at Polson Quay, sta. PQ 0+270.6± to PQ 0+501± and sta. PQ 0+578.5± to PQ 0+915.2±, has a factored resistance greater than the applied bending moment.

- The applied tie rod forces are generally less than the factored tie rod resistance, with the exception of Polson Quay, sta. PQ 0+000 to PQ 0+270.6±.

The recommendations for the study areas depends on the proposed changes.

- Keating Channel: Proposed to have both sides of the channel encapsulated with a berm; thus, stabilizing the piling and eliminating costly reconstruction. The concrete cope beam is proposed to remain in service.

- Former Essroc Facility: Includes the placement of a berm that will encapsulate the entire facility. The encapsulation extends close to the corner of Marine Terminal 35, filling in the slip between the Former Essroc Facility and Marine Terminal 35. This encapsulation will be created during the construction of Promontory.

- Marine Terminal 35: Approximately 232 metres of wall will remain in service for commercial use between sta. MT 0+405± and MT 0+637±. This portion will require repairs to the concrete cope beam and appurtenances. The dockwall analysis shows that the bending stress in the piling is beyond its theoretical capacity; therefore it is recommended that the wall be reconstructed. The remainder of the structure (sta. MT 0+637± to MT 1+130±) will be demolished. With the exception of a new return wall for the shortened dockwall, restoration of the demolished section is covered by others.

- Polson Quay: The steel sheet pile structures within Polson Quay have exceeded their useful life and are mathematically over-stressed or are marginally stressed to the limits. Rehabilitation is not part of the DMNP redevelopment and replacement cost are shown separately. It is recommended that a detailed inspection of the structure be carried out to manage risks and to plan for any future rehabilitation. There is a need to extend Polson Quay east from Sta 0+000 to facilitate future excavation and dredging for the DMNP. A budget is provided in this report. The timber piles beyond sta. 0+915 are typically over-stressed and have connection failures. Replacement is recommended. The estimated replacement costs are separated of the DMNP redevelopment

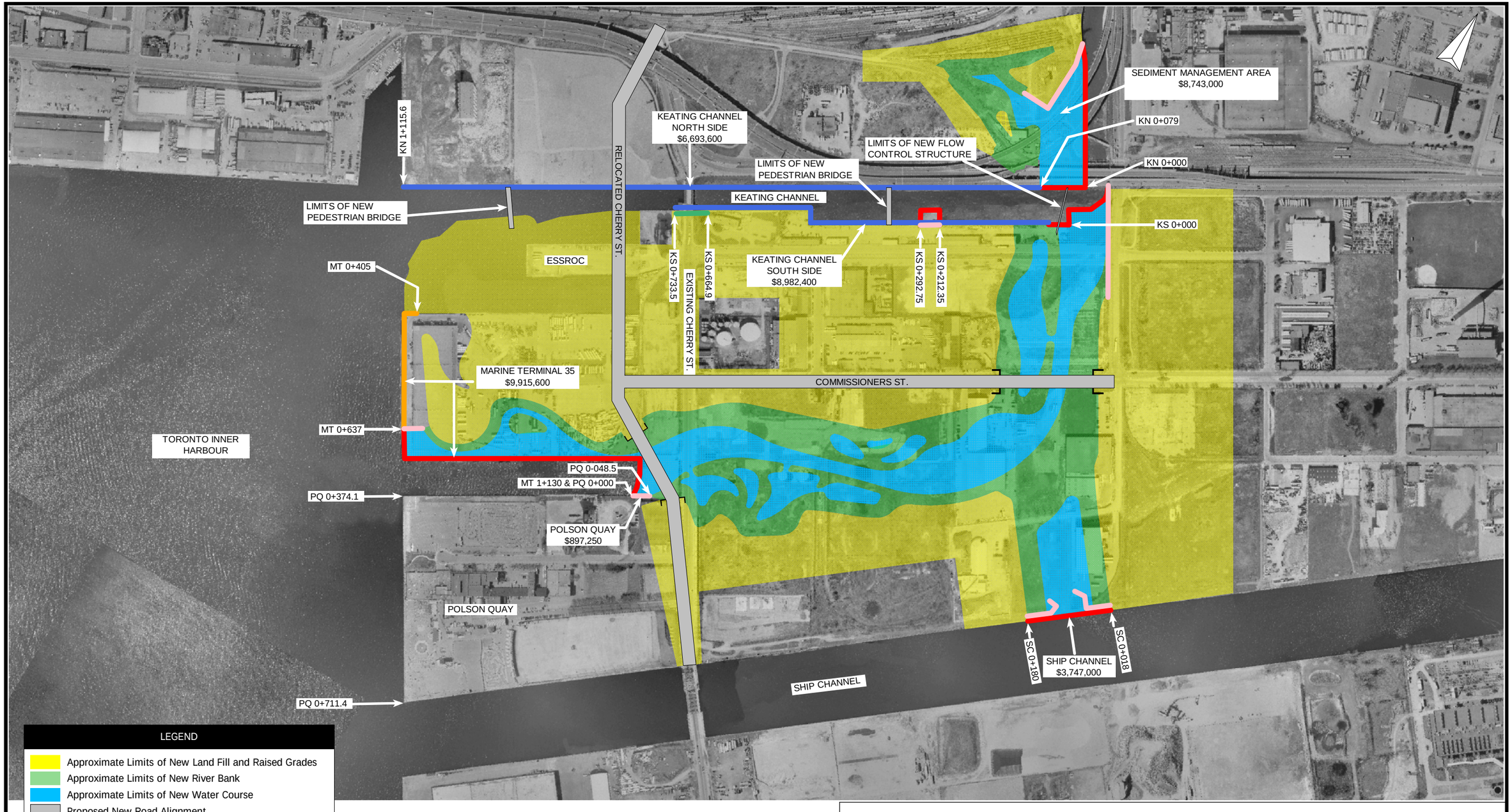
- Ship Channel: There is a proposed overflow structure for the Don River diversion and a portion of the existing dock wall will require demolition to accommodate the spillway. The remainder of the dockwall has exceeded the theoretical life and is mathematically over-stressed. Replacement is recommended. The estimated replacement costs are separated of the DMNP redevelopment

The estimated costs have been determined based on a comparison of recent projects and construction costs. The costs for the DMNP redevelopment are summarized in the following table and Figure - DMNP Redevelopment and Cost Summary.

Structure/Station	Total Cost
Sediment Management	$8,743,000
Keating Channel North Side	$6,693,600
Keating Channel South Side	$8,982,400
Marine Terminal 35	$9,915,600
Polson Quay	$897,250
Ship Channel	$3,747,000
Sub-Total	$38,978,850
Engineering Fees/Contingency	$7,795,770
Total	**$46,774,620**

Estimated replacement costs for the Polson Quay and the Ship Channel dockwalls unrelated to the DMNP redevelopment are summarized in the following table and Figure - Summary TPLC Replacement Costs.

Structure/Station	Total Cost
Polson Quay	$21,661,650
Ship Channel	$9,747,650
Sub-Total	$31,409,300
Engineering Fees/Contingency	$6,281,860
Total	**$37,691,160**



DON MOUTH NATURALIZATION PLAN REDEVELOPMENT AND COST SUMMARY

Client:
TORONTO PORT LANDS COMPANY

Scale Bar 0 300 m

SEDIMENT MANAGEMENT AREA

LIMITS OF NEW FLOW CONTROL STRUCTURE

LIMITS OF NEW PEDESTRIAN BRIDGE

KEATING CHANNEL

LIMITS OF NEW PEDESTRIAN BRIDGE

RELOCATED CHERRY ST.

ESSROC

EXISTING CHERRY ST.

MARINE TERMINAL 35

COMMISSIONERS ST.

TORONTO INNER HARBOUR

PQ 0+270.6

PQ 0+000

PQ 0+374.1

POLSON QUAY
$21,661,650

SHIP CHANNEL
$9,747,650

SC 0+180

SHIP CHANNEL

PQ 0+711.4

PQ 0+915.2

PQ 1+170.9

SC 0+706.9

LEGEND

- Approximate Limits of New Land Fill and Raised Grades
- Approximate Limits of New River Bank
- Approximate Limits of New Water Course
- Proposed New Road Alignment
- Shipping Channel Replacement Costs
- Polson Quay Replacement Costs

SUMMARY - TPLC REPLACEMENT COSTS

Client:
TORONTO PORT LANDS COMPANY

Scale Bar 0 300 m

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1 INTRODUCTION

Riggs Engineering Ltd. was retained by the Toronto Port Lands Company (TPLC) to:

(i) review background documents;
(ii) carry out a visual assessment of dockwalls within the study area;
(iii) present assessment findings with the due diligence project team;
(iv) perform evaluation of structures which will require land raising;
(v) prepare recommendations and design schematics to accommodate said land raising; and
(vi) prepare a detailed summary report of all main findings.

This report is in support of the existing Don Mouth Naturalization Plan (DMNP) of the Port Lands where certain sections will require removal, repair, modification, and/or extension to support new grades in the proposed naturalization plans. The intent of this work is to review and evaluate the existing structures within the study area, and offer recommendations for repairs, modifications, and/or possible replacement. Figure 1-1 shows the limits of the study area and station references.

Figure 1-1

EXISTING STATION LAYOUT PLAN

Client:

TORONTO PORT LANDS COMPANY

Scale Bar 0 300 m

2 STUDY TEAM

Our team's organization chart is presented in Figure 2-1.

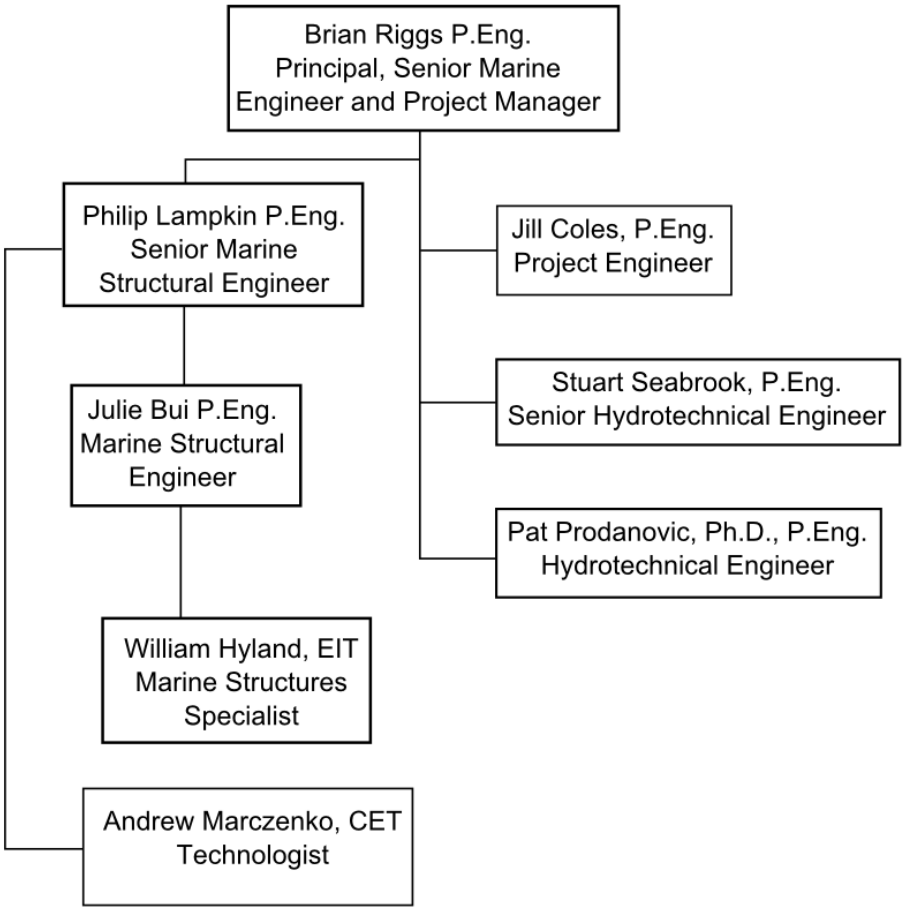


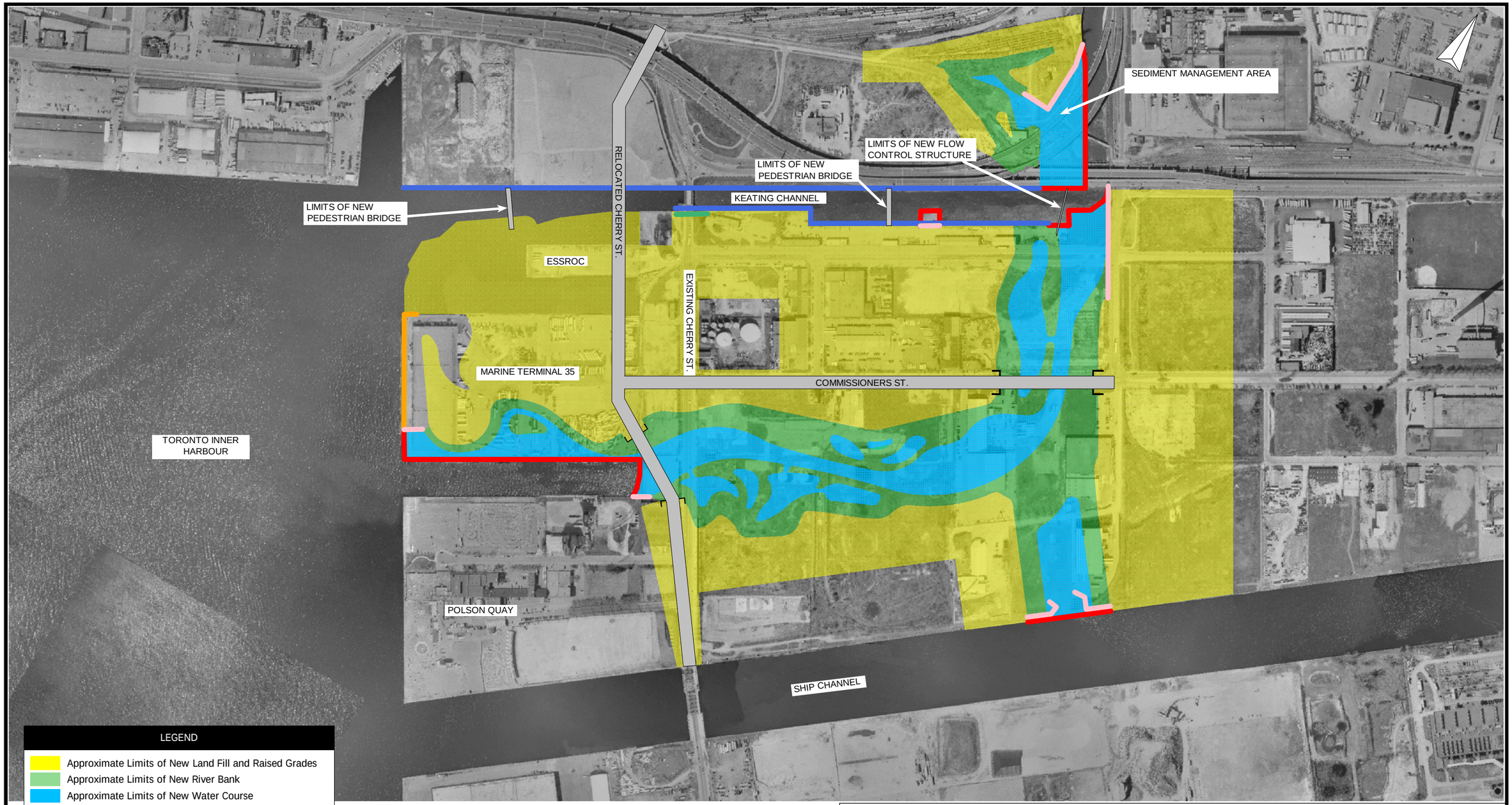
Figure 2-1 Project Team Organization

3 DON MOUTH NATURALIZATION PLAN

The Don Mouth Naturalization and Port Lands Flood Protection Project (DMNP) focuses on naturalization of the Don River valley at its confluence with Toronto Harbour with a design that will adequately address existing flooding and flood spill issues. In concert with the DMNP, the Lower Don Lands Master Plan Environmental Assessment (LDLMP EA) identifies infrastructure needs that are necessary to accommodate the DMNP. Amended Environmental Assessments (EA) for both of these projects have been developed such that the preferred solution integrates a design which provides an iconic identify for the area while addressing a range of local issues and needs including channel naturalization, flood mitigation, transportation, sustainability and other ecological issues. The preferred concept which has been developed on this basis is identified as Alternative 4WS Amended in the DMNP EA. Initial due diligence and project planning work is necessary to reconfirm and refine preliminary implementation budget for key project components and functionality.

The redevelopment of the Port Lands area in order to accommodate the river mouth realignment and naturalization as well as the revitalized upland land uses and public space areas requires modifications to shoreline structures and upland grading in various locations. An evaluation of existing dockwall conditions within the context of the proposed development plan is necessary to ensure future stability of the dockwalls and viability of the upland developments. This report presents the results of the dockwall structural assessment, which has been completed to identify opportunities and deficiencies associated with the existing dockwall structures as may be realized through the redevelopment of the Port Lands area.

The various features of the DMNP, which influence the dockwall structural requirements, are discussed briefly in this section, with specific reference to the affected dockwall structures. The locations of the various areas of interest are presented graphically in Figure 3-1.



LEGEND

- Approximate Limits of New Land Fill and Raised Grades
- Approximate Limits of New River Bank
- Approximate Limits of New Water Course
- Proposed New Road Alignment
- Removal of Existing Structures
- New Rock Revetment
- New Retaining Walls
- New Dock Wall
- New Modifications at Bridge

Figure 3-1

SITE PLAN OF FUTURE DMNP REDEVELOPMENT

Client:
TORONTO PORT LANDS COMPANY

Scale Bar 0 300 m

3.1 KEATING CHANNEL

The Keating Channel is presently the final reach of the Lower Don River before its transition to the Toronto inner harbour. Backwater due to Lake Ontario water levels and associated low flow velocities under most flow conditions results in sedimentation and debris accumulation within this channel and in the lower Don River reach in general. This area is periodically dredged to maintain hydraulic capacity and navigable depths. Under proposed development conditions, the Keating Channel's function within the flow conveyance system will be adjusted. Low flows will be conveyed within the new naturalized channel and the Keating Channel will receive Don River flows during events which exceed the 2 year flood approximately.

Modifications to the Keating Channel to accommodate the changes proposed in the LDMP include:

- relocation of the Cherry Street Bridge approximately 120 to the west, with the removal of the existing bridge abutments and demolition of the existing channel wall protrusion at the existing south abutment with associated dockwall rehabilitation in this location;

- removal of the structural protrusion on the south dockwall between sta. KS 0+212.35± and KS 0+292.75± and rehabilitation of the dock wall face where this protrusion is demolished;

- partial demolition of the South Keating channel wall upstream of sta. KS 0+040± and modification of the remaining wall structure in this area to accommodate the transition from existing Keating Channel to the new naturalized channel and construction of overflow and sediment weirs; and

- dredging of the Keating Channel along its entire length and construction of a rock armour toe along the north and south channel walls to stabilize the existing dockwall.

Ultimate proposed grades in the vicinity of the Keating Channel along the south wall range from approximately 77.5 m ± to 79.0 m ±.

3.2 FORMER ESSROC FACILITY

The proposed land area in the region of the existing Essroc Quay will be a created land mass. This land will be largely created through the placement of materials excavated for the creation of the Lower Don naturalized channel. The materials will be placed within a containment structure created along the proposed shoreline perimeter. This containment structure will include a rock berm along the west and northwest limits of the new land mass, transitioning to a vertical structural wall along the northeastern section of the new land mass. As a result of the land creation activities, the existing dockwalls of the Essroc Pier will be buried by the land creation activities, and a mix of residential, commercial and parkland spaces will be created on the new land mass. The majority of the urban development, including the new Cherry Street alignment will be situated east of the westerly limits of the existing Essroc Pier. Parklands will be created on the new lands created on the inner harbour bed to the west of the Essroc Pier.

The Essroc Quay land creation activities are one of the first priorities of the overall Lower Don Lands development projects in order to facilitate the relocation of the existing Cherry Street bridge. Proposed grades in this area range from approximately 78.0 m to 85.5 m, with the majority of land created above the existing dockwalls in the order of 78.0 m - 79.0 m ±. Design of future municipal servicing and building foundations may conflict with the buried dockwall structures.

3.3 MARINE TERMINAL 35 (COUSINS QUAY)

Marine Terminal 35 lies between the proposed Essroc Quay land creation area and the northern bank of the naturalized Don River mouth. The existing buildings along the western wall of the terminal lands have been identified with heritage significance and are therefore expected to remain under the proposed development scenario. The maintenance of these buildings has significance in terms of local grading and dockwall modifications to accommodate the proposed adjacent development.

The development of the Essroc Quay land area will require filling against the majority of the northern dock wall of Marine Terminal 35, with fill grades on the order of 78.0 m - 79.0 m ± elevation. The northeast corner and majority of the western face of the existing dockwall will remain in service under proposed development conditions. Approximately 50 m of the most southerly portion of the western dockwall face, the entire southern dockwall and the dockwall between Marine Terminal 35 and Polson Quay will require demolition to accommodate the naturalized river mouth construction. A new return wall of approximately 40 m length will be required to transition from the western end of Marine Terminal 35 into the new naturalized river mouth area.

The northeast quadrant of Marine Terminal 35 will be developed as residential and commercial lands with proposed grades on the order of 78.5 m to 79.5 m ±. The new Cherry Street alignment will traverse the extreme southeast corner of the existing terminal lands, and the northern bridge abutment for Cherry Street over the naturalized channel will be constructed near the eastern limits of the existing southern dockwall. The remainder of the terminal lands, with the exception of the western limits reserved for heritage purposes, will be developed as parkland and naturalized areas integrating with the new Don River mouth. Design of future municipal servicing and building foundations may conflict with the buried northerly dockwall structure. An existing storm sewer discharging through this dockwall will require re-routing as an early component of the Essroc Quay land creation works.

3.4 POLSON QUAY

The Polson Quay dockwall structures will remain in service under the proposed development scenario. Lafarge operations along the northern dockwall are expected to continue during and after the proposed construction of the Lower Don lands flood protection works. As the existing

dockwall at the eastern end of the slip between Marine Terminal 35 and Polson Quay will be demolished to accommodate the naturalized channel construction, an extension of the eastern limits of the dockwall at Lafarge will be required to accommodate the local grade transitions. The southern abutment for the new Cherry Street crossing of the naturalized channel will also be constructed in this area and will require design integration with the proposed dockwall extension.

The majority of the perimeter of the Quay, with the exception of the Lafarge lands, will be developed as a Waterfront Promenade. Proposed developments of the majority of the Quay area are to ultimately include a mix of community and residential with grades increasing towards the east. Ultimate design grades range from existing grade of 77.0 m ± around the perimeter of the quay to approximately 80.0 m± at the central eastern limits of the quay.

3.5 SHIP CHANNEL

The ship channel is located along the south side of Polson Quay. For the purposes of this report, the ship channel dockwall is considered to begin at the existing Cherry Street bridge crossing. Approximately 600 m ± east of the existing Cherry Street bridge, the existing ship channel wall will require partial demolition over a length of approximately 162 m to accommodate the proposed spillway. This spillway will only be effective in major flood events to provide flood relief to the newly naturalized Don River channel and the Keating Channel spillway. Modifications to the existing dockwall and construction of return wall structures to accommodate transition to the spillway channel in this area are required as part of the DMNP works.

While the northern ship channel wall to the west of the proposed spillway outlet will remain in service under the proposed development conditions, its' primary function within the DMNP works will be as a waterfront promenade. Ultimate proposed grades within the region to the north of the ship channel wall vary between approximately 78.0 m ± to 79.5 m ±.

3.6 SEDIMENT MANAGEMENT AREA

The Sediment Management Area is area comprises of the area north of the confluence of the Keating Channel and the Don River and includes the area south of the confluence where the Don River is redirected as part of the DMNP works.

Modification in the sediment management area include removal the existing steel sheet pile wall and concrete parapet some 239 m north along the west bank of the Don River from the corner of the Keating Channel and Don River confluence. Removal of the existing steel sheet pile and concrete parapet are also required along eastern extents of the south wall of the Keating Channel where the wall wraps around the confluence and connects with the east bank of the Don River at the Lakeshore Boulevard bridge. These removals will permit widening of the Don River for the sediment management area and the redirection of the Don River to the south.
The widening of the Don River at the confluence will necessitate the construction of new retaining walls on the west side of the river to follow the new river alignment. The new retaining

wall is to commence at the north limit of the removals, extend south 123 m, and terminate with a 45 m return wall to the west. On the eastside of the Don River, a new 194 m retaining wall is required to protect a stretch the Don Roadway south of the Lakeshore from the redirected Don River.

Included in the sediment management area is the extension of the Lakeshore Boulevard bridge to the west and installation of two weirs, a fixed side flow weir south of the confluence and an adjustable weir to the north of the confluence. The bridge and weir work are addressed by others and not part of this due diligence report.

4 DESCRIPTION OF STRUCTURES

The study area includes the structures of Keating Channel, the former Essroc facility, Marine Terminal 35, Polson Quay and the Ship Channel.

A detailed description of the structures, other than Marine Terminal 35, is found in Dockwall Condition Survey/Investigation - Lower Don Lands, 2009, Riggs Engineering Ltd.

Drawings showing the stationing used in the inspection are presented in Appendix A. Drawings of the structures are presented in Appendix B. A brief description of the structures follows.

4.1 KEATING CHANNEL NORTH SIDE

The total length of the Keating Channel North Side is approximately 1115.6 metres. It was constructed and reconstructed between 1912 and 1939. The substructure consists of steel sheet piling and timber sheet piling with a concrete cope beam as the superstructure. The north dockwall is divided into three different sections as follows.

- Sta. KN 0+000 To KN 0+493.9±
- Sta. KN 0+493.9± To KN 0+639.8±
- Sta. KN 1+019.5± To KN 1+115.6±

4.2 KEATING CHANNEL SOUTH SIDE

The total length of the Keating Channel South Side is approximately 733.5 metres. It was constructed and reconstructed between 1912 and 1940. The substructure consists of steel sheet piling and timber sheet piling with a concrete cope beam as the superstructure. The south dock wall is divided into seven different sections as follows.

- Sta. KS 0+000 To KS 0+060.6±
- Sta. KS 0+060.6± To KS 0+212.35±
- Sta. KS 0+212.35± To KS 0+240.91±
- Sta. KS 0+240.91± To KS 0+269±
- Sta. KS 0+269± To KS 0+540.35±
- Sta. KS 0+540.35± To KS 0+664.9±
- Sta. KS 0+664.9± To KS 0+733.5±

4.3 FORMER ESSROC FACILITY

The total perimeter of this structure is approximately 544.1 metres comprising two construction types within Essroc, namely, timber sheet pile wall and timber cribs. These structures were built between 1912 and 1914.

- Sta. E 0+000 To E 0+120.8±

- Sta. E 0+120.8± To E 0+544.1±

4.4 MARINE TERMINAL 35

The total perimeter of Marine Terminal 35, constructed in 1935, is approximately 1,130 metres long. The substructure consists of steel sheet piling, a concrete relieving platform constructed on round timber piles and both timber and steel anchor piles. In 1961 the grade of the wharf was raised with the addition of a 2 metre high vertical extension to the concrete cope beam.

4.5 POLSON QUAY

The total perimeter of this structure is approximately 1170.9 metres and is comprised of steel sheet piles and timber sheet piles. Polson Quay is subdivided into 5 sections, based on the construction types. These structures were built between 1917 and 1936.

- Sta. PQ 0+000 To PQ 0+270.6±
- Sta. PQ 0+270.6± To PQ 0+501±
- Sta. PQ 0+501± To PQ 0+578.8±
- Sta. PQ 0+578.8± To PQ 0+915.2±
- Sta. PQ 0+915.2± To PQ 1+170.9±

4.6 SHIP CHANNEL

This structure was constructed between 1917 and 1921 of timber sheet piles and concrete cope beams. The structure extends from sta. SC 0+000, which will be the west end of the future spillway to sta. SC 0+706.79±.

5 BACKGROUND REPORTS

5.1 SHAL 1996, DOCKWALL CONDITION SURVEY

In 1995, SHAL Consulting Engineers Inc was commissioned to carry out an investigation of the dockwall structures in the East Bayfront and Port Industrial District for the Toronto Economic Development Corporation (TEDCO). The above water inspection included the East Bayfront, Keating Channel, both north and south walls, Essroc, Cousins and Polson Quays and the Ship Channel, both north and south walls. Previous underwater inspection findings undertaken in 1990 and 1991 for the Toronto Port Authority were relied upon as resources. The underwater inspection undertaken in 1995 as part of the investigation was limited to two days and targeted the south side of the Keating Channel at a mid-channel pier within the Toronto Port Authority area, the north side of Polson Quay immediately west of the Lafarge property and the west wall of the Ship Channel turning basin. The findings were presented in their report “Dockwall Condition Survey, Toronto Harbour, Investigation Report “, July 1996. A summary of the findings is outlined below.

5.1.1 Keating North

- The north wall east of berth 321, was noted as being severely deteriorated with missing tie rods, tie rods nuts and wale bolts, resulting in loose sheets. The concrete cope beam is deteriorated in places but appeared to be acting structurally. Concerns were expressed about the stability of the major vehicle thoroughfares. Repairs to this area were recommended.
- At berth 321, located east of Cherry Street, fill loss through the timber sheet pile wall and sink holes behind the wall were noted. Deterioration of the concrete cope wall was noted, but it continues to be structurally effective.
- West of Cherry Street at berths 313 and 314, the concrete cope wall was noted as being severally deteriorated with the need for considerable reconstruction. No concerns, such as sink holes or loss of fill, were noted behind the wall. No comments were available or recorded in the 1990 and 1991 underwater inspections.
- Further west at berth 312, the steel sheet piling appeared in good condition. The copewall was spalled and severally cracked in some areas, but appeared structurally sound.

5.1.2 Keating South

- At berths 331 and 332 no concerns were noted, but the pier located between these two berths, at the northeast corner was found to have sink holes behind the wall and large holes in the face under water. This section was subsequently repaired with the installation of a new steel sheet pile wall.

5.1.3 Former Essroc Facility

- The concrete cope beam mounted on the timber cribs was noted to be severally cracked and spalled. Repairs were undertaken to repair the noted damaged concrete. No damage was noted on the timber crib based on the 1990 and 1991 underwater inspections.

5.1.4 Marine Terminal 35

- All was found to be generally in good condition on all three faces. Some bolts on the south face that connect the steel sheet piling to the concrete cope beam were noted to be damaged.

5.1.5 Polson Quay

- Berth 361 at the Lafarge Dock is timber sheet pile construction with a concrete cope beam. Similar construction continues west into berth 362, where missing tie rods were noted in the 1990 and 1991 underwater inspection. This condition that exists over an 85 m length was reconfirmed during this investigation.
- A significant bulge in the wall alignment has existed since 1932. Wall movement within this area has been observed up to 1971. Little additional movement was noted in 1974 and 1991 surveys. Reinstatement of lost lateral strength was recommended.
- On the westerly 104 m of the north wall, the wall construction changes to steel sheet pile. A significant bulge exists in a local area near the west end. Tie rod failure is suspected.
- On the west face of Polson Quay a 113 m, at berth 364, a similar condition is expected. Excavation and inspection of these tie rods is recommended. In 1990/1991 the underwater inspections noted a large hole in the steel sheet pile in this same stretch of wall. Ship impact was suspected.
- On the south face of Polson Quay, in the timber sheet pile area, there is excessive lean to the piles. The tie rod connection failure is suspected. Exposure and examination is recommended.

5.1.6 Ship Channel

- The north wall of the Shipping Channel extending from Cherry Street to the turning basin, is timber sheet piling with the exception of berth 425 which has been reconstructed in steel sheet piling. The top of the wall leans out toward the channel 180 mm or more. Tie rods have failed where excessive lean is present.

5.2 SHAL 2004 TORONTO EAST HARBOUR DOCKWALL CONDITION INSPECTION

In 2004, SHAL was asked by TEDCO to provide an update on the current condition of the dockwalls based on visual observations. This inspection was carried out in April/May, 2004 and included the dockwalls from the Redpath property to the south side of the Shipping Channel. The inspection was limited to visual observations of the top and front face of the dockwalls. The

observations targeted deficiencies, which included cope beam and bollard damage, sink holes and front face hazards. Underwater deficiencies were not listed as no underwater inspection was undertaken. Also included were safety related items that included life stations and ladders. The findings were submitted in a report, “Toronto East Harbour, Dockwall Condition Inspection”, May 2004.

Since the 1996 report, it is noted that repairs were undertaken on the concrete cope wall on the north side of the Essroc dock. Also, new tie rods and anchor blocks were added on the north side of Polson Quay. Some other minor repairs included bollard replacement. New steel sheet piling was installed on the east face of the Toronto Port Authority dock located on the south side of the Keating Channel to repair observed holes in the dockwall face and loss of back fill from behind the wall.

A summary of the findings from the 2004 inspection is outlined below.

5.2.1 Keating North

- 180 metres of cope beam were inspected west of Cherry Street, 26 metres of which was identified as needing repairs, generally full width and varying in depth from 400 mm to 1,500 mm.

5.2.2 Keating South

- 690 metres of cope beam were inspected, 76 metres of which were identified as needing repairs to the full cope beam, width and varying in depth from 200 mm to 1,500 mm.
- One broken bollard was noted.
- One sink hole behind the dockwall was observed in the west berth of the Toronto Port Authority.
- There are a number of steel protrusions covered by rubber tires.

5.2.3 Former Essroc Facility

- 416 metres of cope beam were inspected, 35 metres of which were identified on the west and south faces as requiring repairs that varied in depth from 200 mm to 2000 mm, full beam width.
- As well, a total of 22 metres of cope beam repairs were identified on the connecting wall from the Keating Channel and 25 metres on the connecting wall to Marine Terminal 35. Most were full width repairs and varied in depth from 200 mm to 1,500 mm.
- Four weak or broken bollards were identified on the cope beam including the connecting walls.
- Seven sink holes were identified, one of which was large indicating possible damage below water.
- There were no hazards noted on the face other than concrete deterioration.

5.2.4 Marine Terminal 35

- There is small scale concrete damage the full length of all faces, some of which extend down the full face of the cope beam. On the north face, 153 m of the 385 m length have concrete damage 200 mm to 300 mm in depth, generally over 50% of the cope beam width. On the west face, 163 m of the 240 m length, has concrete damage 300 mm to 600 mm in depth which covers 50 to 100% of the cope beam width. On the south face, concrete damage was noted on 282 m of 385 m, and it is 300 to 400 mm deep, covering 50% of the cope beam width.
- The connecting wall to Polson Quay had 34 m of concrete damage 300 mm to 1,200 mm in depth on the full width of the cope beam.
- Five bollards were noted to have deficiencies.
- Some of the hanging rubber fenders are missing.

5.2.5 Polson Quay

- Of the 337 m length of the north face, only one 2 m length of concrete deterioration was noted. It was 300 mm deep and covers 100% of the cope beam width.
- 64 m of the 374 m length on the west face were noted to have concrete damage 200 to 1,000 mm deep, the majority of which covers 100% of the cope beam width.
- Two broken bollards were identified.
- The south side of Polson Quay was included in the Ship Channel observations.
- No sink holes were identified.
- Remains of steel angles that supported timber fenders protrude from the dock face over 50% of the face.

5.2.6 Ship Channel

- 365 m of the 1,910 m cope beam length had deterioration that was 200 mm to 2,000 mm deep, consistently over 100% width of the cope beam width.
- Three bollards with damage were identified.
- Three sink holes were identified west of Cherry Street and two east of Cherry Street. All are adjacent to areas of timber sheet piling, and are between 300 mm and 600 mm deep.
- Steel attachments protrude from the face where once a timber rub strip existed.

5.3 SHAL 2009 EASTERN PORT LANDS DOCKWALL REHABILITATION

In 2009, SHAL presented to TEDCO a letter-style report consisting of a desk top assessment of the current condition of the dockwalls, which advised on potential opportunities for repairs.

5.3.1 Keating North

- The north side of the Keating Channel, particularly in reference to the dockwall adjacent to the Gardner Expressway/Lakeshore corridor was excluded from the report as not being under TEDCO jurisdiction.
- The portion of wall west of Cherry Street consisting of timber sheet pile walls with a concrete copewall is considered the “most severely deteriorated cope beam in all the Toronto Harbour”. Severe lamination and concrete spalling exists. The underwater condition is unknown but observations of similar construction elsewhere suggest that gaps between timber piles exist.
- Complete reconstruction with steel sheet piling and a new concrete cope beam were considered necessary for any new water’s edge promenade.
- No comment was provided with respect to the steel sheet pile portion further west to the corner of the Parliament Street slip.

5.3.2 Keating South

- The Keating Channel walls on the south side were considered to be in reasonable condition, but potential problems could arise if turned over to long term use. Since this dockwall is of similar construction to the timber sheet pile walls of the Polson Quay, lateral support may be lost due to badly deteriorated tie rods and resulting lean in the piles. Remedial work was carried out on Polson Quay. Similar remedial work is expected to carry loading associated with any future water’s edge promenade.

5.3.3 Former Essroc Facility

- This dock is the only one in TEDCO jurisdiction that is a timber crib construction. Underwater inspections carried out in 1990 showed the continuously submerged cribs to be in reasonable condition. Minor underwater repairs may be required.
- Cope beam repairs on the west and south faces anticipated at that time involved replacement of the upper cast-in-place portion and select removal and replacement of the supporting precast concrete blocks.

5.3.4 Marine Terminal 35

- Due to the robust construction no need of repairs were expected over the short or medium term.

5.3.5 Polson Quay

- The steel sheet pile section of the Polson Quay along the westerly 100 m of the north and south faces and on the west face were considered robust for the non-marine use. SHAL’s opinion was that no repairs or remedial works were expected for the light deck loading.

- Remedial repairs were undertaken along a 105 m portion of the north face of Polson Quay where there is timber sheet piling. These included new tie rods and new precast anchor blocks. Similar remedial repairs were considered appropriate to the remaining wall that has the same inherent weakness at the timber sheet pile tie rod connection.

5.3.6 Ship Channel

- SHAL previously reported on remedial works for the Ship Channel in a letter to TEDCO dated February 5, 2009. Summarized sections of that letter indicated that many sections of the timber sheet pile wall lean out 175 mm or more as reported in underwater inspections undertaken in 1990/1991. The exposed ends of the tie rods and nuts are deteriorated and have punched through the face.
- SHAL prepared remedial drawings in 1998 on a section of the wall at the corner of the turning basin. Similar repairs were recommended consisting of new tie rods and anchorages for structural stability. At a later date, concrete copewall repairs to the upper 300 mm could be carried out in consideration of the future promenade work.

5.4 RIGGS 2009 DOCKWALL CONDITION SURVEY/INVESTIGATION - LOWER DON LANDS

In 2009, Riggs Engineering Ltd. undertook a condition survey of the dockwalls in the lower Don Lands area for Waterfront Toronto. A summary of the findings, taken from the executive summary of the 2009 report, are presented below.

Summary of Structure Condition						
From Station To Station		**Year and Substructure Type**	**Lower Don Lands Development Plans**	**Verticality**	**SSP Corrosion**	**Cope Beam Condition**
Parliament Street Slip						
0+000	0+100	1939, SSP	Abutting wetland	Toed out	Modest	Poor
0+100	0+208	1939, SSP	None	Toed out	N/A	Poor
Keating Channel North Side						
0+000	0+439	Before 1914, SSP	Partially encapsulated with a berm	Leans out	Severe	Poor
0+439	0+656	1912, TSP	Partially encapsulated with a berm	Good	N/A	Fair
1+020	1+116	1939,SSP	None	Toed out	Modest	Poor
Keating Channel South Side						
0+000	0+061	1940, SSP	Partially encapsulated with a berm	Good	Severe	Poor
0+061	0+180	Before 1914, TSP	Partially encapsulated with a berm	Leans out	N/A	Fair
0+180	0+212	Before 1914, TSP	New bulkhead structure	Leans out	N/A	Fair

0+212	0+238	1997,SSP	New bulkhead structure	-	Modest	Good
0+238	0+269	1912,SSP	Partially encapsulated with a berm	Good	Severe	Fair
0+269	0+540	1912, SSP	New bulkhead structure	Leans out	Severe	Fair
0+540	0+665	1912, TSP	Partially encapsulated with a berm	Leans out	N/A	Fair
0+665	0+734	After 1912, TSP	Existing structure to be removed, then encapsulated with berm	-	N/A	Good
Essroc Dock						
0+000	0+120	1912,TSP	Partially encapsulated with a berm	-	N/A	Fair
0+120	0+544	1917-1921, timber crib	Fully encapsulated with a berm	-	N/A	Fair
Polson Quay						
0+000	0+271	1917, TSP	Fully encapsulated with a berm	Leans out	N/A	Fair
0+271	0+501	1929, SSP	Partially encapsulated with a berm	Toed out	Modest	Poor
0+501	0+578	1936,SSP	None	Good	Moderate	Fair
0+578	0+915	1935, SSP	None	Toed out	Moderate	Poor
0+915	1+171	1917-1921, TSP	None	Leans out	N/A	Poor
Ship Channel						
0+000	0+707	1917-1921,TSP	None	Leans out	N/A	Poor

NOTES:
1. SSP = Steel sheet piling.
2. TSP = Timber sheet piling.
3. N/A = Not applicable.
4. " – " = Condition not assessed.
5. Toed out = Toe of pile at lakebed is out beyond top of pile, towards the water.
6. Leans out = Top of pile is out beyond toe of pile at lakebed, towards the water.

6 2015 OBSERVATIONS

Riggs Engineering undertook a visual inspection of each structure from both the topside and the waterside. Waterside inspection was undertaken from a boat and topside inspection was undertaken on foot. Changes in condition from previous inspections will be noted and each structure was inspected and evaluated with the stated future of the structure in mind.

The photograph log, including the plan and elevation of its corresponding structures, is presented as follows:

- Appendix A - Stationing Plans;
- Appendix B - Structure Drawings;
- Appendix C - Keating Channel North Side Photos;
- Appendix D - Keating Channel South Side Photos;
- Appendix E - Former Essroc Facility Photos;
- Appendix F - Marine Terminal 35 Photos;
- Appendix G - Polson Quay Photos; and
- Appendix H - Ship Channel Photos

6.1 KEATING CHANNEL NORTH SIDE (STATION KN 0+000 TO KN 1+115.6±)

The Keating Channel North Side is divided into three sections, which corresponds to the changes in the piling type and is as follows:

- Lackawanna Arched-web No. AP14 Steel Sheet Piles (sta. KN 0+000 to KN 0+493.9±);
- Timber Sheet Piling (sta. KN 0+493.9± to KN 0+975±); and
- Algoma A10 Steel Sheet Piles (sta. KN 0+960± to KN 1+115.6±).

6.1.1 Station KN 0+000 to KN 0+493.9±

The tie rod and wale connections are in an advanced state of disrepair. The external channel wale is flattened and heavily corroded or missing throughout the length of this section of wall. Many tie rods are not connected to the steel sheet pile and wale connections once embedded into the concrete cope beam are separated such that many sections of steel sheet piling are free standing.

The concrete cope beam is in fair to poor condition. There are sections that are heavily spalled on the top and down the face of the cope beam. Spalling at the vertical joints between concrete sections is common as well as delamination along the top of the beam. Generally the worst concrete exists up to sta. KN 0+350, where Lakeshore Boulevard road alignment starts to depart to the north away from the wall. Road runoff has likely advanced the deterioration of the concrete in this area. The cope beam is supported on timber piles which were not visible.

Two deteriorated outfalls were noted around sta. KN 0+368 and KN 0+424.

The horizontal timber rub strip is gone with only isolated rotten fragments clinging to the wall at some places. All the attaching hardware is bent and damaged or completely gone.

Generally, this section of wall is in the same or advanced state of disrepair as in 2009.

6.1.2 Station KN 0+493.9± to KN 0+669±

This section commences at the structure change at sta. KN 0+439.3 where the wall changes to timber sheet piles from steel sheet piling. No portions of the timber sheet piles were visible above water. The timber sheet pile condition is expected to be the same or worse since the 2009 inspection.

The concrete cope beam is in fair condition with the top edge generally spalled throughout. Some spalling extends down the face of the cope beam where areas of exposed concrete reinforcing steel can be seen. Recent repairs to the cope beam are evident between sta. KN 0+607 and KN 0+611.

This section also includes the north abutment to the Cherry Street Bridge. The abutment extends above the cope beam and forms a seat for the lift bridge. The concrete face of the abutment appears in good condition. It has undergone some concrete repairs and/or modifications at both upper east and west corners.

The concrete cope beam from the west bridge abutment near sta. KN 0+653 to the structure change at sta. KN 0+669 is in fair condition with some spalling on the face behind where horizontal timber fenders were present.

It appears that a horizontal timber rub strip once existed on the cope beam face. Holes for anchor bolt attachment points were observed throughout the length of the wall. On the bridge abutment, there are multiple levels of horizontal timbers across the face. Three levels were observed above water. The upper level of timbers is deteriorated with fractured or missing timbers. The rub strip terminates short of the structure change at sta. KN 0+669.

6.1.3 Station KN 0+669± to KN 0+764±

There is a change in cope beam construction at the start of this section. The concrete cope beam consists of precast blocks upon which an upper cast-in-place portion lies. The timber sheet piling below the cope beam is submerged and was not visible. The precast blocks have some deterioration at the bottom of the joint between blocks. The cast-in-place portion of the cope beam has near continuous mechanical damage or spalling along the top at the water's edge. On the back edge of the cope beam, there is a vertical concrete splash wall. It appears in fair condition.

6.1.4 Station KN 0+764± to KN 0+973.5±

The timber sheet piling continues to be submerged throughout this section and was not visible. The cope beam changes to cast-in-place construction for the full height. The top surface and upper half of the cope beam face is extremely deteriorated throughout with major spalling. It appears that a timber rub strip once existed on the face. Holes from the anchor bolt attachments were visible on the lower half of the cope beam face

6.1.5 Station KN 0+973.5± to KN 1+115.6±

The section of wall changes to steel sheet piling with a cast-in-place cope beam. The wall was partially obstructed from view on the waterside due to the presence of three berthed vessels. Where unobstructed, the face of the concrete cope beam and the upper portion of the steel sheet pile were visible to the tie rod level. Generally, up to sta. KN 1+003 the cope beam is in fair condition with spalling and mechanical damage observed along the top water's edge. Some delamination was evident on this edge as well. Spalling is evident along the vertical joints between cope beam sections. Mechanical damage, spalling and some exposed concrete reinforcing were evident on the top and face of the cope beam from sta. KN 1+103 to the corner of the slip at sta. 1+115.6. There is mechanical damage to the top of the steel sheet piling at the corner of the slip. No fenders were present on the face of the wall, only isolated hanging tires.

6.2 KEATING CHANNEL SOUTH SIDE (STATION KS 0+000 TO KS 0+733.5±)

6.2.1 KS 0+000 to KS 0+061±

The upper portion of the steel sheet pile was visible above water. No significant change in the extent of corrosion was observed. Tie rods and wale bolts have surface corrosion. Every fourth sheet pile extends to the top of the cope beam which appears to have once served as an attachment point for fenders that no longer exist. The concrete of the cope beam is in fair condition with little difference noted in the condition since 2009.

6.2.2 KS 0+061± to KS 0+212.35±

The structure changes to timber sheet piling with a concrete cope beam within these stations. Only the concrete cope beam was visible above water. Generally, there is mechanical damage or spalled concrete along the top water's edge of the cope beam, some of which extends across the top of the beam. Some areas have more extensive deterioration with reinforcing steel exposed. The deteriorated vertical joints remain the same. A new concrete deck has been placed behind the cope beam in the vicinity of sta. KS 0+100. The deteriorated vertical joints between concrete sections remain the same. There is mechanical damage intermittently along the face of the cope beam. The rotation in the top of the wall between sta. KS 0+146 and KS 0+180± appears stable with no noticeable additional movement.

6.2.3 KS 0+212.35± to KS 0+240.91±

The Toronto Port Authority has a jetty that juts out from the general south alignment channel. The east wall of the jetty is newer steel sheet pile placed outboard of the old wall and cope beam. It extends out to the corner at sta. KS 0+237.75 and turns down the north face to sta. KS 0+240.91. The steel sheet piling as observed above water is in good condition.

6.2.4 KS 0+240.91± to KS 0+269.0±

The original wall construction consisting of steel sheet piling with a concrete cope beam above continues to the next outboard corner at sta. KS 0+269.0. The top steel sheet piling terminates just above water. The concrete cope beam above has mechanical damage along the top water`s edge that is more severely deteriorated at the corner. There is damage down the vertical joints between sections of concrete.

6.2.5 KS 0+269.0± to KS 0+540.35 ±

The construction consists of steel sheet piling with a concrete cope beam above very similar to the previous section. The top steel sheet piling terminates just above water. The concrete cope beam above has mechanical damage along the top water`s edge with isolated sections of severe spalling across the top width of the cope beam and continuing down the face. A few sections are so severe that there is exposed reinforcing steel. There is damage down the vertical joints between sections of concrete. Some edge repairs have been undertaken along the water`s edge of the cope beam.

The horizontal steel channels along the top of the steel sheet piles are damaged or missing throughout the length of the wall. The horizontal timber rub strip once situated on top of the steel sheet piling is gone, exposing channel and the top of the sheet piling to mechanical damage. Additional horizontal timbers are mounted on the upper portion of the cope beam at some locations. They are in fair to poor condition.

6.2.6 KS 0+540.35± to KS 0+664.9 ±

Within this section of wall, the construction changes to timber sheet piling with a concrete cope beam. Only the horizontal steel channel was observable along the very top of the timber sheet pile. Above this point is the concrete cope beam. There is intermittent edge deterioration either from spalling or mechanical damage throughout the length of the cope beam, the extent of which is less than on previous sections along the south side of the Keating Channel. Along the bottom of the cope beam there is near continuous spalling of the concrete in the splash zone. Efflorescence is noted on the face of the cope beam. Some isolated sections of horizontal cracking were noted in the area of sta. KS 0+630±. None of the horizontal timber fenders remain on the dock face.

6.2.7 KS 0+664.9± to KS 0+733.5 ±

The south abutment of the Cherry Street Bridge lies between these stations. At the east and west ends of the abutment are rolling style fenders. The concrete abutment is in good condition. On the bridge abutment, there are three levels of horizontal timbers across the face. There is deterioration to all three levels of timbers on the west end of the abutment. On the west face of the abutment there is spalling of concrete along the splash zone.

6.3 FORMER ESSROC FACILITY (STATION E 0+000 TO E 0+544.1±)

6.3.1 E 0+000 to E 0+120.8±

This section of Essroc is a continuation of the timber sheet piling and concrete cope beam from the east side of the Cherry Street Bridge. The concrete condition on the top of the cope beam becomes progressively worse out to the corner at sta. E 0+065±, with spalling and top edge damage. There is extensive deterioration at the corner with exposed reinforcing steel. The lower portion of the cope beam in the splash zone is eroded.

The top edge deterioration is somewhat more extensive from the outside corner at sta. E 0+065± to the inside corner at sta. E 0+120.8± with larger spalled areas. Three of the areas have exposed reinforcing steel. Spalling is evident down the joints between concrete sections. The lower part of the concrete cope beam continues to be eroded throughout the length.

No fenders presently exist on the dock face.

6.3.2 E 0+120.8 to E 0+544.1±

This section of Essroc changes to timber cribs with a concrete cope beam. No portion of the timber cribs was visible above water.

Visually the dock face has an irregular alignment from the inside corner at sta. E 0+120.8± to the outside corner at sta. E 0+305.5±. The concrete cope beam has intermittent spalling and edge damage throughout the length. Major sections of the cope beam have been repaired throughout this length.

Similarly, the alignment of the dock face is not straight from the outside corner at sta. E 0+305.5± to the outside corner at sta. E 0+359±. The cope beam around the corner at sta. E 0+305.5± has had a major repair. The concrete is in good condition. The top edge of the cope beam appears rounded, likely from erosion from wave overtopping. There are at least five locations of major damage to cope beam along this west face. Concrete fill has been placed behind the cope beam in an attempt to minimize washouts from wave overtopping. The cope beam has a raised corner at sta. E 0+359±. The concrete at the corner has been significantly undermined by erosion.

The wall alignment is more uniform from the outside corner at sta. E 0+359± to the inside corner at sta. E 0+544.1±. The top of the cope beam has edge deterioration throughout this length along with locations of concrete delamination. More significant, are the areas of erosion at the base of the cope beam along the splash zone. This is apparent east from the corner, where an internally embedded rail beam is exposed along with reinforcing steel. Erosion can be seen down the wall below the joints between concrete sections. Throughout the length of the south wall are locations of severe erosion at the splash zone, where reinforcing steel is exposed. There is a 5 metre long delaminated portion of cope beam cap in the vicinity of sta. E 0+394±. At the splash zone below this location is a major area of significant erosion. There are two other areas of similar erosion all present before sta. E 0+400. Beyond this station to the inside corner, there are many other smaller areas of similar erosion at the splash zone. Generally, there is concrete deterioration at the vertical joints between concrete sections.

6.4 MARINE TERMINAL 35 (STATION MT 0+000 TO MT 1+130±)

6.4.1 MT 0+000 to MT 0+060±

Between these limits is the connecting wall between Essroc and Marine Terminal 25. The details of this wall are unknown. It likely pre-exists the construction of Marine Terminal 35. Only the cope beam was visible above water. Severe spalling is present across the top and down the face of the cope beam up to sta. MT 0+050. Beyond this point to the inside corner at sta. MT 0+060 there are isolated areas of mechanical damage on the face of the cope beam. At the splash zone there is continuous erosion of the concrete over the full length of the cope beam. It is more severe from sta. MT 0+000 to MT 0+050±.

6.4.2 MT 0+060 to MT 0+445±

Sta. MT 0+060 is the north inside corner of Marine Terminal 35. This section of wall continues to the outside corner of the terminal at sta. MT 0+455±. The upper portion of the steel sheet piling and the cope beam above were visible for observation. Approximately 50% of the waterside was obstructed from view by berthed vessels. The face of the cope beam is generally in good condition with isolated area of mechanical damage. Around sta. MT0+400± and to the corner there is spalling on the face, particularly at the vertical joints between concrete sections. Along the top of the cope beam, particularly on the top outside edge, there is mechanical damage and spalling to varying degrees. There are several locations of exposed reinforcing between sta. MT 0+100 and MT 0+150 ±.

6.4.3 MT 0+455 to MT 0+682±

This section of wall extends across the west face of the Marine Terminal from the north outside corner at sta. MT 0+455± to the south outside corner at sta. MT 0+682±. Over 90% of the waterside face was obstructed by a moored vessel. At the north corner, there is impact damage

to the top and face of the cope beam on either side of the rotating fenders. The first bollard inboard from the corner has failed as it was pulled out of the cope beam. A similar condition exists on the south corner where there is impact damage to the face of the cope beam. The first bollard inboard from the corner, as well, has failed. The rotating fender itself has sustained impact damage. As viewed from the topside, there is significant edge damage along the length of the cope beam. Several areas have exposed reinforcing steel. This damage may continue down the face of the cope beam. It was noted that several of the hanging rubber fenders on the face are missing.

6.4.4 MT 0+682 to MT 1+067±

This section of wall extends from the south outboard corner to the south inboard corner at the connecting wall between Marine Terminal 35 and Polson Quay and constitutes the south face of Marine Terminal 35. Less of the waterside face was obstructed along this face revealing nearly 55% of the wall. From the corner to the vicinity of sta. MT 0+710 there are three large areas of damaged cope beam with exposed reinforcing steel. All tie rods in this length appear secured to the wall, except two consecutive tie rods that are secured at outpan locations inboard of the corner. The nuts appear to have been sheared off from vessel contact. This would coincide with the corner damage to the face of the cope beam above. The once-embedded base of the bollard at this location is exposed. Between sta. MT 0+770 and MT 0+800, the face of the cope beam appears in good condition. There is a continuous joint along the base of the cope beam just below the location of ancillary tie rods that were added in 1961. This may be a horizontal cold joint associated in raising the height of the cope beam at that time. All the original tie rods securing the steel sheet piling appear intact. The next visible section of wall is between sta. MT 0+ 820 and MT 0+840. The face appears in good condition. The same horizontal joint exists. There is top edge deterioration at sta. MT 0+840± and the bollard base is exposed. The top of the cope beam transitions down toward the inner corner. The next visible section is between sta. MT 0+890 and MT 1+110. There is significant damage to the cope beam throughout. It is most severe near the heavy lift crane. Beyond sta. MT 0+950 the extent of deterioration is less. The same horizontal joint at the base of the cope beam is apparent throughout this length. All lower tie rods connecting the steel sheet piling appear intact. The next visible section is from sta. MT 1+150 to the corner at sta. MT 1+067. There is edge damage and spalling, however, the tie rods are intact. Top side observations reveal many locations of cope beam edge deterioration throughout the length of wall. Some are severe with exposed reinforcing steel.

6.4.5 MT 1+067 to MT 1+130±

This section is the connecting wall between Marine Terminal 35 and Polson Quay. Details are unknown, but it appears similar to the connecting wall between Essroc and Marine Terminal 35. There is extensive spalling throughout and severe erosion at the waterline.

6.5 POLSON QUAY (STATION PQ 0+000 TO PQ 1+170.9±)

6.5.1 PQ 0+000 to PQ 0+270.6±

This section of wall extends from the inside corner at sta. PQ 0+000 to the structure change at sta. PQ 0+270.6±. Only the concrete cope beam was visible above water. Generally, the cope beam is in fair to good condition out to the limit of the Lafarge dock at sta. PQ 0+060±. Areas of efflorescence were noticed on the face. Between sta. 0+0+60± and PQ 0+85± efflorescence and spalling is more evident on top and down the face of the cope beam. Beyond sta. PQ 0+085 to the end of the structure the cope beam is weathered with isolated cracks through the beam where a few locations of edge damage exist. Isolated repairs have been undertaken to repair the concrete cope beam throughout this length.

Along the topside there were no sink holes observed behind the cope beam.

There are isolated tire fenders on the face of the cope beam. The original horizontal timber fender is gone with only remains of the steel attachment hardware present.

6.5.2 PQ 0+270.6 to PQ 0+501±

The change in structure continues to the outside corner at sta. 0+364.1±, where this section of wall turns south and terminates at the next structure change at sta. PQ 0+501±. The concrete cope beam and the upper part of the steel sheet pile wall were visible, including tie rod and wale bolt connections.

At the structure change, there is significant spalling and efflorescence on the face of the cope beam. Up to sta. PQ 0+300 the cope beam has edge deterioration and lesser efflorescence on the face. The cope beam is weathered. Closer to sta. PQ 0+350, and ahead to the corner, there are several larger locations of edge damage and cracks through the cope beam. On the west face just beyond the corner there are a two major cracks through the cope beam. Further south, the edge of the cope beam is severely deteriorated before sta. PQ 0+400. Within the next 50 m there are several lengths of severe edge deterioration on the cope wall. Locations of lesser edge deterioration continue to the structure change.

All tie rod and wale bolt connections appear intact.

6.5.3 PQ 0+501 to PQ 0+578.5±

The concrete cope beam and upper portion of the steel sheet pile wall were visible. The cope beam is weathered with isolated sections of major edge deterioration, which extends partially down the face.

Tie rod and wale connections appear intact.

6.5.4 PQ 0+578.5 to PQ 0+915.2±

From sta. PQ 0+578.5 to PQ 0+711.4 the cope beam has various extensive sections of deteriorated concrete that consist of edge deterioration which at times extends across the width of the cope beam and partially down the face. Some areas of deterioration have exposed reinforcing steel. There is efflorescence on the face of the cope beam to the outside corner at sta. PQ 0+711.4

From the corner, the condition of the wall improves. Efflorescence is present on the face of the cope beam from the corner to approximately sta. PQ 0+750. There are some isolated areas of edge deterioration. The condition of the cope beam improves from sta. PQ 0+750 until just before sta. PQ 0+850. From sta. PQ 0+850 to PQ 0+885, the cope beam condition is better. Efflorescence and edge deterioration reappears over several lengths to the structure change at PQ 0+915.2±.

6.5.5 PQ 0+915.2 to PQ 1+170.9±

At the structure change there is extensive concrete deterioration with exposed reinforcing steel. This deterioration is typical at the joints between concrete pours. The concrete is eroded along the splash zone. Efflorescence is present on the face of the cope beam in varying degrees. Near sta. PQ 1+000 until the end of the structure there are many extensive lengths of severe cope beam deterioration, including efflorescence, on the edge and down the face. Similar deteriorated concrete is present along the west face of the bridge abutment at Cherry Street.

6.6 SHIP CHANNEL (STATION SC 0-250 TO SC 0+706.79±)

6.6.1 SC 0-250± to SC 0+000

From sta. SC 0-250 to SC 0+000 there is intermittent edge deterioration. Near sta. SC 0+000 the deterioration becomes continuous with exposed reinforcing steel. Erosion along the splash zone is continuous. Similar edge conditions are consistent throughout this length of the Ship Channel with varying degrees of deterioration. Efflorescence is present on the face of the cope beam in varying degrees and sections of the cope beam face.

6.6.2 SC 0+000± to SC 0+706.79±

The timber sheet pile substructure was not inspected as the piling was below the waterline. The Riggs Engineering 2009 condition survey indicated that there is a continuous timber wale below the cope beam which has missing or loose timber wale sections and was generally in poor condition. The previous condition survey also stated that the timber sheet pile generally has gaps 25 mm or less between the timbers and splines, and occasionally has gaps 50 mm or larger. Furthermore, there are some locations with missing timbers and splines. The condition of the substructure was not inspected in this report. It is presumed that the condition of the underwater substructures is the same or worse than the 2009 inspection.

The concrete cope beam within this section typically has varying degrees of concrete deterioration. There are areas of efflorescence on the face of the cope beam, which suggests possible occurrence of alkali aggregate reactivity. The Riggs Engineering 2009 condition survey indicated that there was minor to severe spalling along the top and face of the cope beam at some 21 locations, and this is consistence with what was observed. There were also several locations with exposed reinforcing steel. The 2009 condition survey recommended repairs/replacement of a few broken/missing horn style bollards, and it appears that some of the recommendations were implemented. Two of the broken/missing bollards between sta. SC 0+500± and SC 0+600± have been replaced with pipe style bollards, which are in good condition.

The appurtenances along the Ship Channel are generally in similar condition to what was observed in 2009.

7 USEFUL RESIDUAL LIFE

Facility assessment is an empirical method published within Public Works Canada and Transport Canada "Guidelines for Inspection and Maintenance of Marine Facilities", 1985.

The tables for the useful residual life of the substructures and superstructures are from Riggs Engineering 2009 Dockwall Condition Survey/Investigation - Lower Don Lands. The actual age of these structures has been updated to 2015. These tables have also been updated to include Marine Terminal 35.

This empirical method establishes the remaining useful residual life (URL) of a structure/facility. It takes into account the theoretical useful life (TUL) which is weighted subjectively with a weighting coefficient (WC) related to environmental site conditions and also a compensating factor (CF) related to actual physical condition of the structure. The actual age (AA) of the structure is then subtracted from the modified TUL to determine the URL of the structure. The empirical formula is as follows:

URL = [TUL X (100 – WC)% X CF] – AA

Where:
WC = 0 to 30,

- Depending on the degree of use
- Exposure to salinity and pollution
- Wave climate
- Ice conditions
- Fender systems
- Foundations
- Construction and design
- Biological attack

CF = 0.7 to 1.0,

- Depending on the actual condition of the structure:
  - Severe deterioration = 0.7
  - Considerable Deterioration = 0.8
  - Average Deterioration = 0.9
  - Normal Condition = 1.0

AA = actual age of the structure in years

The facility is assessed by components, and in this case the steel sheet piling, the concrete cope beams, and the asphalt pavement were considered.

The TUL assumed in the calculation of the URL in this report is:

- Steel Sheet Piling/Pipe Piles 80 years
- H-Piles 50 years
- Concrete 60 years
- Submerged timber components 80 years

Factors that influence the selection of the weighting coefficient as presented in the federal government guidelines are shown in the following table:

Table 7-1 Weighting Coefficient Influence Factors

Variables	Description	Weighting Coefficient (WC)			
		Steel	Concrete	Timber	Rock
Use	Normal	0	0	0	0
	Heavy	7.5	5	10	0
	Abusive	15	10	20	0
Exposure to Salinity & Pollution	None	0	0	0	0
	Alternating	10	10	2.5	0
Ice and Waves	Good	0	0	0	0
	Fair	2.5	2.5	7.5	5
	Inadequate	5	5	15	10
Fender System	Good	0	0	0	0
	Fair	2.5	2.5	5	0
	Inadequate	5	5	10	0
Foundation	Excellent	0	0	0	0
	Fair	5	10	2.5	5
	Problems	10	15	5	10
Construction and Design	Excellent	0	0	0	0
	Fair	5	5	5	15
	Weak	10	10	10	30
Biological Attack	None	0	0	0	0
	Some	0	0	15	0
	Advanced	0	0	30	0

The useful residual life of the substructures are summarized in Table 7-2 while the superstructures are summarized in Table 7-3. All substructures and superstructures within the study area have exceeded the theoretical useful life, with the exception of the Keating Channel South Side, sta. KS 0+212.35 to KS 0+240.91 which was constructed in 1997. The development plans and proposed changes for this study area will eliminate significant structural concerns with the existing dockwalls.

Table 7-2 URL Substructures

Structure/Station	Structure Type	Year Constructed	TUL years	WC	CF	AA years	URL years
Keating Channel North Side							
KN 0+000 To KN 0+493.9	SSP: Lackawanna Arched-web No. AP14	1914	80	17.5	0.9	101	**0**
KN 0+493.9 To KN 0+639.8	Timber Sheet Piling	1912	80	25	0.9	103	**0**
KN 0+639.8 To KN 0+655.6	Timber Sheet Piling	1912	80	25	0.9	103	**0**
KN 0+655.6 To KN 0+668±	Timber Sheet Piling	1912	80	25	0.9	103	**0**
KN 1+019.5 To KN 1+115.6	SSP: Algoma A10	1939	80	20	0.9	76	**0**
Keating Channel South Side							
KS 0+000 To KS 0+060.6±	SSP: Lackawanna Arched-web No. AP14	1940	80	17.5	0.9	75	**0**
KS 0+060.6 To KS 0+212.35	Timber Sheet Piling	1914	80	25	0.9	101	**0**
KS 0+212.35 To KS 0+240.91	SSP: XZ90	1997	80	22.5	0.9	18	**38**
KS 0+240.91 To KS 0+269±	SSP: Lackawanna Arched-web No. AP14	1912	80	17.5	0.9	103	**0**
KS 0+269± To 0+540.35±	SSP: Lackawanna Arched-web No. AP14	1912	80	17.5	0.9	103	**0**
KS 0+540.35 To KS 0+664.9±	Timber Sheet Piling	1912	80	25	0.9	103	**0**
KS 0+664.9 To KS 0+733.5	Timber Sheet Piling	1912	80	25	0.9	103	**0**
Former Essroc Facility							
E 0+000 To E 0+120.8±	Timber Sheet Piling	1912	80	27.5	0.9	103	**0**
E 0+120.8± To E 0+544.1±	Stone Filled Timber Crib	1912-1914	80	27.5	0.9	97-95	**0**
Marine Terminal 35							
MT 0+000 To MT 1+130±	SSP: Larssen III	1935-1936	80	20	0.9	81-80	**0**
Polson Quay							
PQ 0+000 To PQ 0+270.6±	Timber Sheet Piling	1917	80	25	0.9	98	**0**
PQ 0+270.6± To PQ 0+501±	SSP: Lackawanna Deep Arch No. DP166	1929	80	20	0.9	86	**0**
PQ 0+501± To PQ 0+578.5	SSP: Algoma A8	1936	80	20	0.9	79	**0**
PQ 0+578.5± To PQ 0+915.2±	SSP: Algoma A10	1935	80	20	0.9	80	**0**
PQ 0+915.2± To PQ 1+170.9±	Timber Sheet Piling	1917-1921	80	27.5	0.9	92-88	**0**
Ship Channel							
SC 0+000 To SC 0+706.79±	Timber Sheet Piling	1917-1921	80	25	0.9	92-88	**0**

Table 7-3 URL Superstructures

Structure/Station	Structure Type	Year Constructed	TUL years	WC	CF	AA years	URL years
Keating Channel North Side							
KN 0+000 To KN 0+493.9	Concrete Cope Beam	1914	60	22.5	0.7	101	**0**
KN 0+493.9 To KN0+639.8	Concrete Cope Beam	1912	60	22.5	0.7	103	**0**
KN 0+639.8 To KN 0+655.6	Concrete Cope Beam	1912	60	22.5	0.8	103	**0**
KN 0+655.6 To KN 0+668±	Concrete Cope Beam	1912	60	22.5	0.8	103	**0**
KN 1+019.5 To KN 1+115.6	Concrete Cope Beam	1939	60	25	0.9	76	**0**
Keating Channel South Side							
KS 0+000 To KS 0+060.6±	Concrete Cope Beam	1940	60	22.5	0.9	75	**0**
KS 0+060.6 To KS0+212.35	Concrete Cope Beam	1940	60	32.5	0.8	75	**0**
KS 0+212.35 To KS 0+240.91	Concrete Cope Beam	1997	60	32.5	0.8	18	**14**
KS 0+240.91 To KS 0+269±	Concrete Cope Beam	1912	60	32.5	0.8	103	**0**
KS 0+269± To KS 0+540.35±	Concrete Cope Beam	1912	60	22.5	0.9	103	**0**
KS 0+540.35 To KS 0+664.9±	Concrete Cope Beam	1912	60	22.5	0.9	103	**0**
KS 0+664.9 To KS 0+733.5	Concrete Cope Beam	1912	60	22.5	0.9	103	**0**
Former Essroc Facility							
E 0+000 To E 0+120.8±	Concrete Cope Beam	1912	60	25	0.9	103	**0**
E 0+120.8± To E 0+544.1±	Concrete Cope Beam	1914	60	25	0.9	97-95	**0**
Marine Terminal 35							
MT 0+000 To MT 1+130±	Concrete Cope Beam & Relieving Platform	1935-1936	60	25	0.9	81-80	**0**
MT 0+050± To MT 0+860±	Raised Concrete Cope Beam	1961	60	25	0.9	54	**0**
Polson Quay							
PQ 0+000 To PQ 0+270.6±	Concrete Cope Beam	1917	60	22.5	0.9	98	**0**
PQ 0+270.6± To PQ 0+501±	Concrete Cope Beam	1929	60	25	0.9	86	**0**
PQ 0+501± To PQ 0+578.5	Concrete Cope Beam	1936	60	25	0.9	79	**0**
PQ 0+578.5± To PQ 0+915.2±	Concrete Cope Beam	1935	60	25	0.9	80	**0**
PQ 0+915.2± To PQ 1+170.9±	Concrete Cope Beam	1917	60	25	0.9	92-88	**0**
Ship Channel							
SC 0+000 To SC 0+706.79±	Concrete Cope Beam	1921	60	22.5	0.9	92-88	**0**

8 DOCKWALL STRUCTURAL ASSESSMENT

Based on the proposed development, only the following structures will remain as vertical face retaining structures: Marine Terminal 35, Polson Quay and the north side of the Ship Channel. These structures have been analyzed to determine pile embedment needs, pile bending moment stresses and tie rod loads. These analyses are very preliminary in nature and are intended to identify if the existing components are roughly in the right proportion. The analyses should not be construed as a design verification.

The GHD Port Lands - Environmental, Geotechnical and Hydrogeological Investigation, September 2015 (GHD's Port Lands Report) investigative locations of the boreholes related to the structure under investigation are shown on Figure 8-1. From the investigative locations, boreholes were carefully chosen to be used in performing classical limit equilibrium analysis of the existing structures. These boreholes are presented in Table 8-1. The GHD's Port Lands Report did not assign soil properties for the material encountered within the investigative locations.

The classical limit equilibrium approach was used to check the integrity of these dockwalls. Behind these dockwalls there is typically a concrete relieving platform, which is designed to carry any surcharge load down to the timber pile bents and thus preventing lateral load on the walls. In order to determine the lateral pressures from applied surcharges outside the limit of the relieving platform, Boussinesq approximation for strip loads was used. It has been Riggs' experience that deriving lateral pressure distribution from point and strip loads using Boussinesq approximation can lead to overestimation of the tie rod loads and underestimation of the bending moment of the sheet piling. Regardless, in order to be consistent with the Canadian practice (CFEM, 2004), Boussinesq approximation is used to determine the lateral pressures applied to the wall.

No reduction in passive pressures was assumed in the analysis. The results of the classical analysis using the Boussinesq approximation are summarized in Table 8-3. The assumed grade of steel for the steel sheet piling is 265 MPa, and 210 MPa for the tie rods. The assumed allowable bending stress of the supposed Douglas Fir-Larch timber sheet piling is 6 MPa. The bending moment and tie rod resistance is based on new materials, even though deterioration and corrosion of the existing tie rods and sheet piling was observed. Despite that, no reduction to the capacity was used in the tabulation of the results shown in Table 8-3.

The piling toe embedment factor of safety is typically 2 or more, with the exception of Marine Terminal 35 and Polson Quay sta. PQ 0+000 to PQ 0+270.6±. These two sections indicate that the pilings are too short.

Typically the bending moment of the piling is more than the capacity it could resist. The steel sheet piling only at Polson Quay sta. PQ 0+270.6± to PQ 0+501± and sta. PQ 0+578.5± to PQ

0+915.2± has a factored resistance greater than the applied bending moment. The analysis indicates that the majority of these structures should have already failed but it is not the case as they are still in marginal service. One explanation as to why the piling has not failed may be due to the probability that there are shadowing effects from the dense grid of timber piles in the relieving platform. These piles may be limiting the lateral load on the actual wall. The relieving platforms also prevent loading on to the wall, as they are designed to transfer the loads vertically through the round timber piles without imposing bending stresses on the facewall.

The applied tie rod forces are generally less than the factored tie rod resistance, with the exception of Polson Quay sta. PQ 0+000 to PQ 0+270.6±. This portion of Polson Quay, as previously mentioned, has had some of the original tie rods replaced with new tie rods and anchor blocks. The limits of the replacement is unknown and the time of construction was between 1996 and 2004. This indicates that the tie rods were undersized.

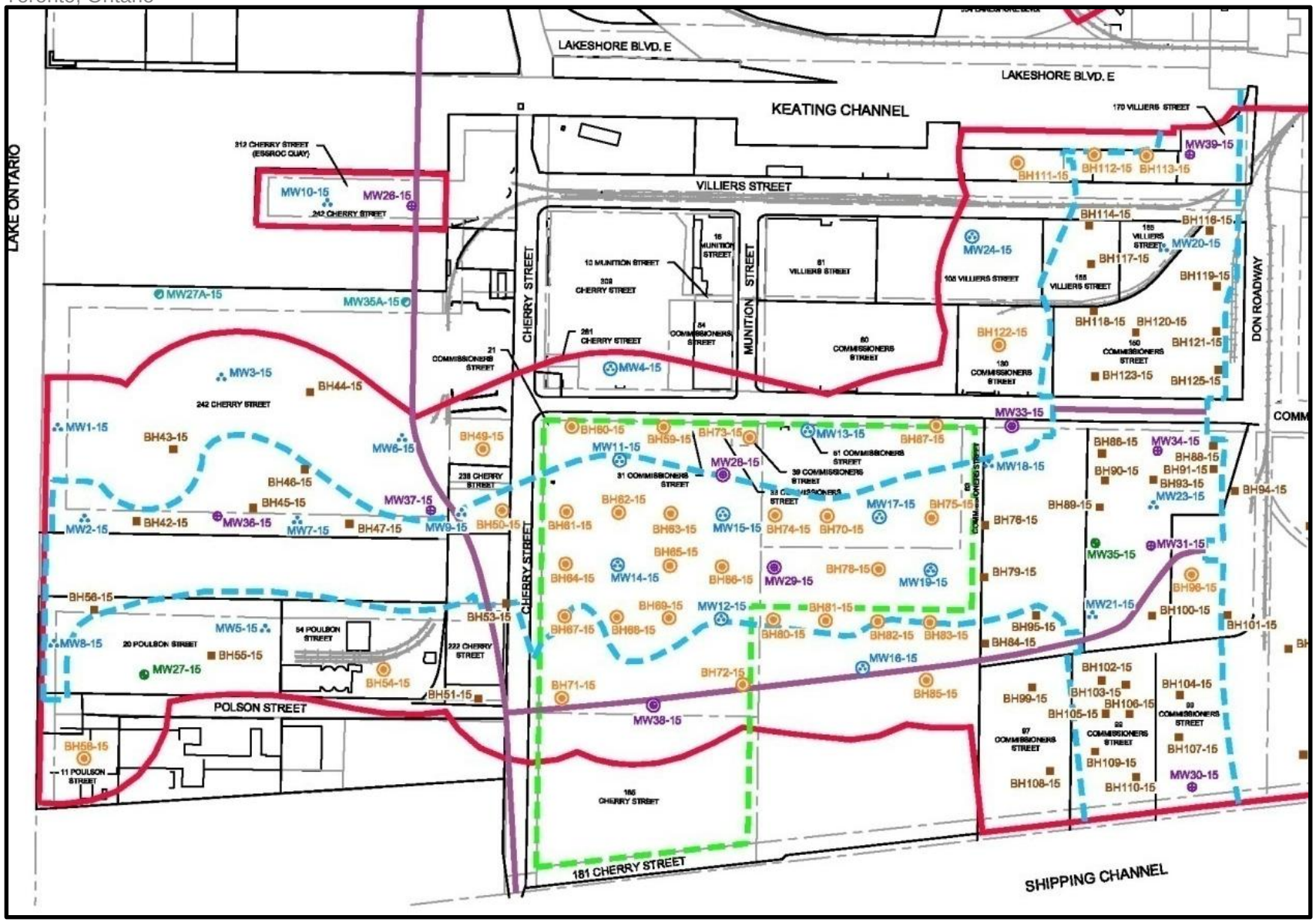


Figure 8-1 Excerpt from GHD's Port Lands Report - Site Plan and Investigative Locations

Table 8-1 Boreholes from GHD's Port Lands Report

Structure	Borehole No.
Marine Terminal 35	MW1A-15 & MW2A-15
Polson Quay	MW5A-15, BH56-15, MW8A-15
Ship Channel	BH48-15

Table 8-2 Assumed Soil Properties for Structure Boreholes

Soil Properties	γ Bulk Unit Weight, (kN/m)	γ' Buoyant Unit Weight (kN/m)	θ Angle of Internal Friction of Soil (Degree)	C Cohesion(kN/m^2)	Ca Adhesion (kN/m^2)
Dense Sand	18.6	10.8	32		
Compact Sand	18.6	10.8	30		
Loose Sand	17.16	10.3	28		
Silty Sand	17.7	7.9	26/28		
Silt	17.7	7.9	26		
Peat	12.8	3	22		
Silty Clay	18.6	8.6	26	40	5
Stiff Silty Clay	18.6	8.8	28	50	5
Bedrock	17.2	9.8	45	200	

Table 8-3 Dockwall Structural Assessment

Structure	Soil Condition	Sur-charge Load (kPa)	Toe Embed. FOS	Applied Bending Moment (kNm/m)	Applied Tie Rod Force (kN/m)	Applied Upper Tie Rod Force (kN/m)	Factored Bending Moment Resistance (kNm/m)	Factored Tie Rod Resistance (kN/m)
Marine Terminal 35 MT 0+000 to MT 1+064±								
Original 1935/1936 SSP: Larssen III	Drained	0	>2	308.2	77.3		324.4	154.6
Raised Concrete Cope Beam 1961 SSP: Larssen III	Drained	0	>1	374.4	113.9	3.1		
	Drained	10	>1	467.2	144.4	6.2		
Polson Quay								
PQ 0+000 to PQ 0+270.6± Timber Sheet Piling	Drained	0	1	291.8	172		139.5	121.8
	Drained	10	< 1	246.5	232.4			
PQ 0+270.6± to PQ 0+501± SSP: Lackawanna Deep Arch No. DP166	Drained	0	>2	341.4	92		376.8	152.2
	Drained	10	2	358.3	98.1			
PQ 0+501± to PQ 0+578.5± SSP: Algoma A8	Undrained	0	>2	334.9	94.1		292.9	152.2
	Undrained	10	>2	352.9	99.4			
	Drained	0	>2	328.5	89.3			
	Drained	10	>2	351	96.3			
PQ 0+578.5± to PQ 0+915.2± SSP: Algoma A10	Undrained	0	>2	326.9	95.3		361.8	261.8
	Undrained	10	>2	341.9	100.2			
	Drained	0	>2	316.6	89.5			
	Drained	10	>2	335.7	96.2			
PQ 0+915.2± to PQ 1+170.9± Timber Sheet Piling	Undrained	0	>2	197.7	109.6		139.5	121.8
	Undrained	10	>2	205.5	115.3			
	Drained	0	>2	195.3	101.9			
	Drained	10	>2	203.5	109.2			
Ship Channel								
SC 0+000 to SC 0+706.79± Timber Sheet Piling	Undrained	0	>2	188.6	108.3		139.5	121.8
	Undrained	10	>2	200.6	113.6			
	Drained	0	>2	177.5	88.4			
	Drained	10	>2	189.3	97.8			

9 RECOMMENDATIONS

The recommendations for the study area dockwalls depends on the proposed DMNP development. In most cases the proposed changes will eliminate the majority of the structural concerns that have been mentioned in previous sections.

9.1 KEATING CHANNEL

The proposed development within the Keating Channel includes removal of the structure between sta. KS 0+212.35 and KS 0+292.75 along the south wall and installation of a new ±31 metre bulkhead structure to match the existing south wall alignment. Both sides of the Keating Channel will be encapsulated with a berm from approximately the harbour bottom to the waterline. The proposed berm will stabilize the piling, eliminating the need to undertake costly reconstruction. The costs related to this DMNP development are presented in Table 10-1.

Cautions should be taken not to destabilized the piling in preparation of the channel bed prior to placement of the rock berm.

The existing concrete cope beam will remain in service according to the proposed development plans; thus, concrete repairs will be required to preserve the above water portions of the concrete cope beams along the south side of the Keating Channel, which will abut the upland development being considered by others.

9.2 FORMER ESSROC FACILITY

Development plans for the former Essroc Facility include the placement of a berm that will encapsulate all of the timber sheet piling and timber crib components, therefore eliminating structural concern within this section. The encapsulation extends close to Marine Terminal 35 sta. MT 0+405±, filling in the slip between the former Essroc Facility and Marine Terminal 35. This encapsulation will be created during the construction of Promontory Park. All costs associated with that development are reported through the TRCA.

9.3 MARINE TERMINAL 35

The proposed change for Marine Terminal 35 includes encapsulation of approximately 405 metres of wall along the north face of this facility. This encapsulation is part of the Essroc Quay filling operation. Approximately 232 metres of wall will remain in service for commercial use, between sta. MT 0+405± and MT 0+637±. The remainder of the structure (sta. MT 0+637± to MT 1+130±) will be demolished. Restoration of the demolished section will be covered by other members of the DMNP team. A review of the restoration limits is not anticipated to affect the removals. The costs shown in Table 10-1 are the budget for demolition, construction of a new returnwall for the shortened dockwall and remediation of the dockwall that is to remain. Remediation will require repairs to the concrete cope beam and the appurtenances (bollards,

guard rail and tie rods). The existing building on the site is to remain and will encumber tie rod installation. No costs are apportion to steel sheet pile replacement or repairs. The removal, new return wall and remediation costs are shown in Table 10-1.

The dockwall analysis shows that when the concrete cope beam height was raised in 1991, it increased the bending stress in the piling beyond its theoretical capacity. Reconstruction is recommended to extended the service life of the dockwall.

9.4 POLSON QUAY

There is no proposed works at the Polson Quay dockwalls, but there is a plan to facilitate future excavation and dredging for the DMMP redevelopment. Thus, an extension of Polson Quay is required east of sta. PQ 0+000 on the north side of Polson Quay. The related cost for the extension is presented in Table 10-1.

There is no budget allowance for reconstruction of the Polson Quay between sta. PQ 0+000 and PQ 0+270.6. as part of the DMNP redevelopment. These structures have exceeded their useful residual life and are mathematically over-stressed (evidence of failure was observed during the inspection). We understand that there are on-going discussions with the tenant regarding continued use of this facility. The replacement/repair cost of this section are shown in Table 10-2.

The section between sta. PQ 0+270.6± and PQ 0+915.2± is composed of three different types of steel sheet piling. These structures have exceeded their useful residual life and are marginally stressed to the limits. Similar to Marine Terminal 35, a detailed inspection of these structures is recommended so that risks can be managed and future rehabilitation can be planned. Estimated replacements cost are shown in Table 10-2.

The timber sheet piling from sta. PQ 0+915.2± to 1+170.9± has exceeded its useful life and is mathematically over-stressed. The timber piles typically lean out toward the water and have tie rod connection failures. Replacement is recommended. The replacement costs for this section are shown separately for in Table 10 2 and are not considered as part of the DMNP redevelopment.

9.5 SHIP CHANNEL

There are no DMNP redevelopment plans for most of the Ship Channel. There is an overflow structure for the Don River diversion that is proposed for a 162 metre length of this wall. The existing dock wall will be completely removed to accommodate the spillway. Final orientation of the new retaining walls shall be such that the new rock in the spillway does not extend into the Ship Channel. Costs related to the spillway are presented in Table 10-1.

The remainder of the Ship Channel dockwall has exceeded the useful life and is mathematically over-stressed. It was observed that many sections of the wall have tie rod connection failures and excessive lean in the piling. Replacement of the dock wall is recommended. The replacement costs for this section of wall are separate of the DMNP redevelopment estimates and are shown in Table 10-2 .

9.6 SEDIMENT MANAGEMENT AREA

This area is to be widened to accommodate new hydraulic structures to control flow between the redirected Don River and the Keating Channel and also the extending of the Lakeshore Bridge to the west. It is designates as a sediment management area. Cost to remove existing retaining walls to permit the DMNP development and the construction of new retaining walls on the east and west sides of the redirected Don River. Costs for removal of existing retaining walls and the construction of new ones are shown Table 10-1

10 COST ESTIMATES

Redevelopment costs have been estimated based on a comparison of recent projects and construction costs. The tabulated costs are presented in Table 10-1.

Table 10-1 Estimated DMNP Development Costs

Structure/Station	Description	Length (m)	Cost/m	Total	Exclusions	Inclusions
Sediment Management Area						
Sediment Management East	Demolition	102	$6,000	$612,000		
Sediment Management West	Demolition	239	$6,000	$1,434,000		
Sediment Management East	Retaining Wall	194	$18,500	$3,589,000		
Sediment Management West	Retaining Wall	168	$18,500	$3,108,000	Note 1	
Keating Channel						
KN 0+000 to KN 0+079	Demolition	79	$6,000	$474,000		
KN 0+079 to KN 1+115.6±	Rock Revetment	1036.6	$6,000	$6,219,600	Note 2	
KS 0+000 to KS 0+665±	Rock Revetment	665	$10,000	$6,650,000		Note 3
KS 0+212.35± to KS 0+292.75±	Demolition	80.4	$6,000	$482,400		
KS 0+212.35± to KS 0+292.75±	Retaining Wall	31	$18,500	$573,500		
KS 0+664.9± to KS 0+733.5±	Modification at Bridge	69	$18,500	$1,276,500		
Marine Terminal 35						
MT 0+405± to MT 0+637±	Dock Wall	232	$26,800	$6,217,600		Note 4
MT 0+637± Return Wall	Retaining Wall	40	$18,500	$740,000		
MT 0+637± to 1+130±	Demolition	493	$6,000	$2,958,000		
Polson Quay						
PQ 0+000 to 0-048.5±	Retaining Wall	48.5	$18,500	$897,250		
Ship Channel						
SC 0+018± to 0+180± (Future Spillway)	Demolition	162	$6,000	$972,000		
East Spillway Return Wall	Retaining Wall	75	$18,500	$1,387,500		
West Spillway Return Wall	Retaining Wall	75	$18,500	$1,387,500		
			Sub-Total	$38,978,850		
			Engineering Fees	$3,897,885		
			Contingency	$3,897,885		
			Total	**$46,774,620**		

Notes

Exclusions

1. Wall between Adjustable and Sideflow Weirs along Lakeshore Bridge West Abutment
2. Cope Beam Repairs

Inclusions

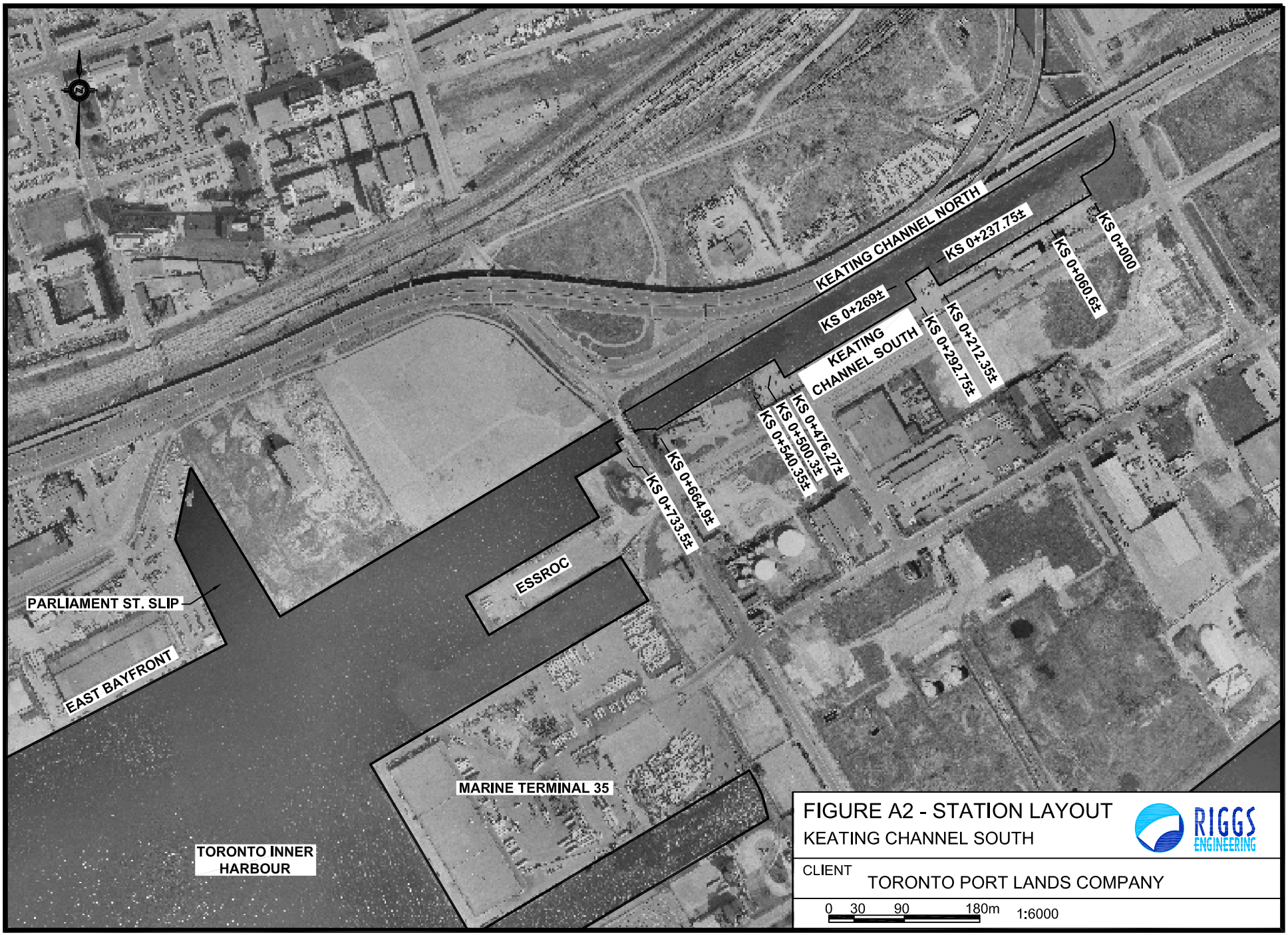
3. Cope Beam Repairs
4. New Steel Sheet Pile and Parapet with Anchor System installed under Existing Building

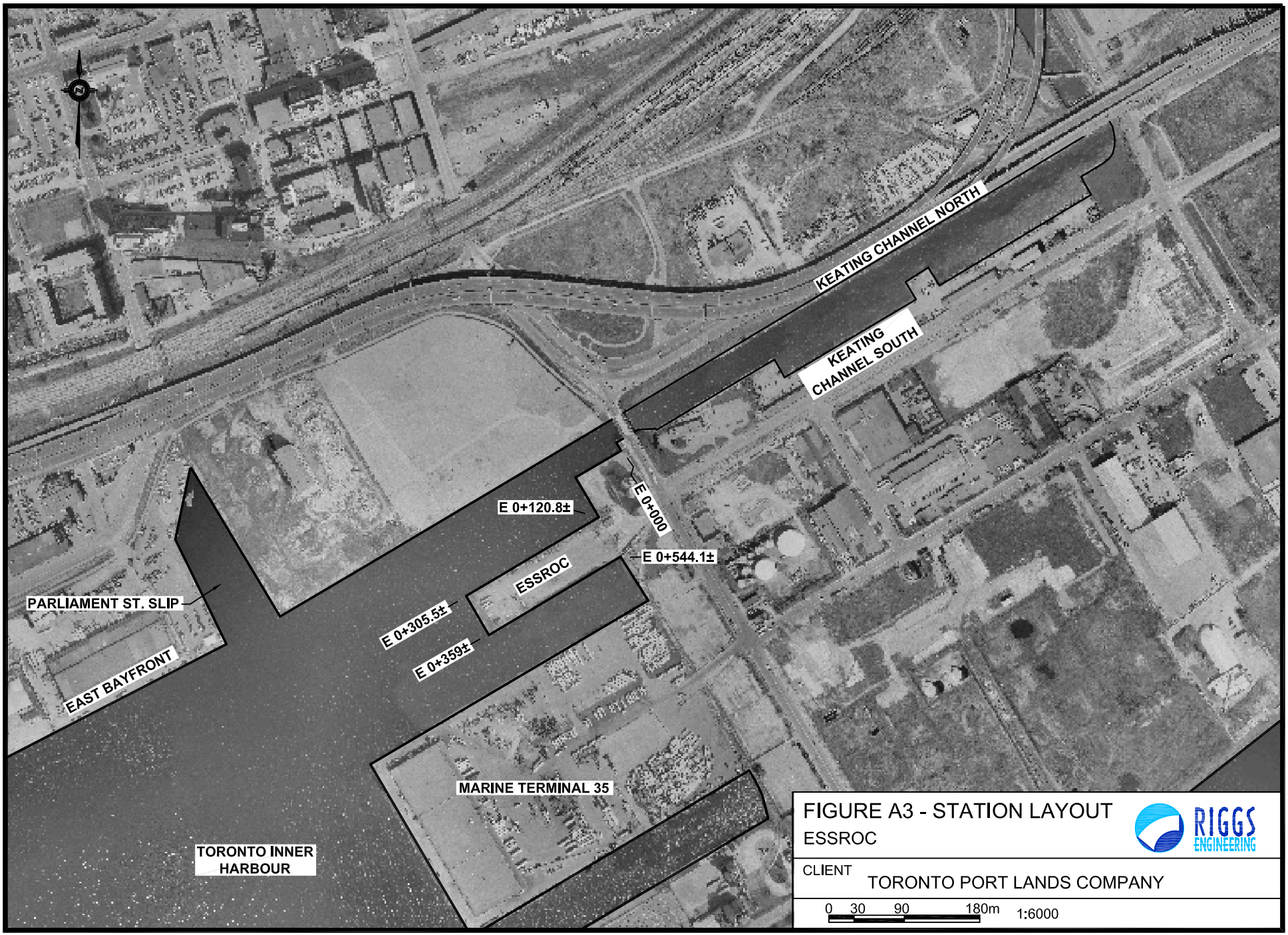
Table 10-2 Estimated TPLC Replacement Costs

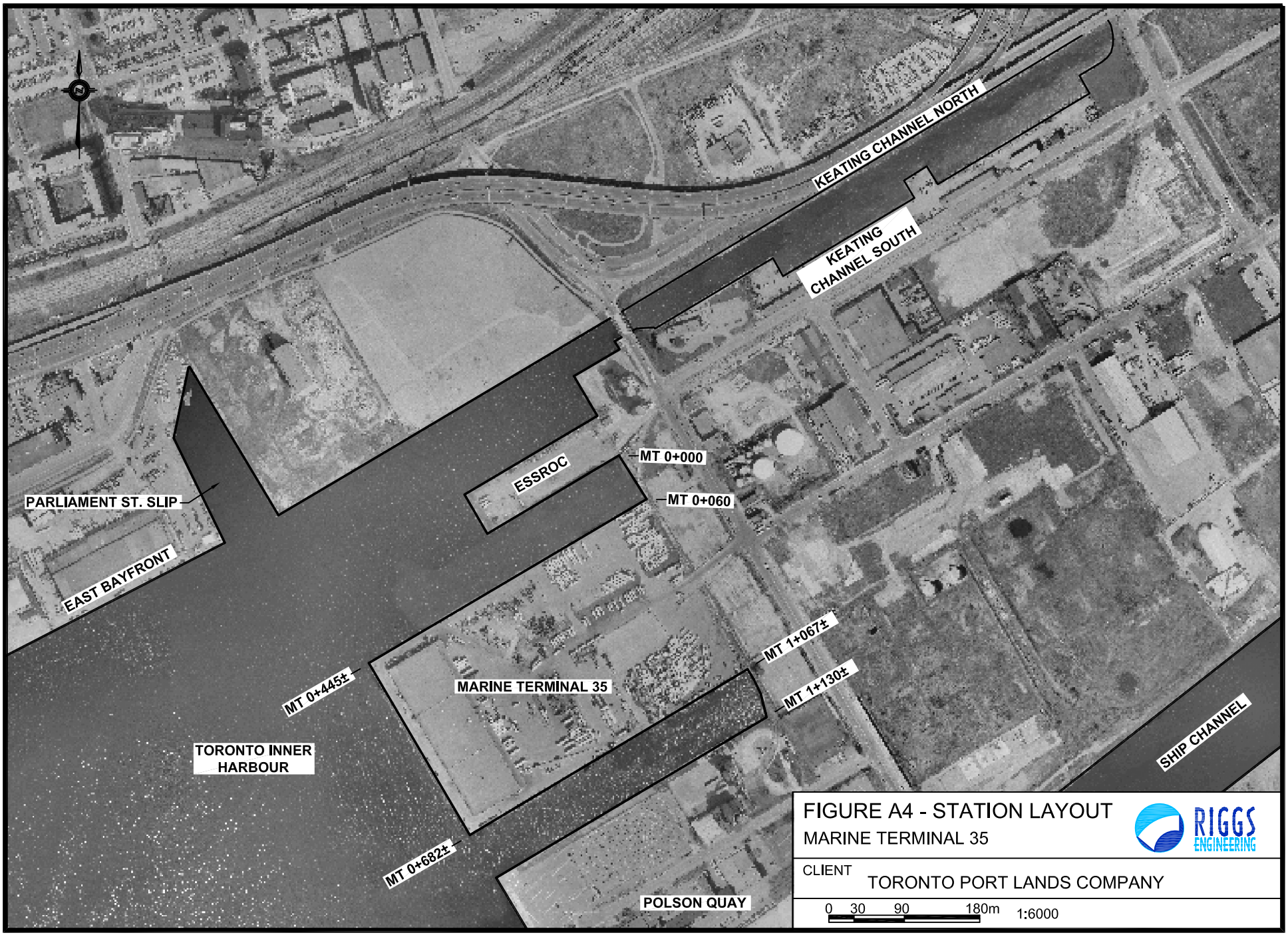
Structure/Station	Description	Length (m)	Cost/m	Total
Polson Quay				
PQ 0+000± 0+270.6±	Dock Wall	270.6	$18,500	$5,006,100
PQ 0+270.6± 0+915.2±	Dock Wall	644.6	$18,500	$11,925,100
PQ 0+915.2± 1+170.9±	Dock Wall	255.7	$18,500	$4,730,450
Ship Channel				
SC 0+706.9± to 0+180±	Dock Wall	526.9	$18,500	$9,747,650
			Sub-Total	$31,409,300
			Engineering Fees	$3,140,930
			Contingency	$3,140,930
			Total	**$37,691,160**

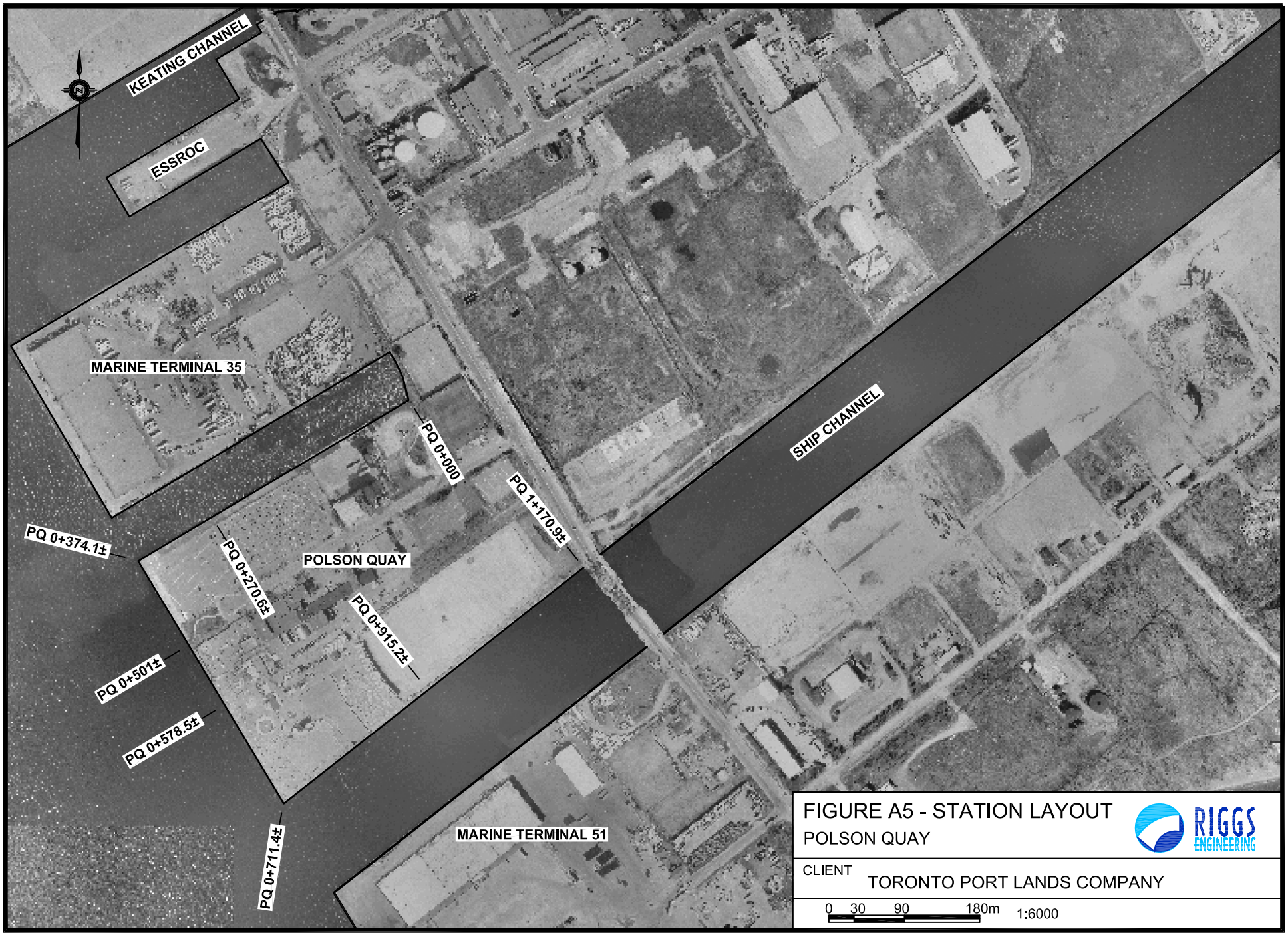
Appendix A
Stationing Plans


KN 0+000
KEATING CHANNEL NORTH
KN 0+493.9±
KN 0+639.8±
KEATING CHANNEL SOUTH
KN 1+019.5±
KN 1+115.6±
ESSROC
PARLIAMENT ST. SLIP
EAST BAYFRONT
MARINE TERMINAL 35
TORONTO INNER HARBOUR
FIGURE A1 - STATION LAYOUT
KEATING CHANNEL NORTH
RIGGS ENGINEERING
CLIENT
TORONTO PORT LANDS COMPANY
0 30 90 180m
1:6000


KEATING CHANNEL NORTH
KS 0+237.75±
KS 0+060.6±
KS 0+000
KS 0+269±
KEATING CHANNEL SOUTH
KS 0+292.75±
KS 0+212.35±
KS 0+476.27±
KS 0+500.3±
KS 0+540.35±
KS 0+664.9±
KS 0+733.5±
ESSROC
PARLIAMENT ST. SLIP
EAST BAYFRONT
MARINE TERMINAL 35
TORONTO INNER HARBOUR
FIGURE A2 - STATION LAYOUT
KEATING CHANNEL SOUTH
RIGGS ENGINEERING
CLIENT
TORONTO PORT LANDS COMPANY
0 30 90 180m
1:6000


KEATING CHANNEL NORTH
KEATING CHANNEL SOUTH
E 0+120.8±
E 0+000
E 0+544.1±
ESSROC
PARLIAMENT ST. SLIP
E 0+305.5±
E 0+359±
EAST BAYFRONT
MARINE TERMINAL 35
TORONTO INNER HARBOUR
FIGURE A3 - STATION LAYOUT
ESSROC
RIGGS ENGINEERING
CLIENT
TORONTO PORT LANDS COMPANY
0 30 90 180m
1:6000


KEATING CHANNEL NORTH
KEATING CHANNEL SOUTH
ESSROC
MT 0+000
MT 0+060
PARLIAMENT ST. SLIP
EAST BAYFRONT
MT 0+445±
MARINE TERMINAL 35
MT 1+067±
MT 1+130±
TORONTO INNER HARBOUR
SHIP CHANNEL
MT 0+682±
POLSON QUAY
FIGURE A4 - STATION LAYOUT
MARINE TERMINAL 35
RIGGS ENGINEERING
CLIENT
TORONTO PORT LANDS COMPANY
0 30 90 180m
1:6000


KEATING CHANNEL
ESSROC
MARINE TERMINAL 35
PQ 0+000
PQ 1+170.9±
SHIP CHANNEL
PQ 0+374.1±
PQ 0+270.6±
POLSON QUAY
PQ 0+915.2±
PQ 0+501±
PQ 0+578.5±
PQ 0+711.4±
MARINE TERMINAL 51
FIGURE A5 - STATION LAYOUT
POLSON QUAY
RIGGS ENGINEERING
CLIENT
TORONTO PORT LANDS COMPANY
0 30 90 180m
1:6000

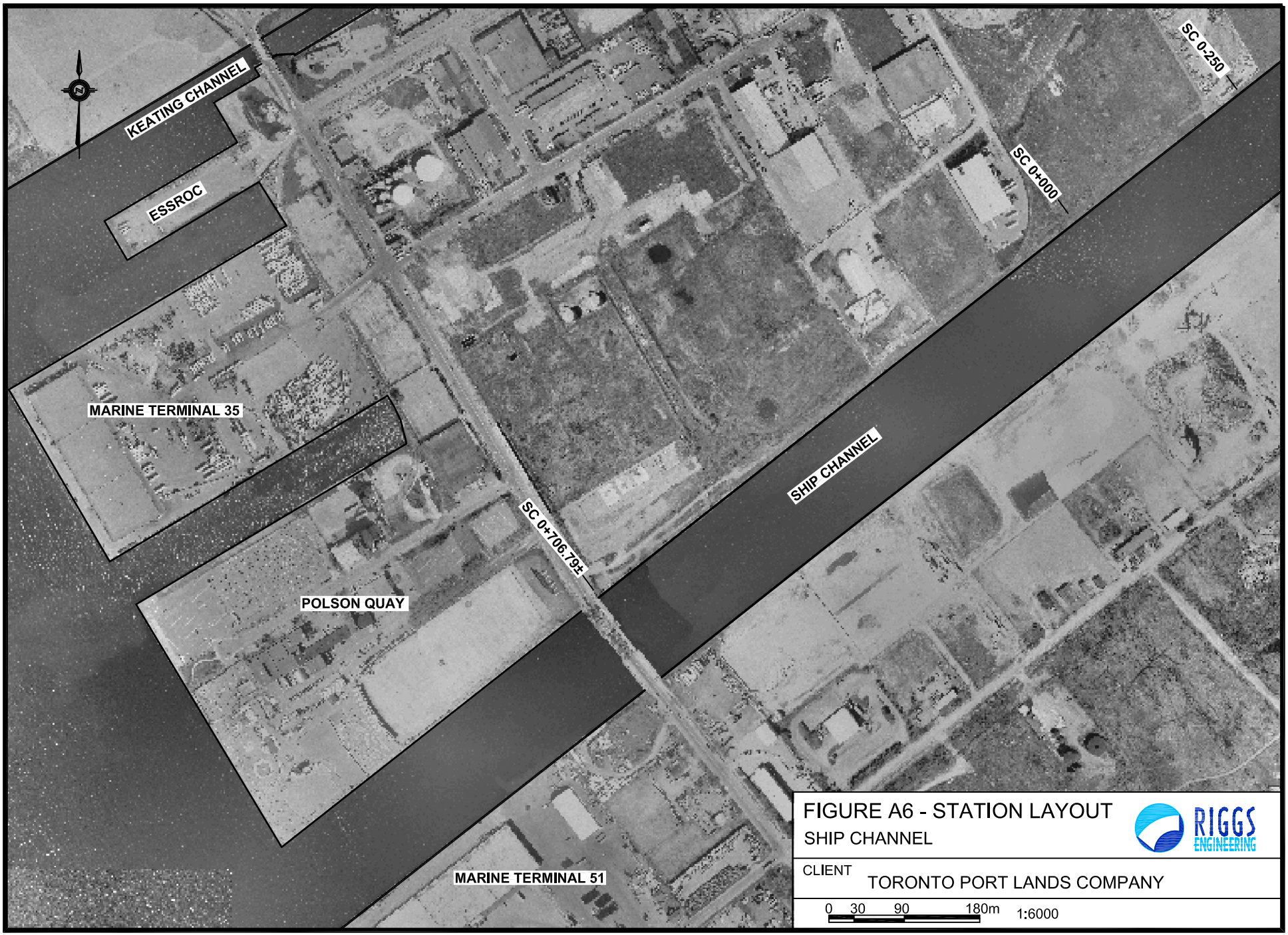


FIGURE A6 - STATION LAYOUT

SHIP CHANNEL

RIGGS ENGINEERING

CLIENT

TORONTO PORT LANDS COMPANY

0 30 90 180m 1:6000

Appendix B
Structure Drawings

Note: Drawings of the structures for the Keating Channel, Former Essroc Facility, Polson Quay and the Ship Channel are extracted from *Dockwall Condition Survey/Investigation - Lower Don Lands, 2009, Riggs Engineering Ltd.*

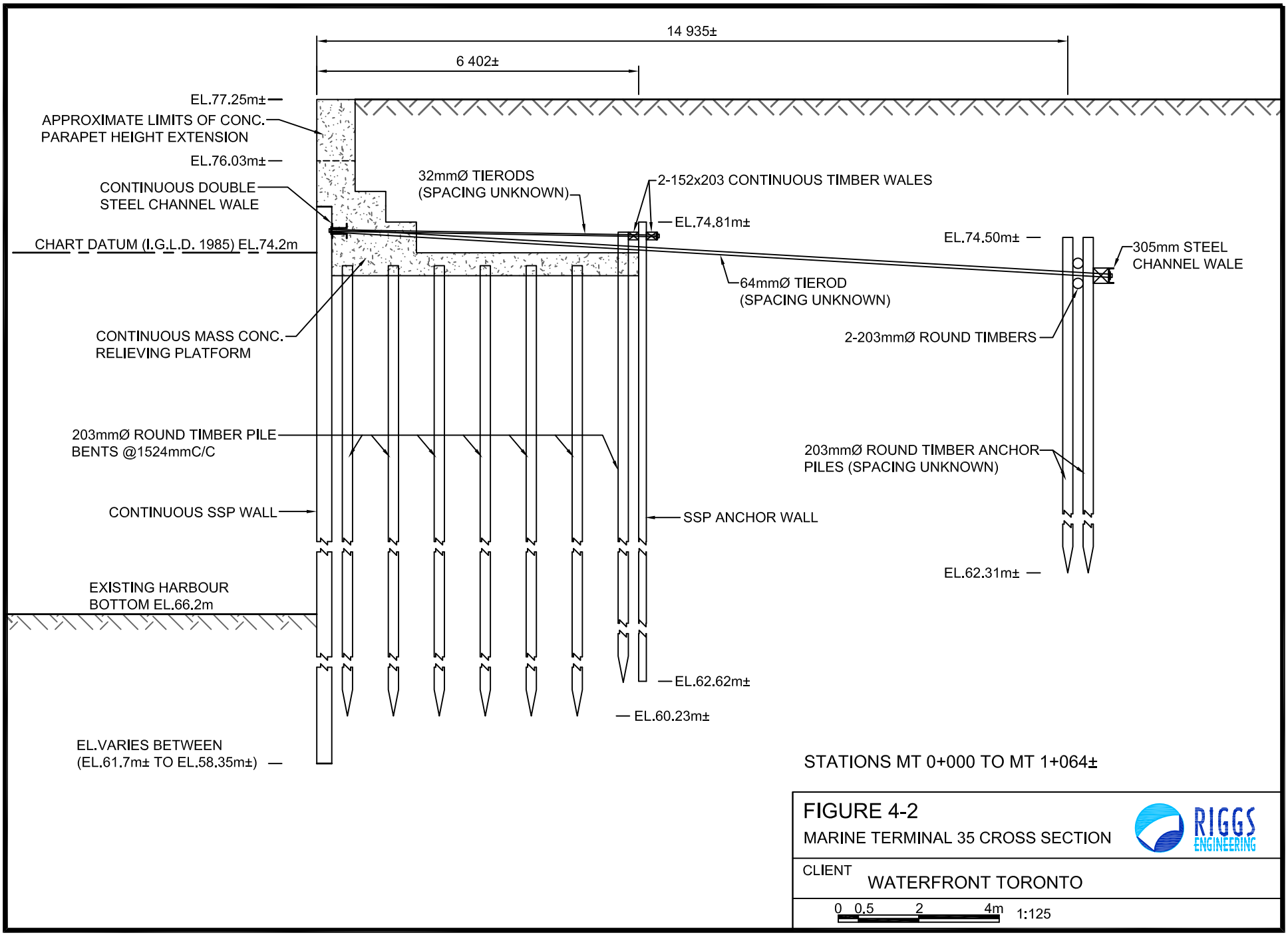


FIGURE 4-2

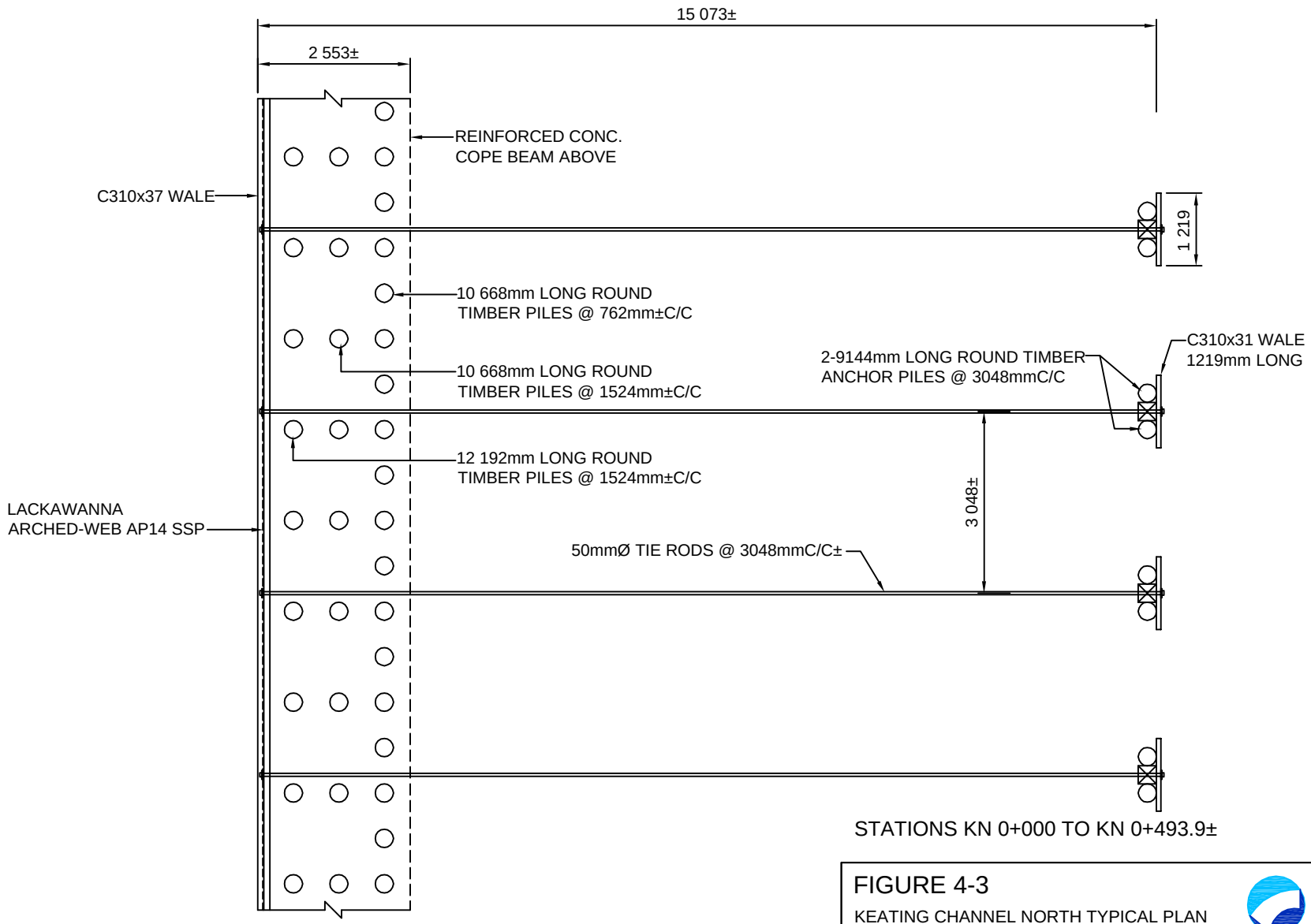
MARINE TERMINAL 35 CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 2 4m 1:125



STATIONS KN 0+000 TO KN 0+493.9±

FIGURE 4-3

KEATING CHANNEL NORTH TYPICAL PLAN

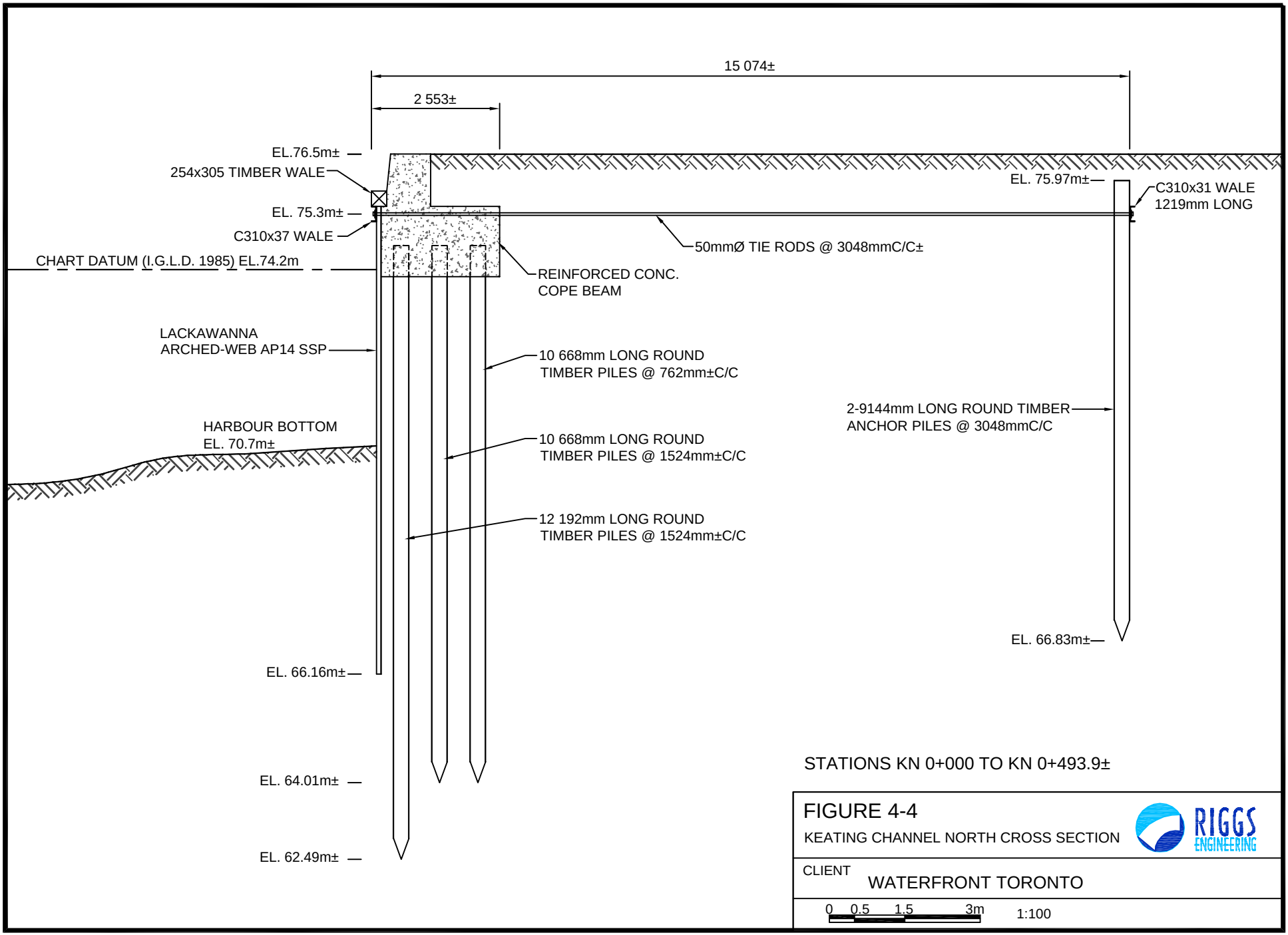
RIGGS ENGINEERING

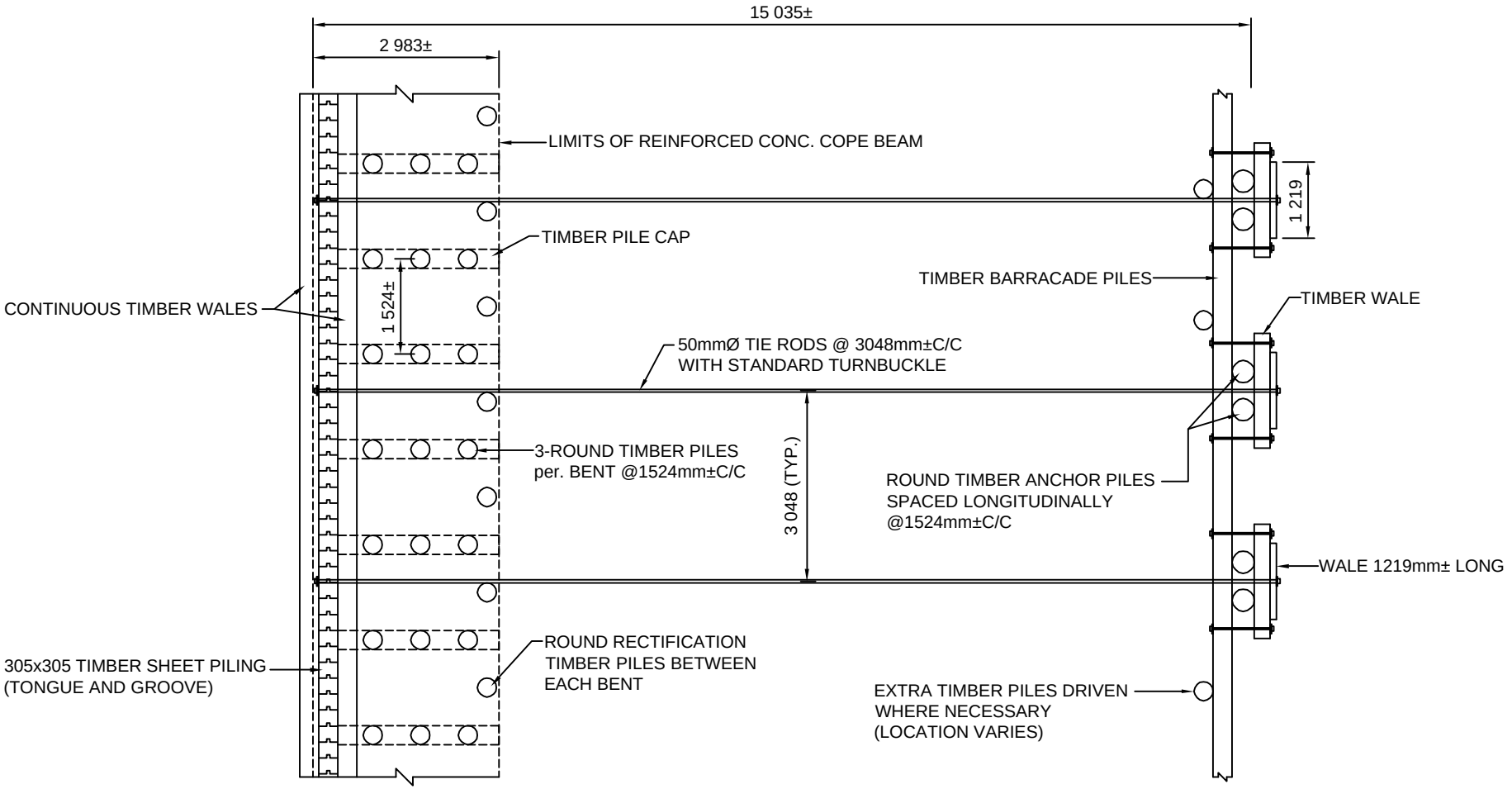
CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100


15 074±
2 553±
EL.76.5m±
254x305 TIMBER WALE
EL. 75.3m±
C310x37 WALE
CHART DATUM (I.G.L.D. 1985) EL.74.2m
REINFORCED CONC.
COPE BEAM
50mmØ TIE RODS @ 3048mmC/C±
EL. 75.97m±
C310x31 WALE
1219mm LONG
LACKAWANNA
ARCHED-WEB AP14 SSP
10 668mm LONG ROUND
TIMBER PILES @ 762mm±C/C
2-9144mm LONG ROUND TIMBER
ANCHOR PILES @ 3048mmC/C
HARBOUR BOTTOM
EL. 70.7m±
10 668mm LONG ROUND
TIMBER PILES @ 1524mm±C/C
12 192mm LONG ROUND
TIMBER PILES @ 1524mm±C/C
EL. 66.83m±
EL. 66.16m±
EL. 64.01m±
EL. 62.49m±
STATIONS KN 0+000 TO KN 0+493.9±
FIGURE 4-4
KEATING CHANNEL NORTH CROSS SECTION
RIGGS ENGINEERING
CLIENT
WATERFRONT TORONTO
0 0.5 1.5 3m
1:100



STATIONS KN 0+493.9± TO KN 0+639.8±

FIGURE 4-5

KEATING CHANNEL NORTH TYPICAL PLAN

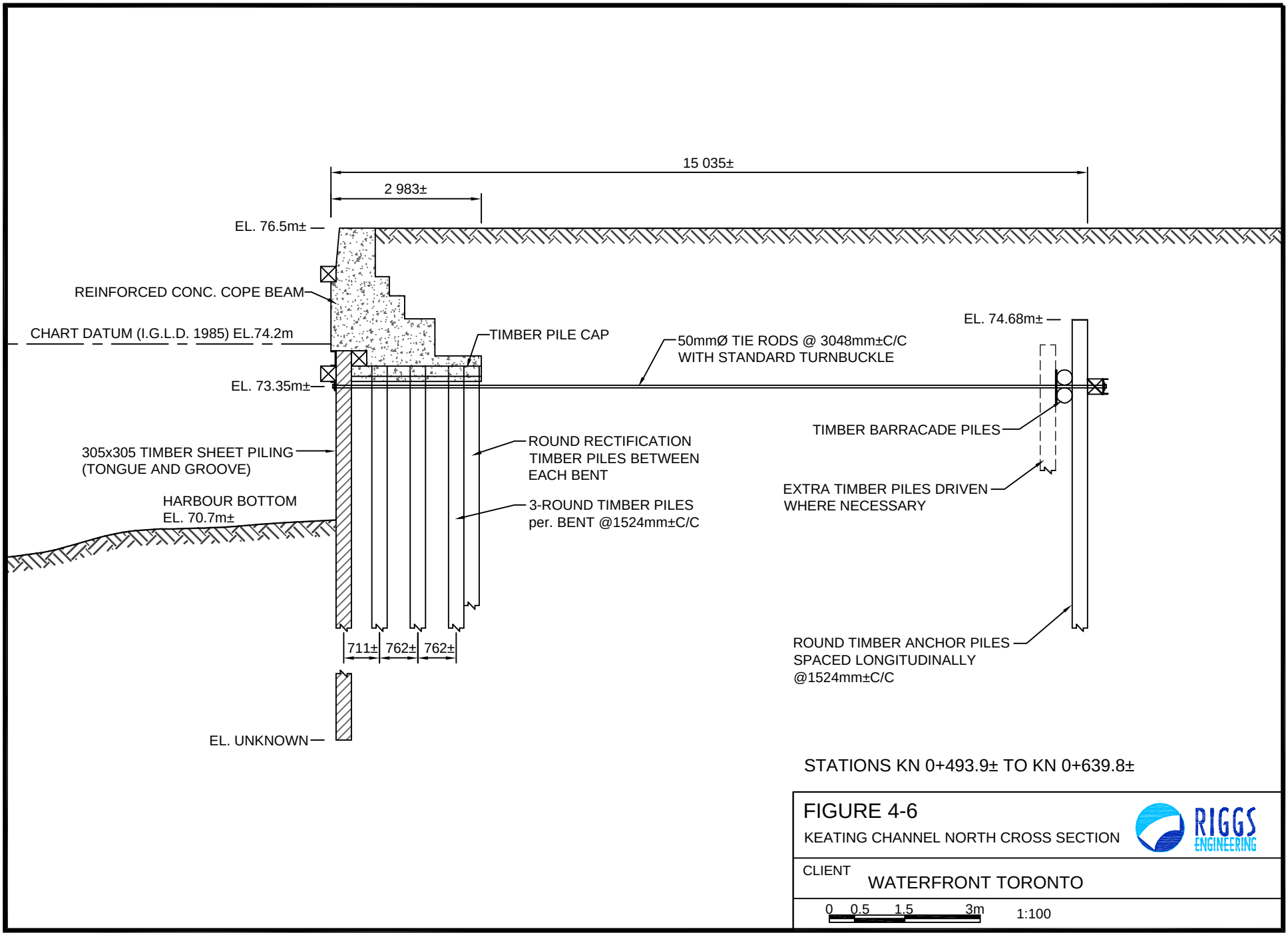
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KN 0+493.9± TO KN 0+639.8±

FIGURE 4-6

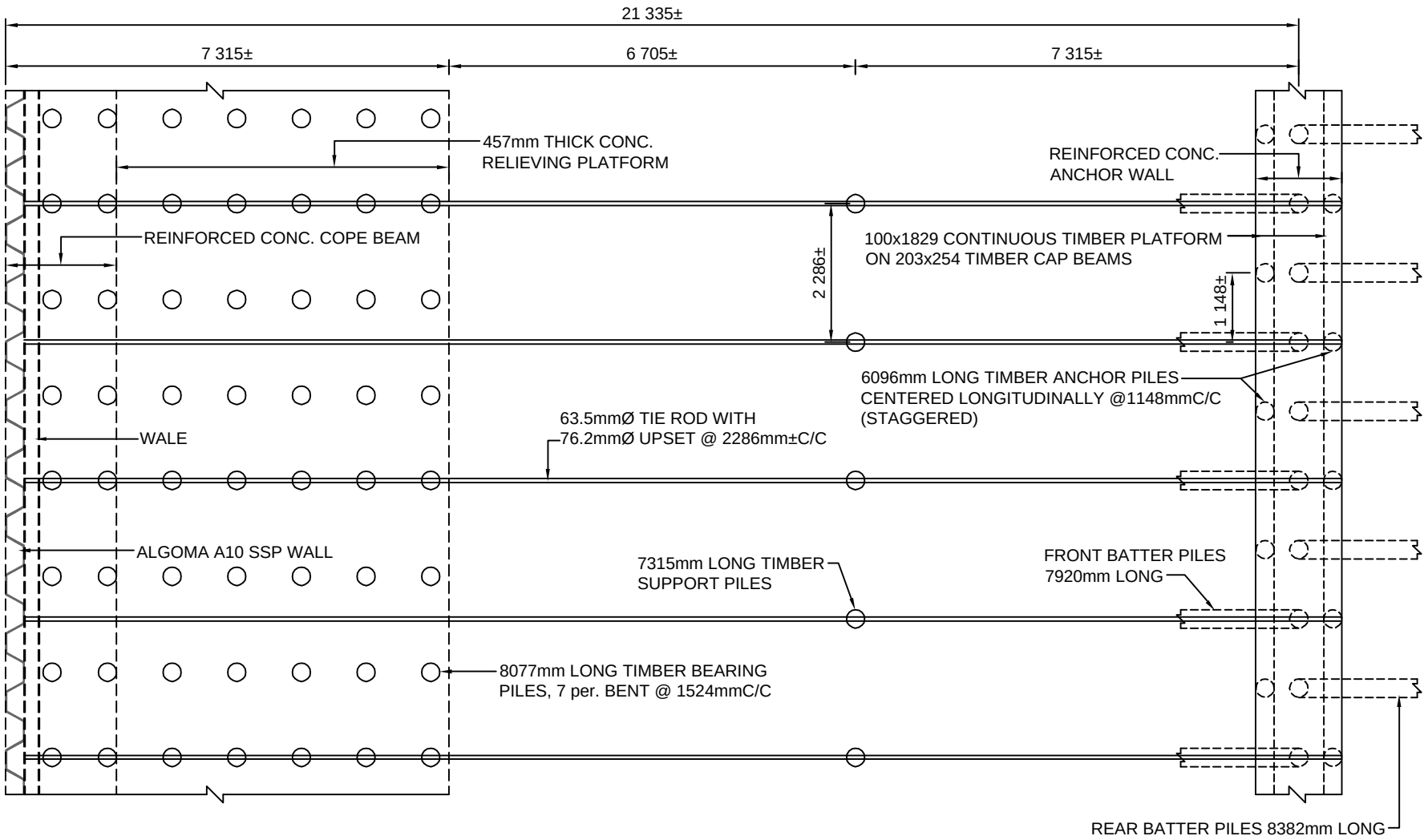
KEATING CHANNEL NORTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KN 1+019.5± TO KN 1+115.6±

FIGURE 4-7

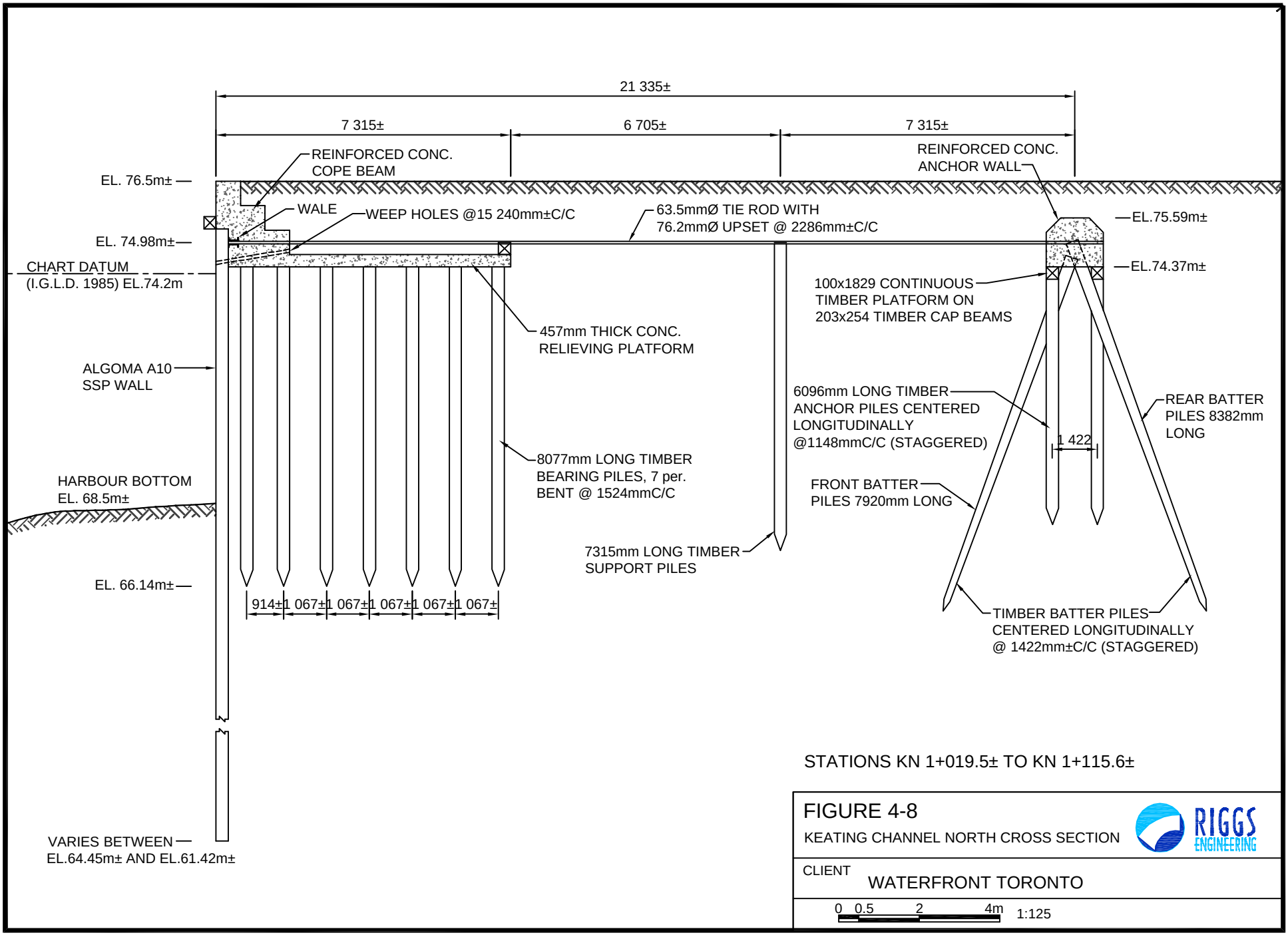
KEATING CHANNEL NORTH TYPICAL PLAN

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KN 1+019.5± TO KN 1+115.6±

FIGURE 4-8

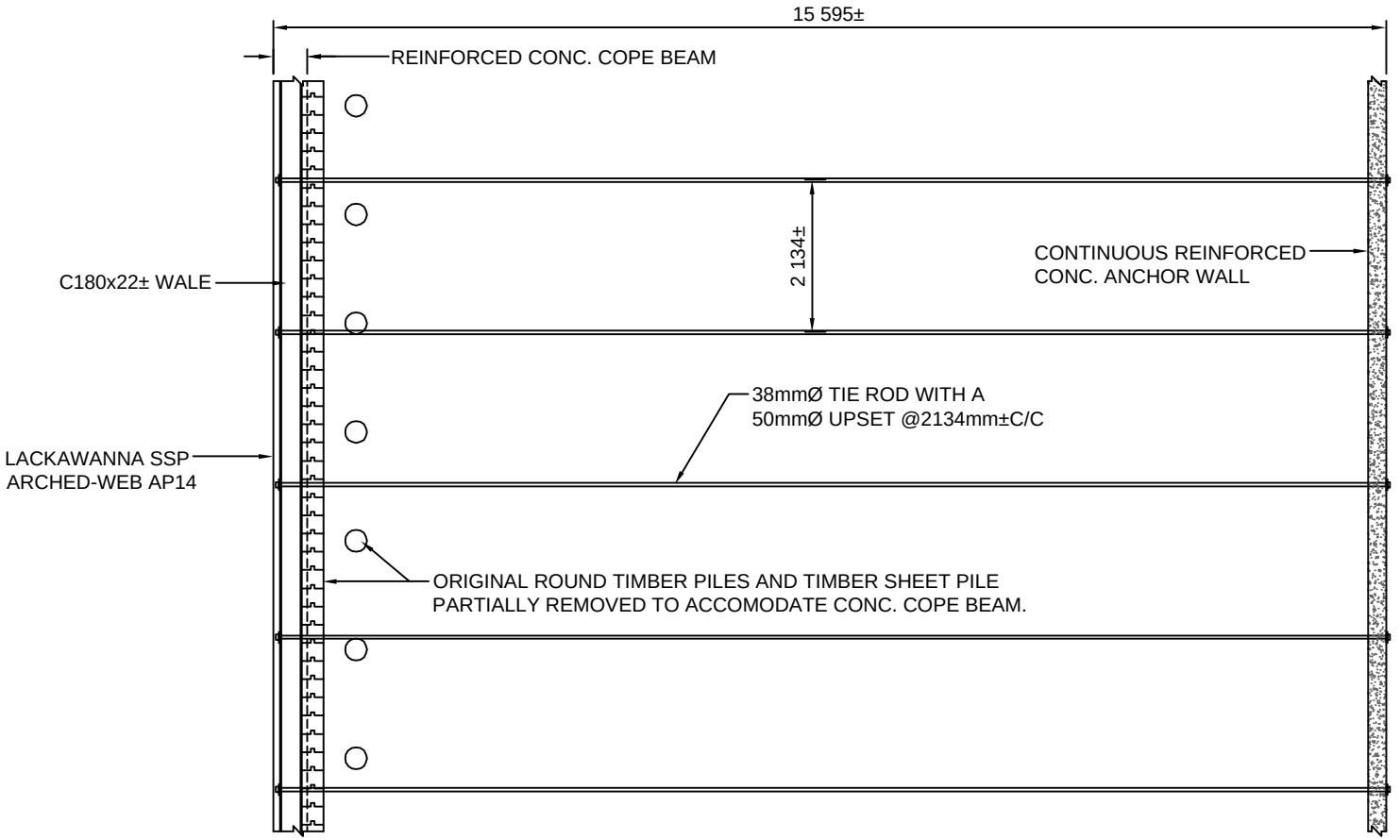
KEATING CHANNEL NORTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 2 4m 1:125



STATIONS KS 0+000 TO KS 0+060.6±

FIGURE 4-9

KEATING CHANNEL SOUTH TYPICAL PLAN

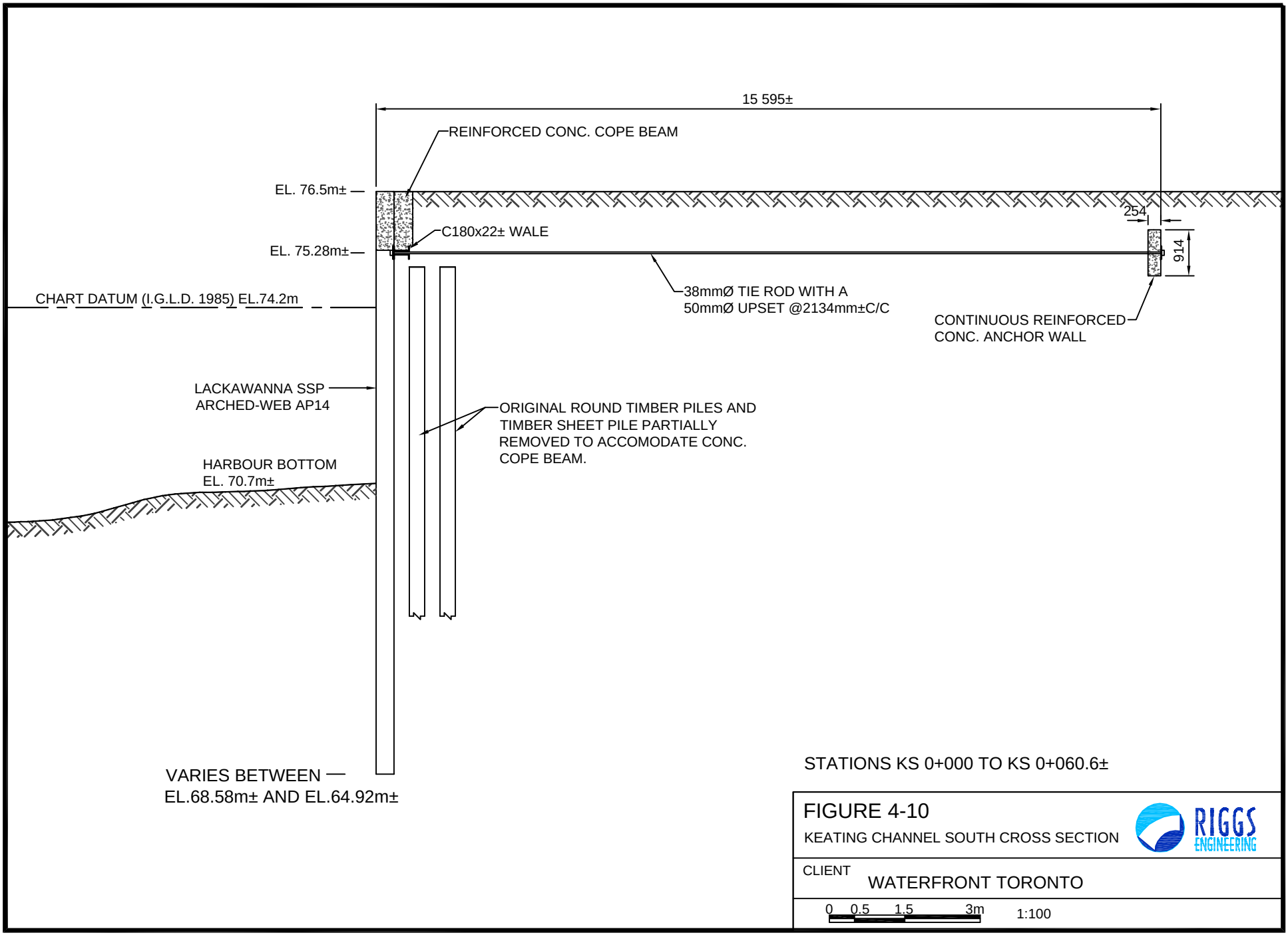
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KS 0+000 TO KS 0+060.6±

FIGURE 4-10

KEATING CHANNEL SOUTH CROSS SECTION

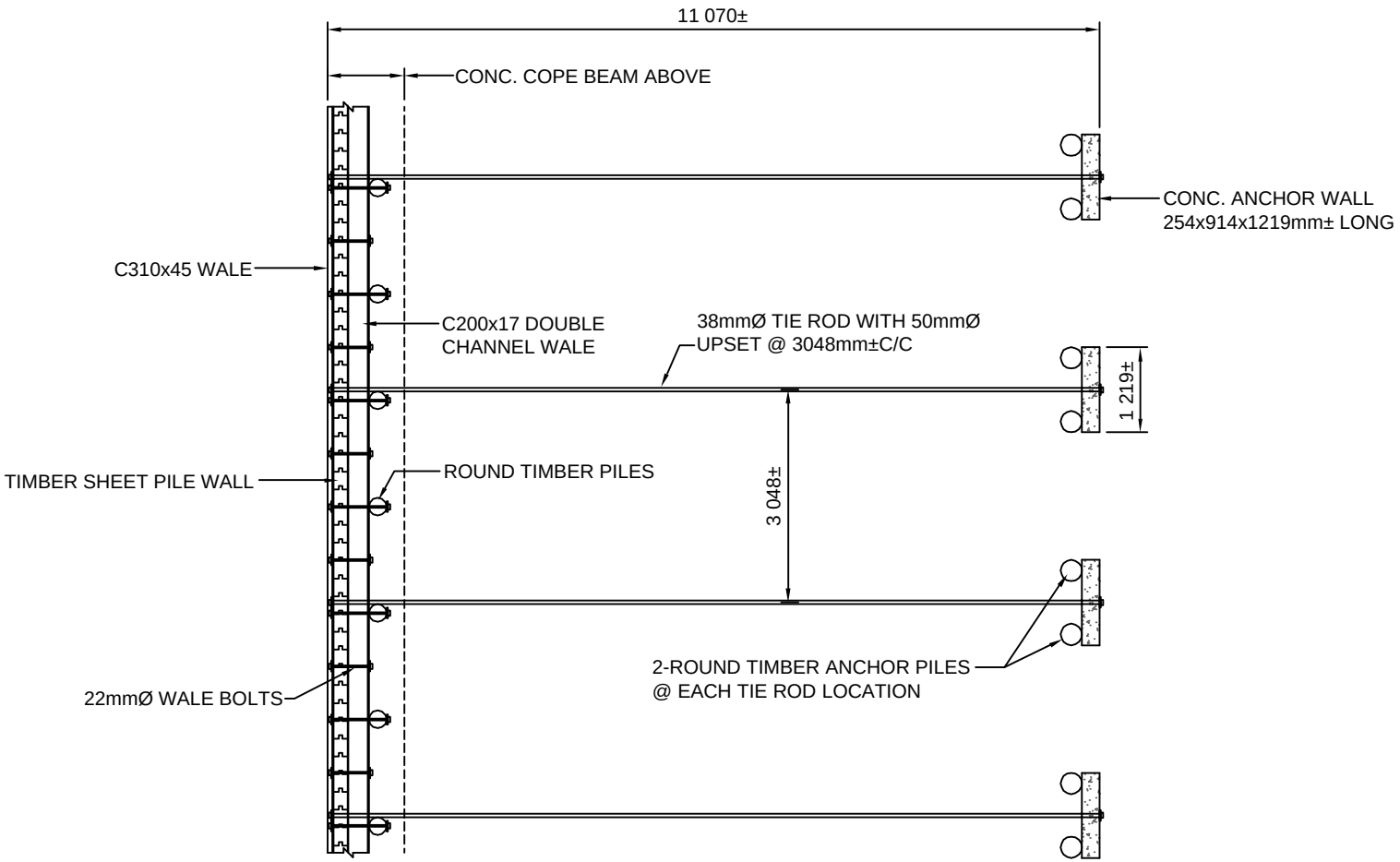
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KS 0+060.6± TO KS 0+212.35±

FIGURE 4-11

KEATING CHANNEL SOUTH TYPICAL PLAN

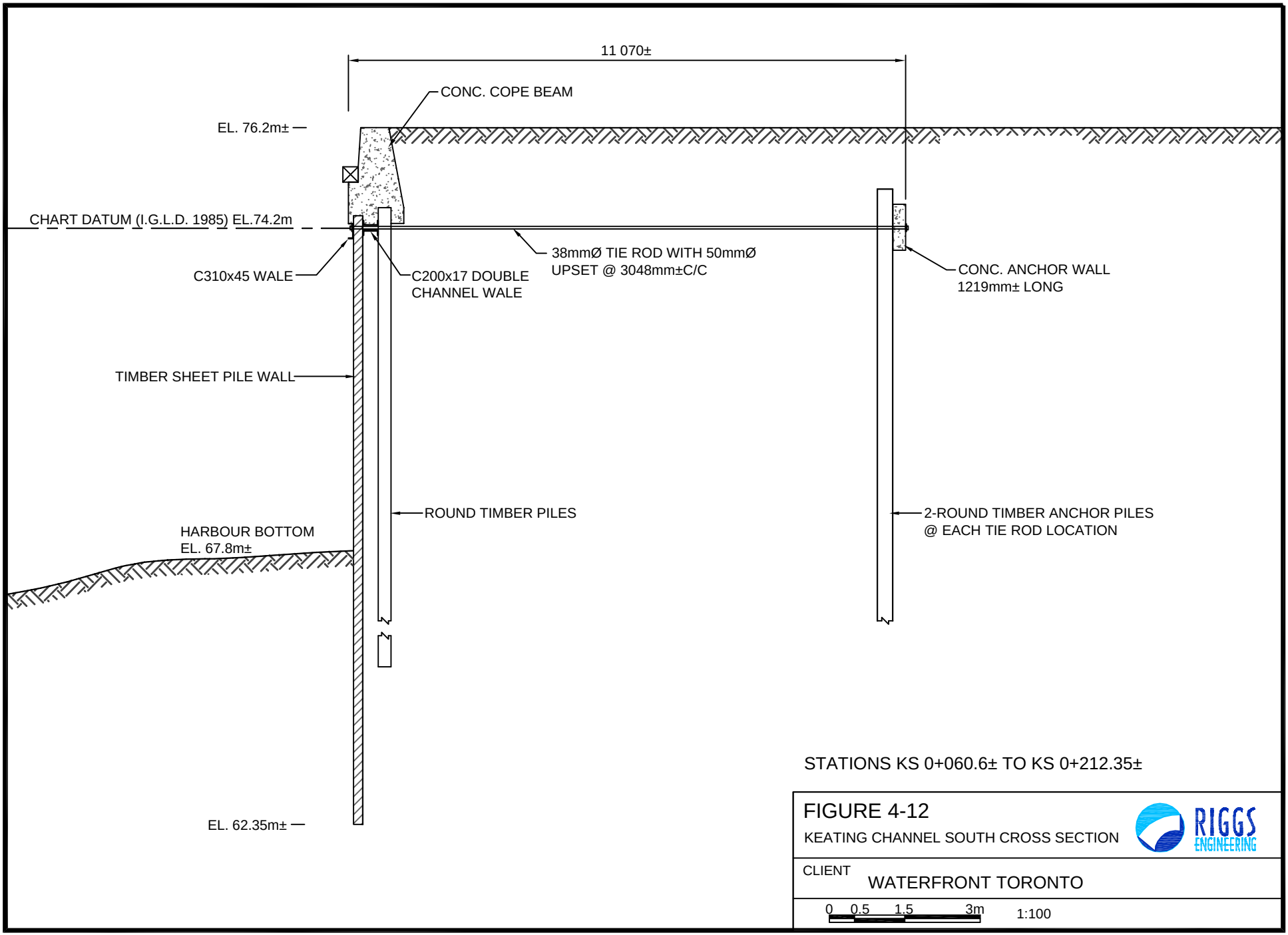
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KS 0+060.6± TO KS 0+212.35±

FIGURE 4-12

KEATING CHANNEL SOUTH CROSS SECTION

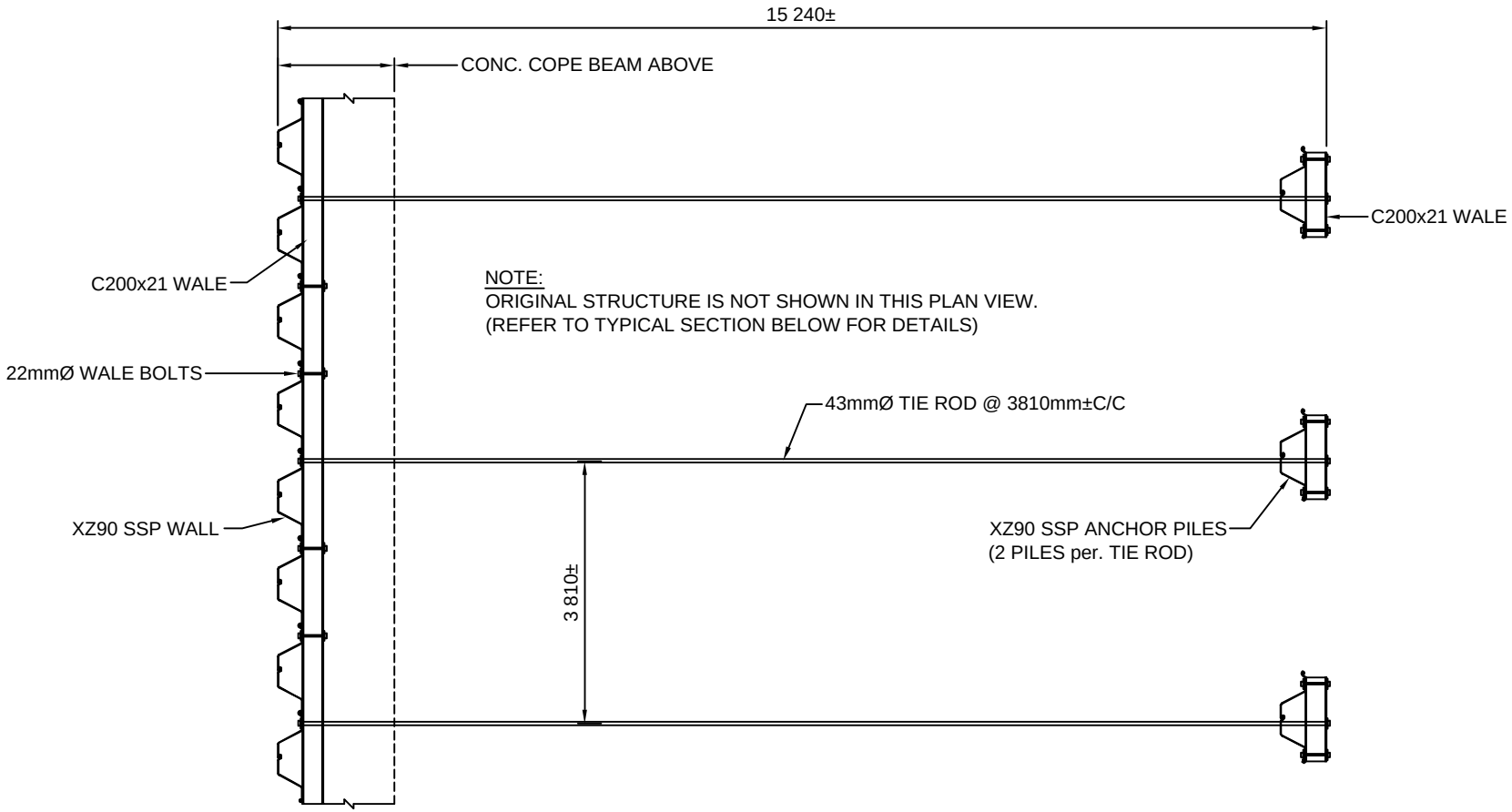
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KS 0+212.35± TO KS 0+240.91±

FIGURE 4-13

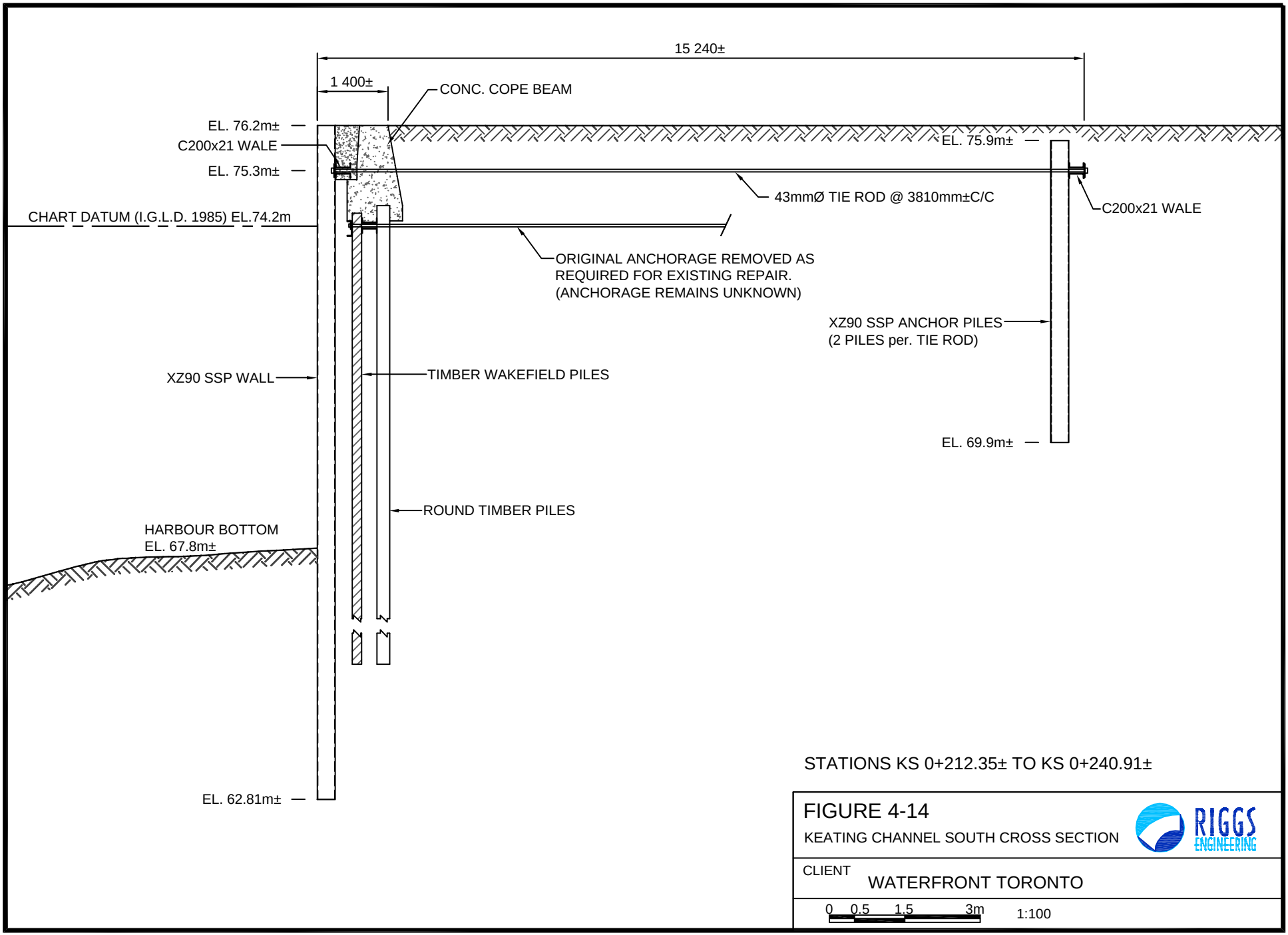
KEATING CHANNEL SOUTH TYPICAL PLAN

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KS 0+212.35± TO KS 0+240.91±

FIGURE 4-14

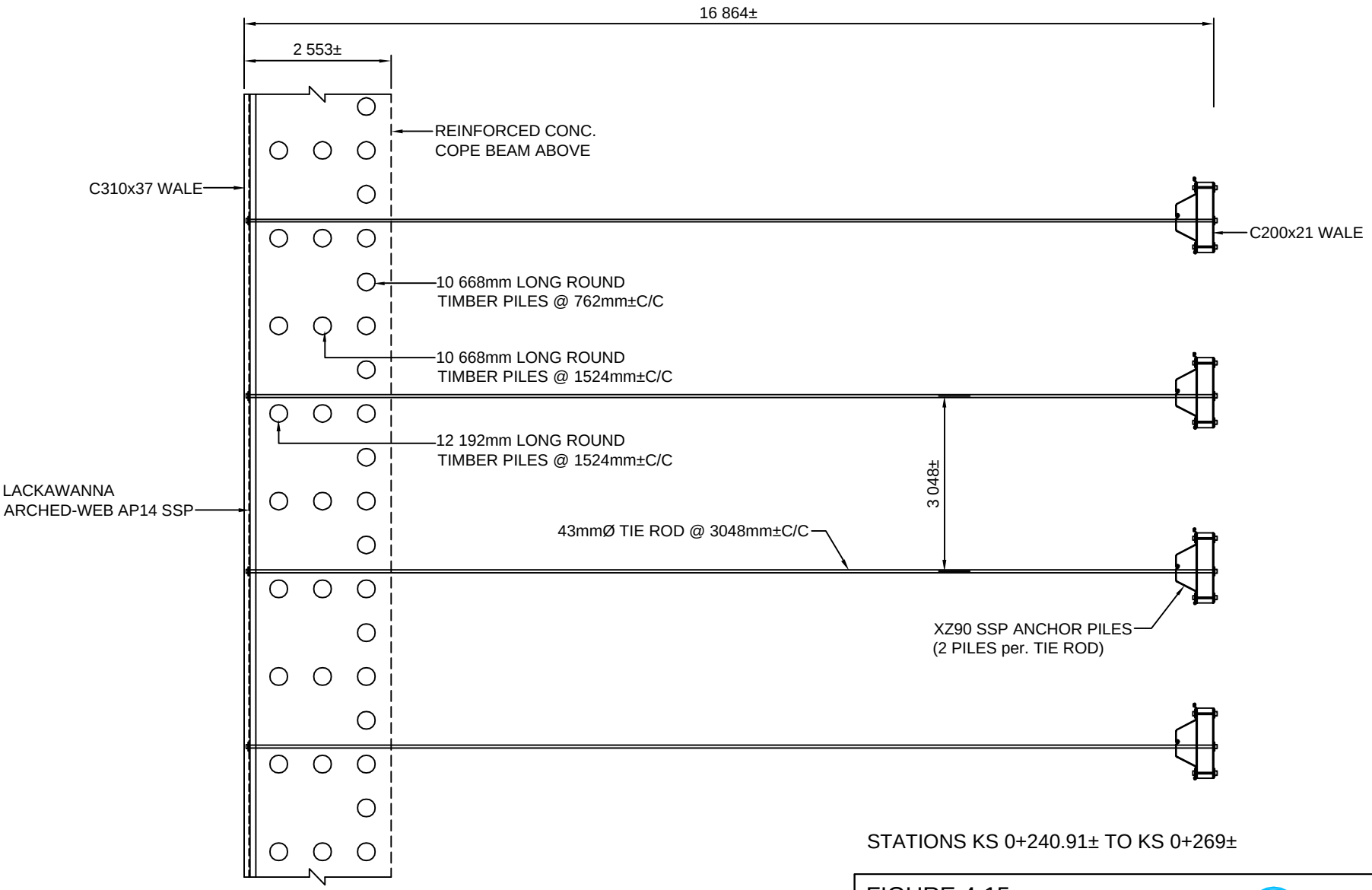
KEATING CHANNEL SOUTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KS 0+240.91± TO KS 0+269±

FIGURE 4-15

KEATING CHANNEL SOUTH TYPICAL PLAN

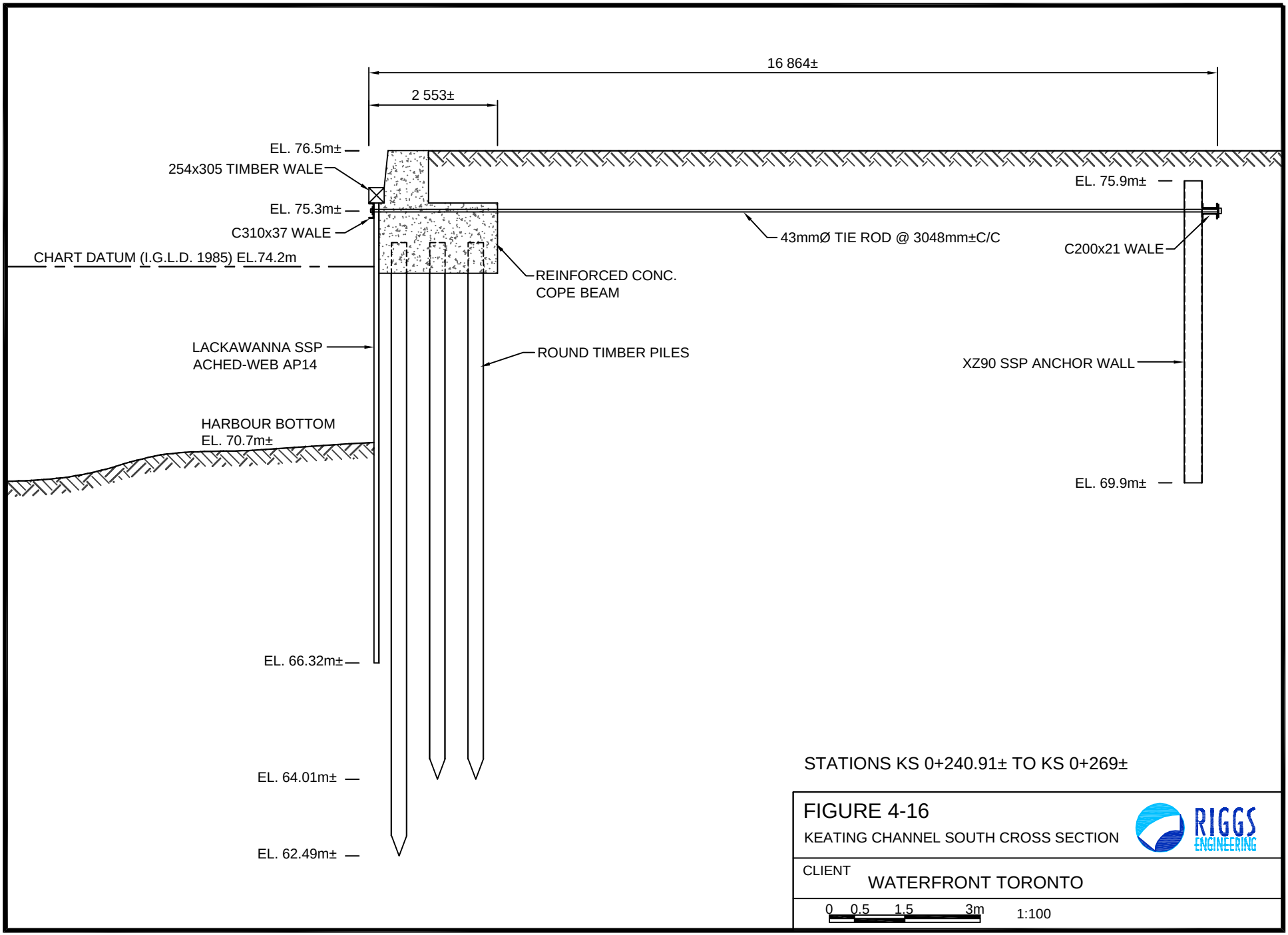
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KS 0+240.91± TO KS 0+269±

FIGURE 4-16

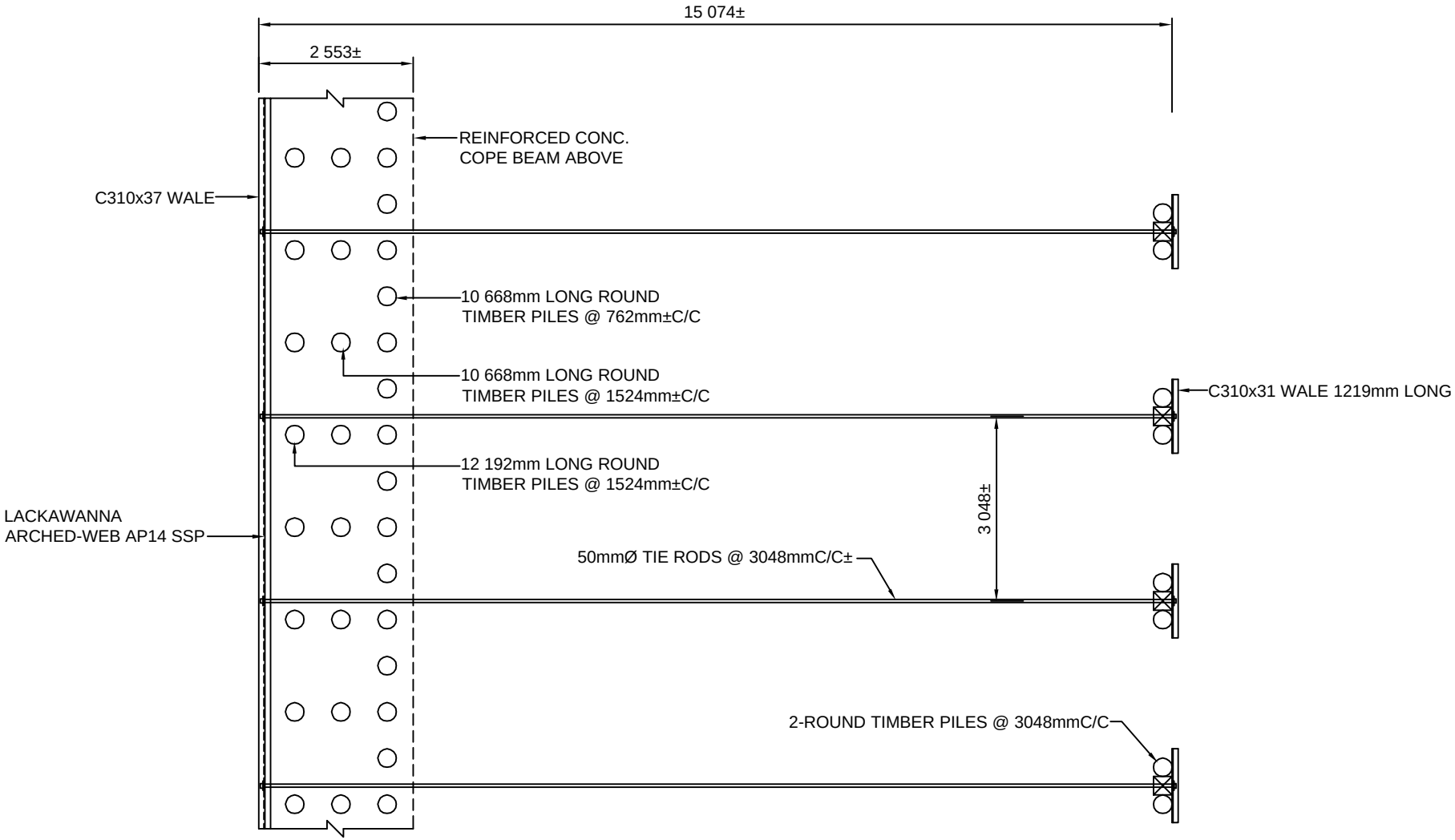
KEATING CHANNEL SOUTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KS 0+269± TO KS 0+540.35±

FIGURE 4-17

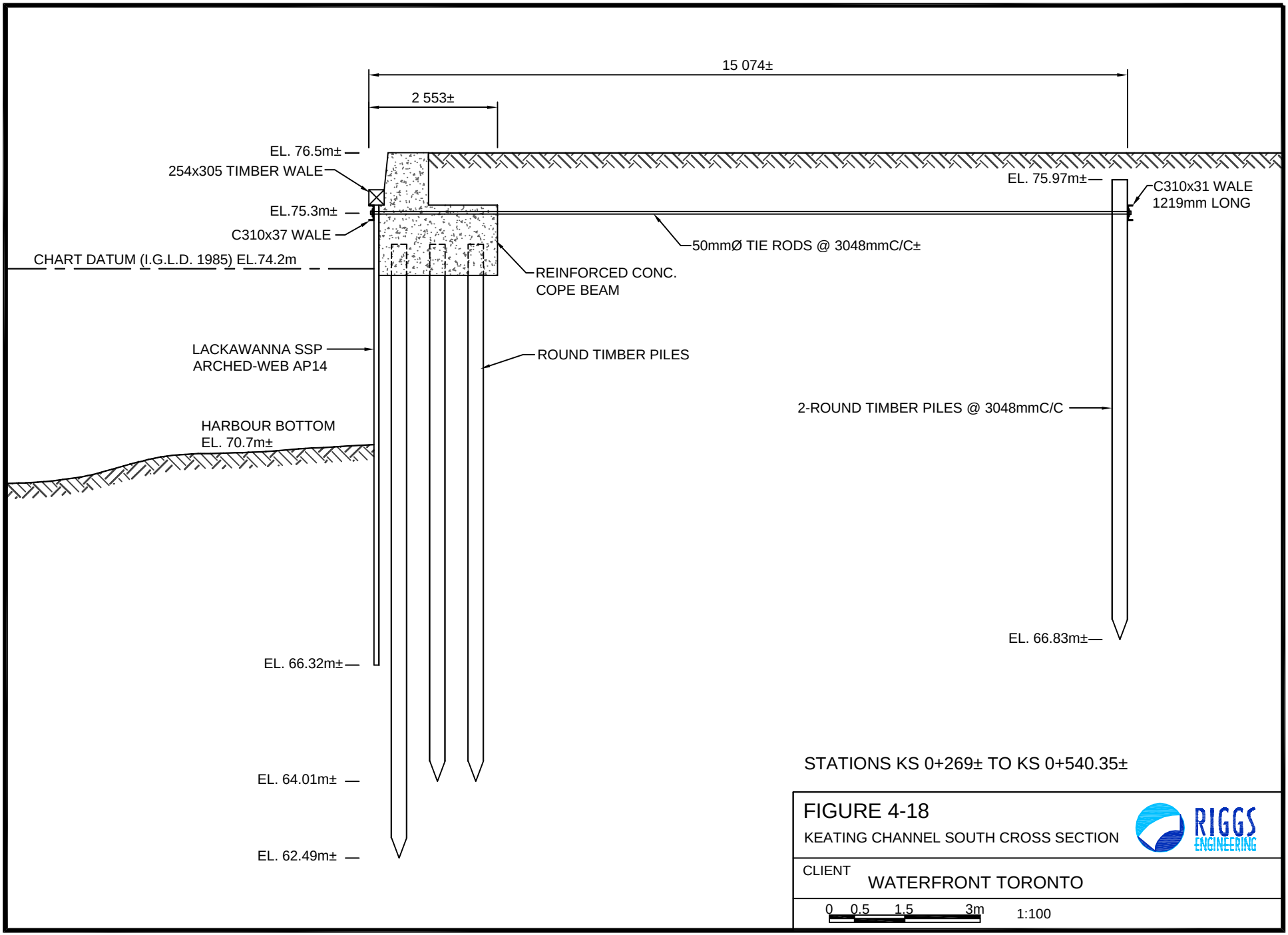
KEATING CHANNEL SOUTH TYPICAL PLAN

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KS 0+269± TO KS 0+540.35±

FIGURE 4-18

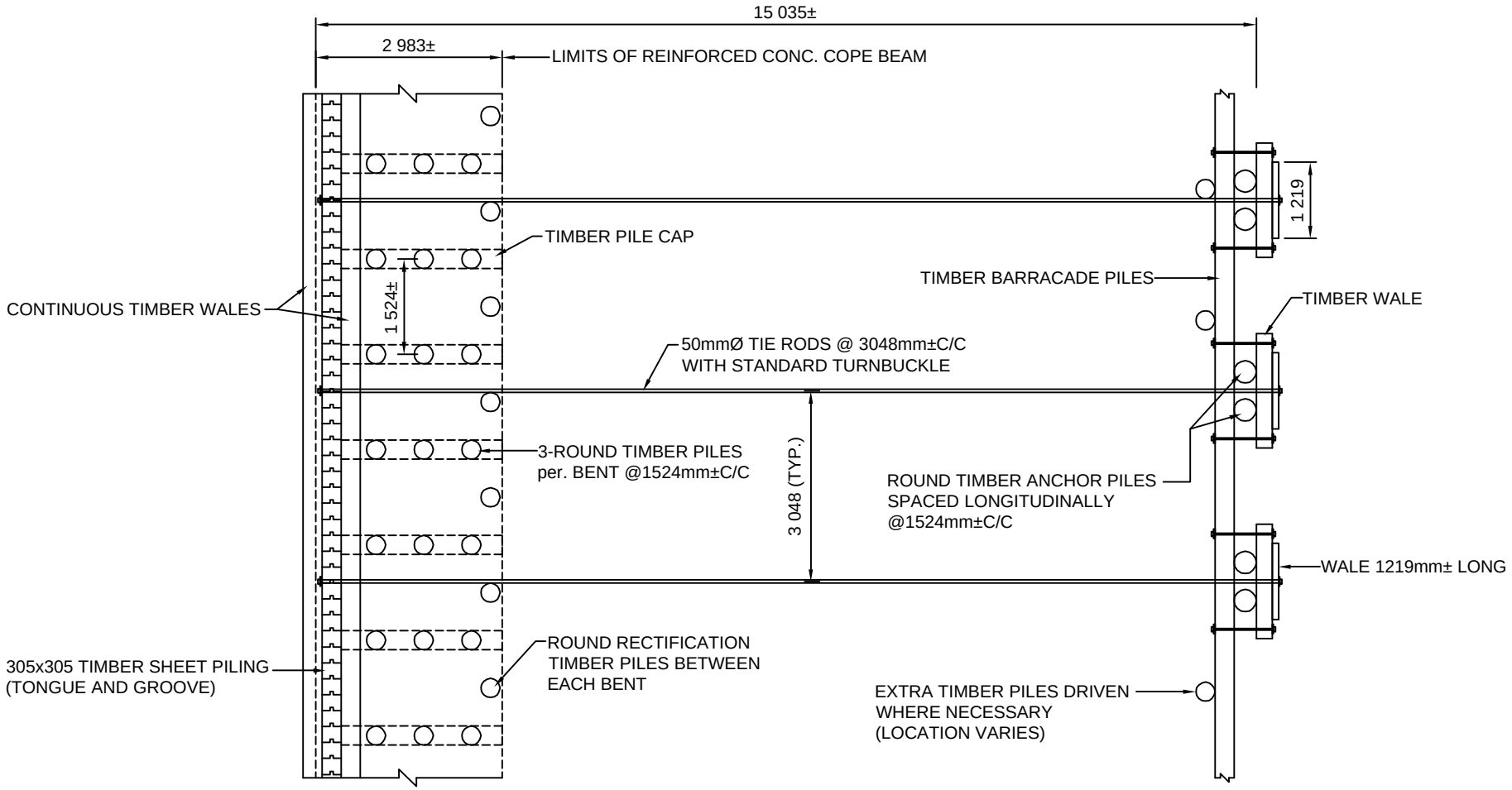
KEATING CHANNEL SOUTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KS 0+540.35± TO KS 0+664.9±

FIGURE 4-19

KEATING CHANNEL SOUTH TYPICAL PLAN

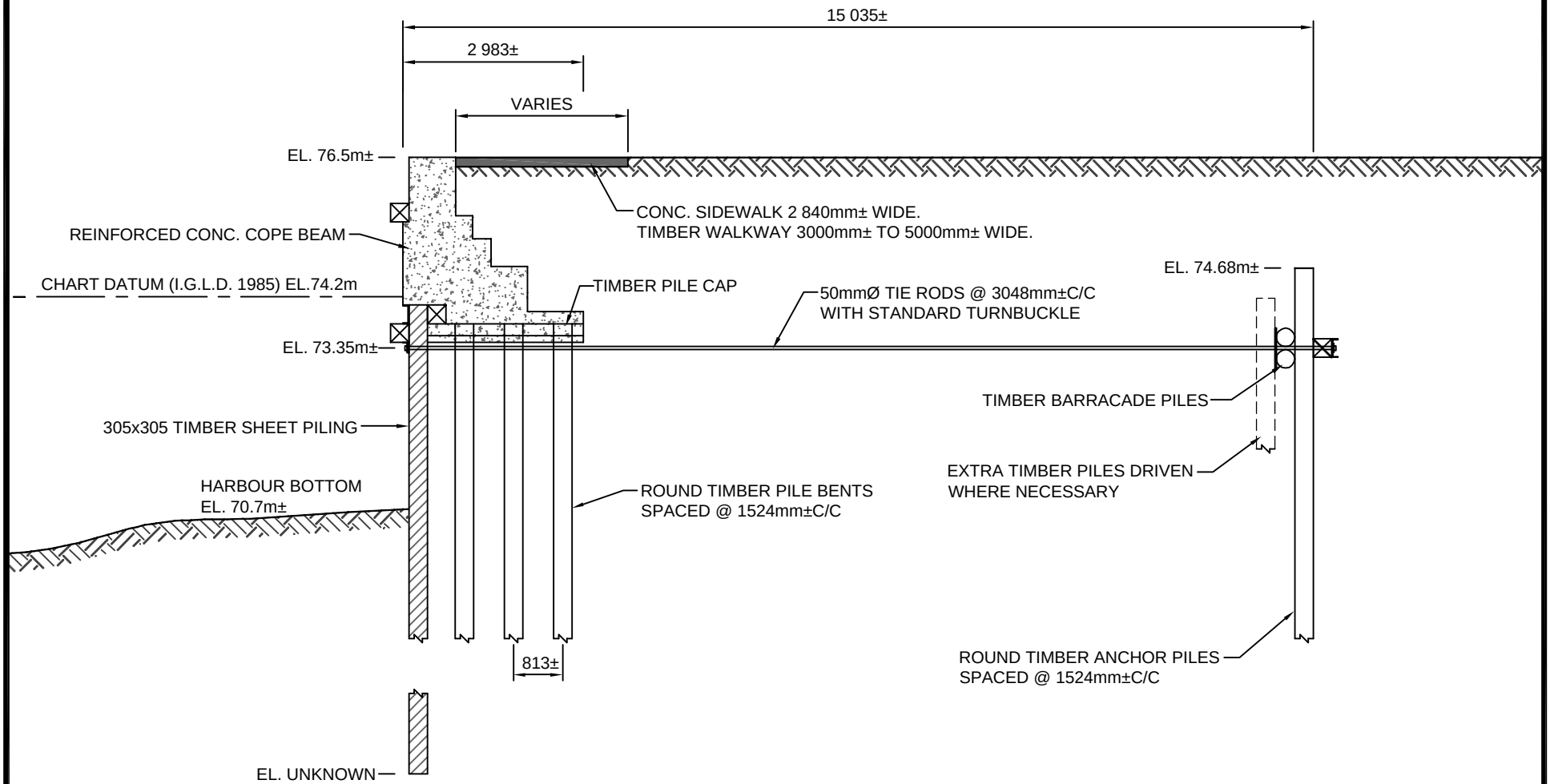
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS KS 0+540.35± TO KS 0+664.9±

FIGURE 4-20

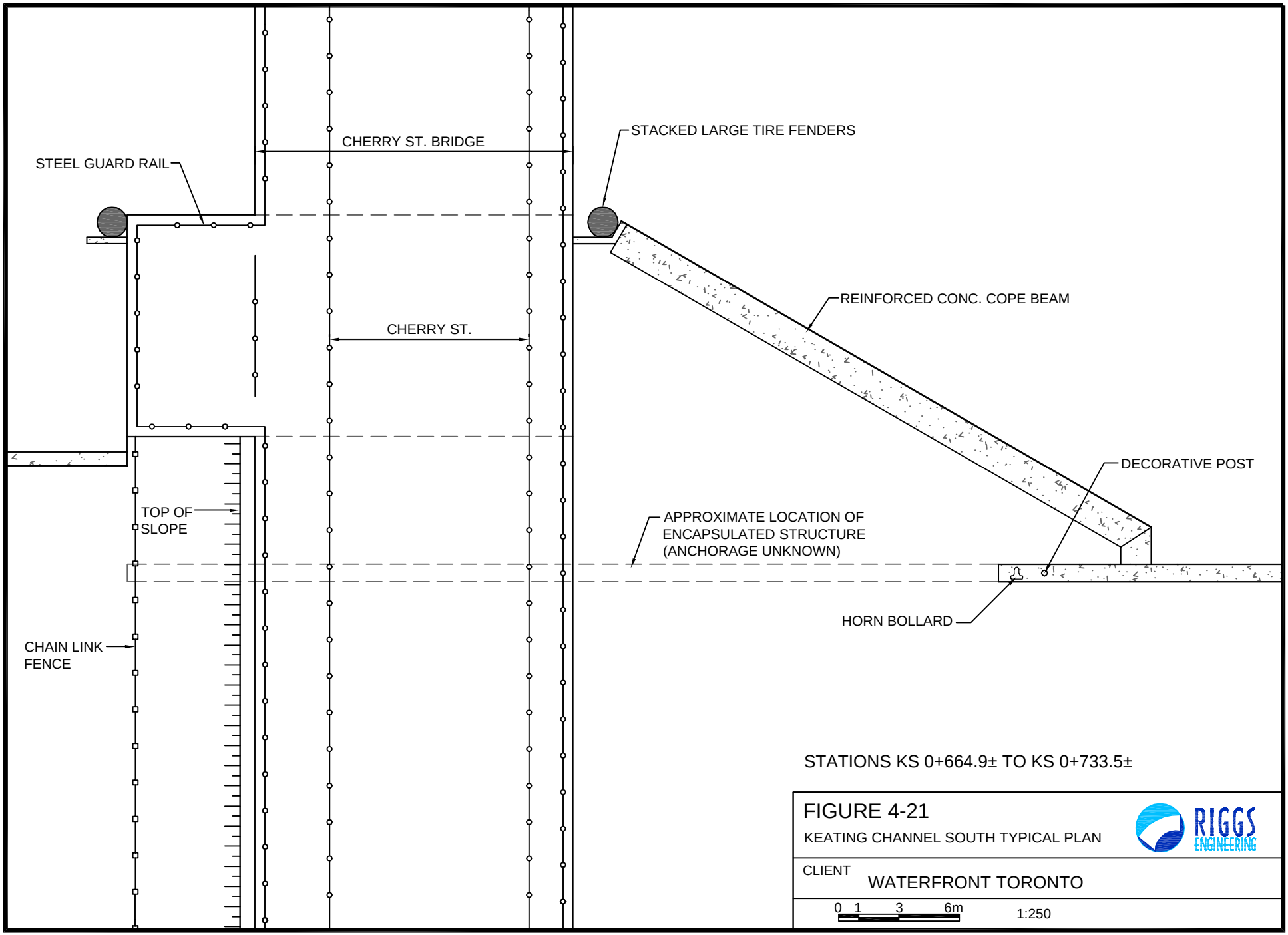
KEATING CHANNEL SOUTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS KS 0+664.9± TO KS 0+733.5±

FIGURE 4-21

KEATING CHANNEL SOUTH TYPICAL PLAN

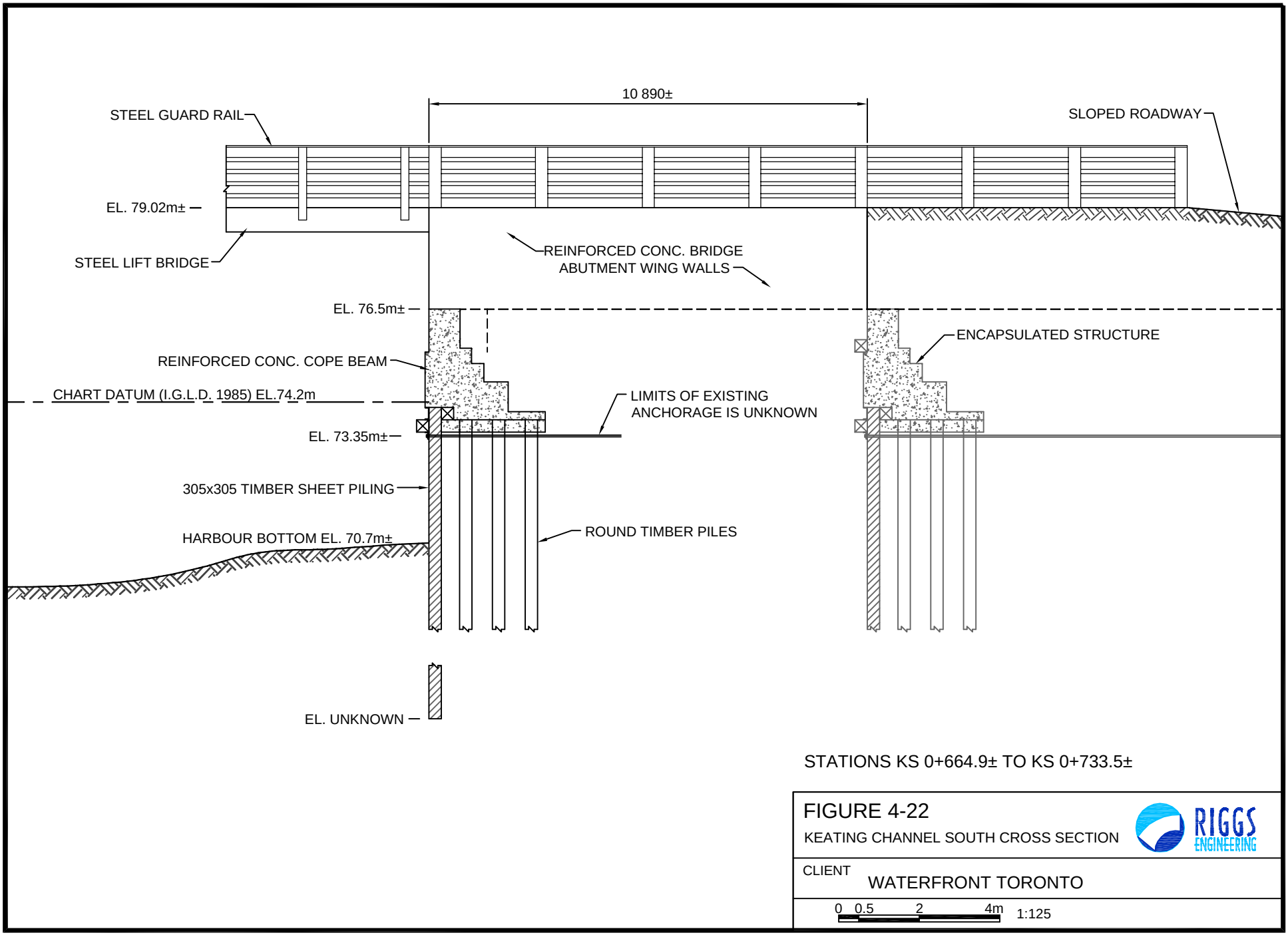
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 1 3 6m

1:250



STATIONS KS 0+664.9± TO KS 0+733.5±

FIGURE 4-22

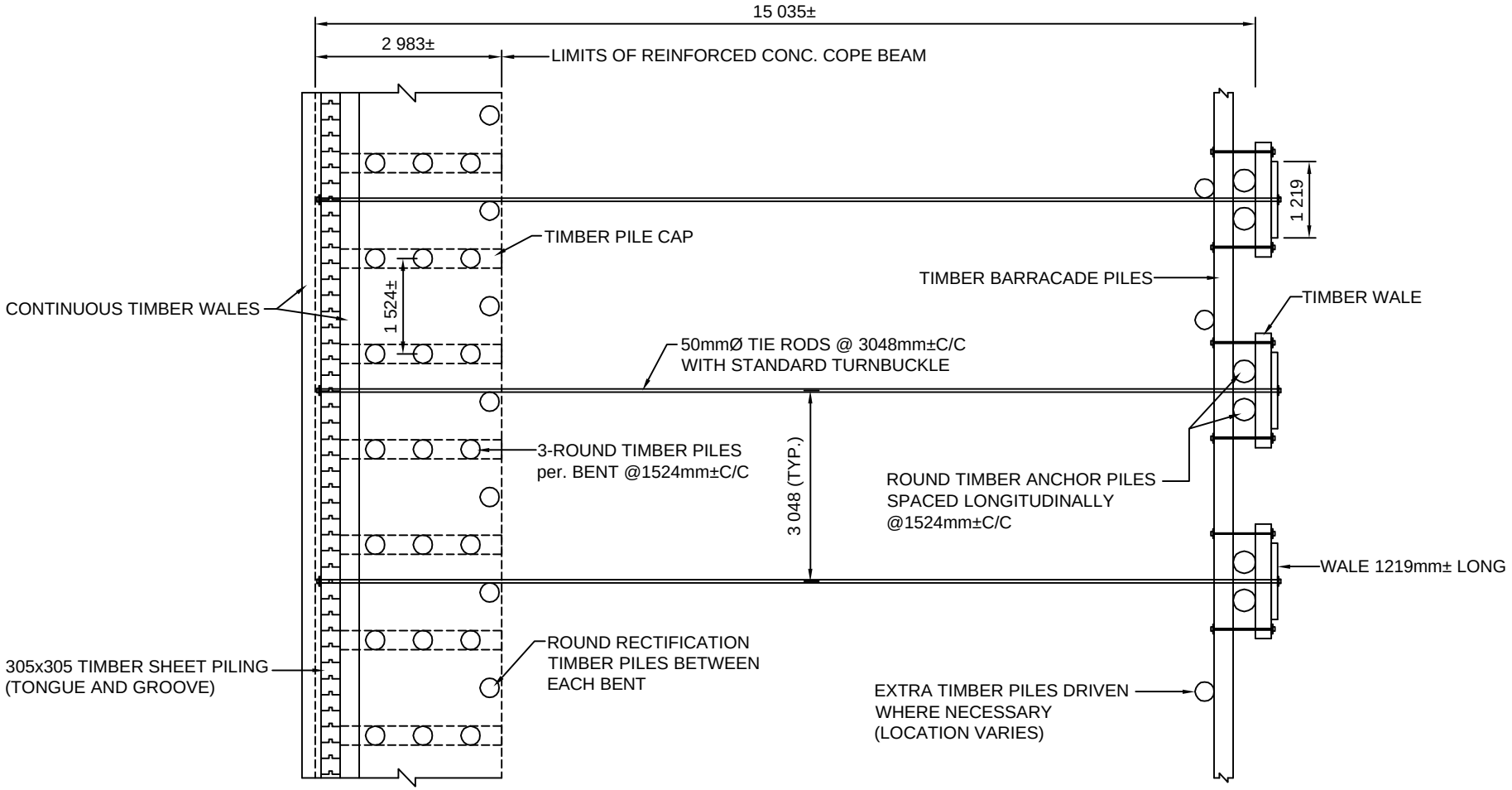
KEATING CHANNEL SOUTH CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 2 4m 1:125



STATIONS E 0+000 TO E 0+120.8±

FIGURE 4-23

ESSROC TYPICAL PLAN

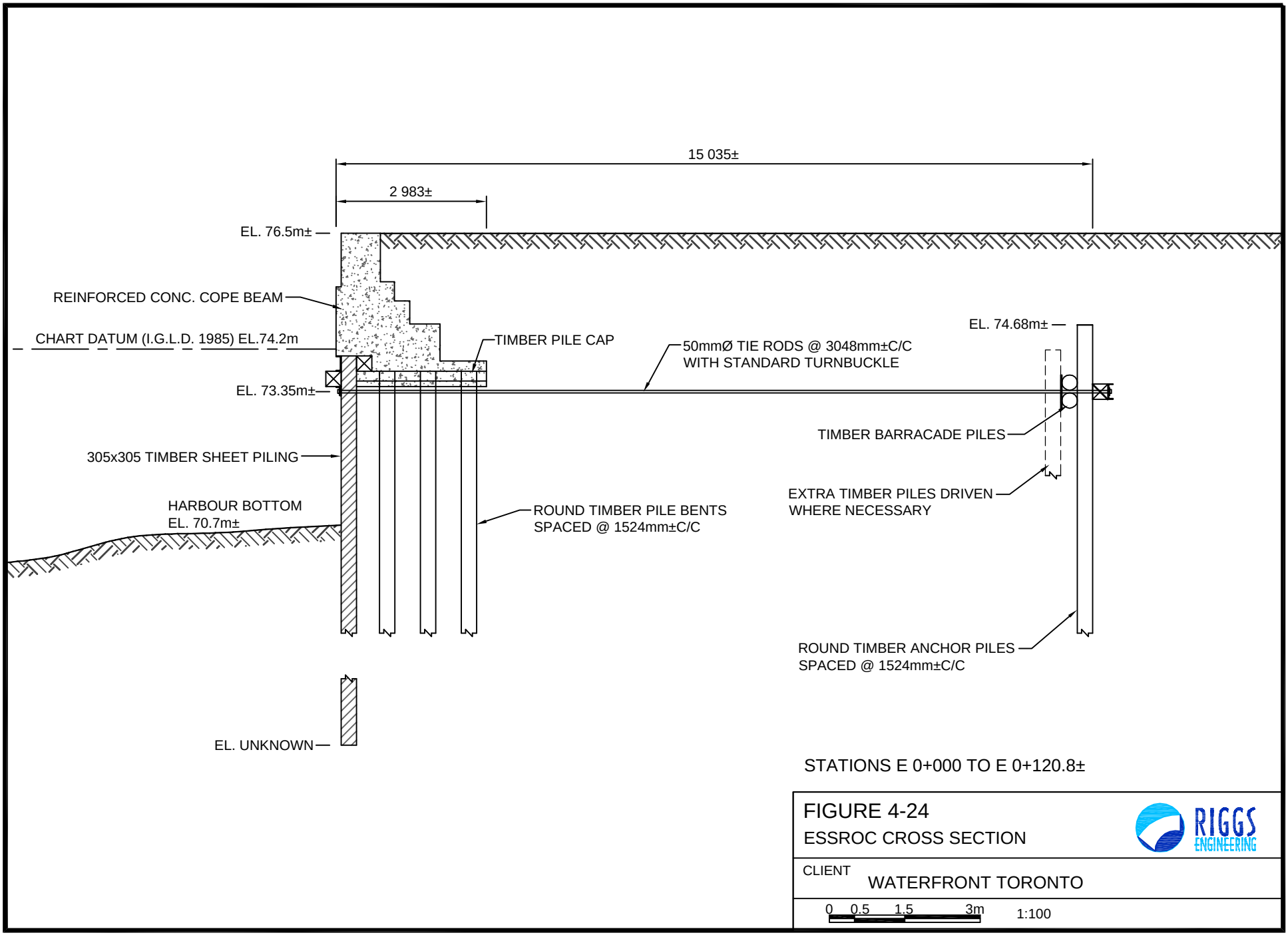
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



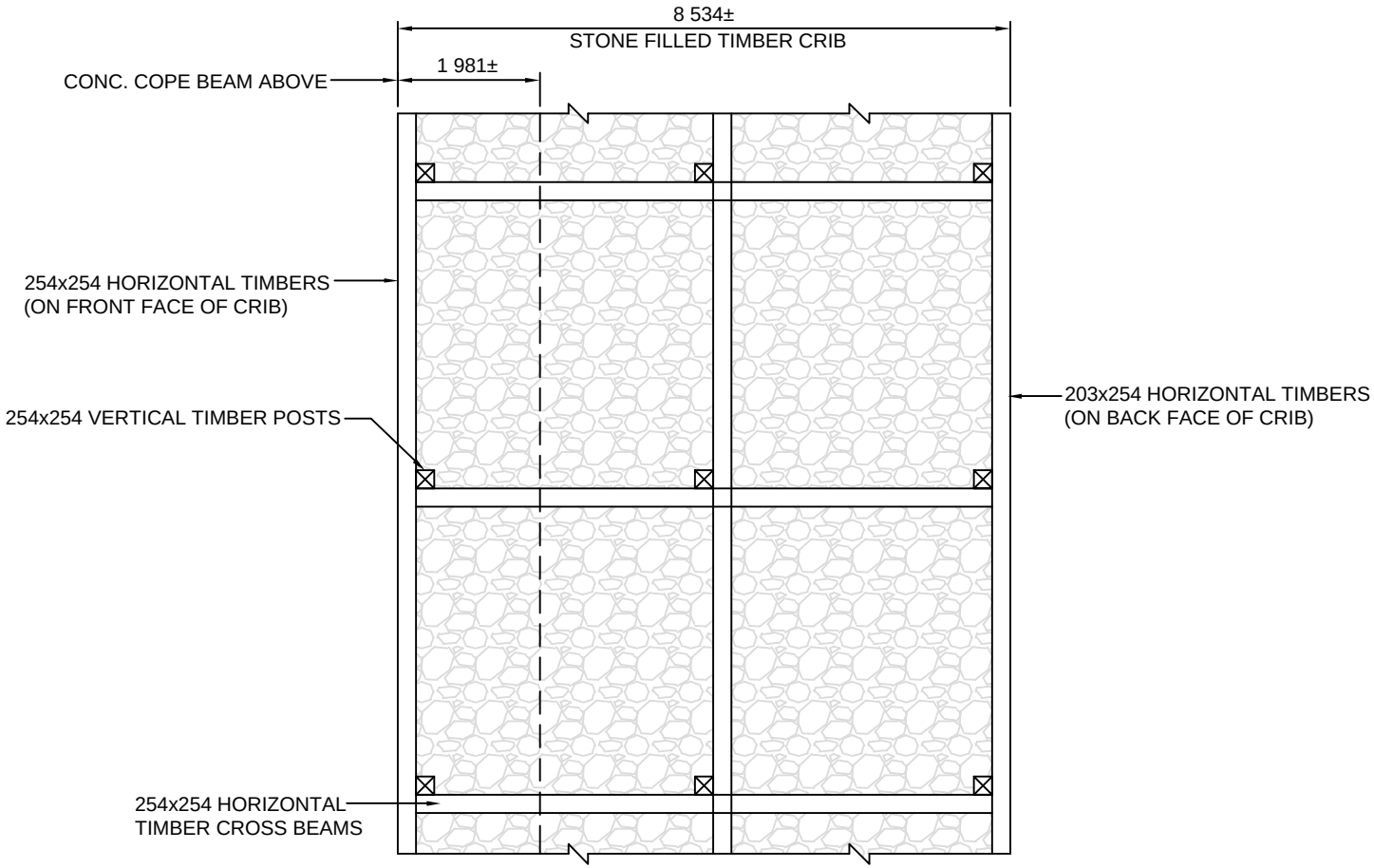
STATIONS E 0+000 TO E 0+120.8±

FIGURE 4-24
ESSROC CROSS SECTION

RIGGS ENGINEERING

CLIENT
WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS E 0+120.8± TO E 0+544.1±

FIGURE 4-25

ESSROC TYPICAL PLAN

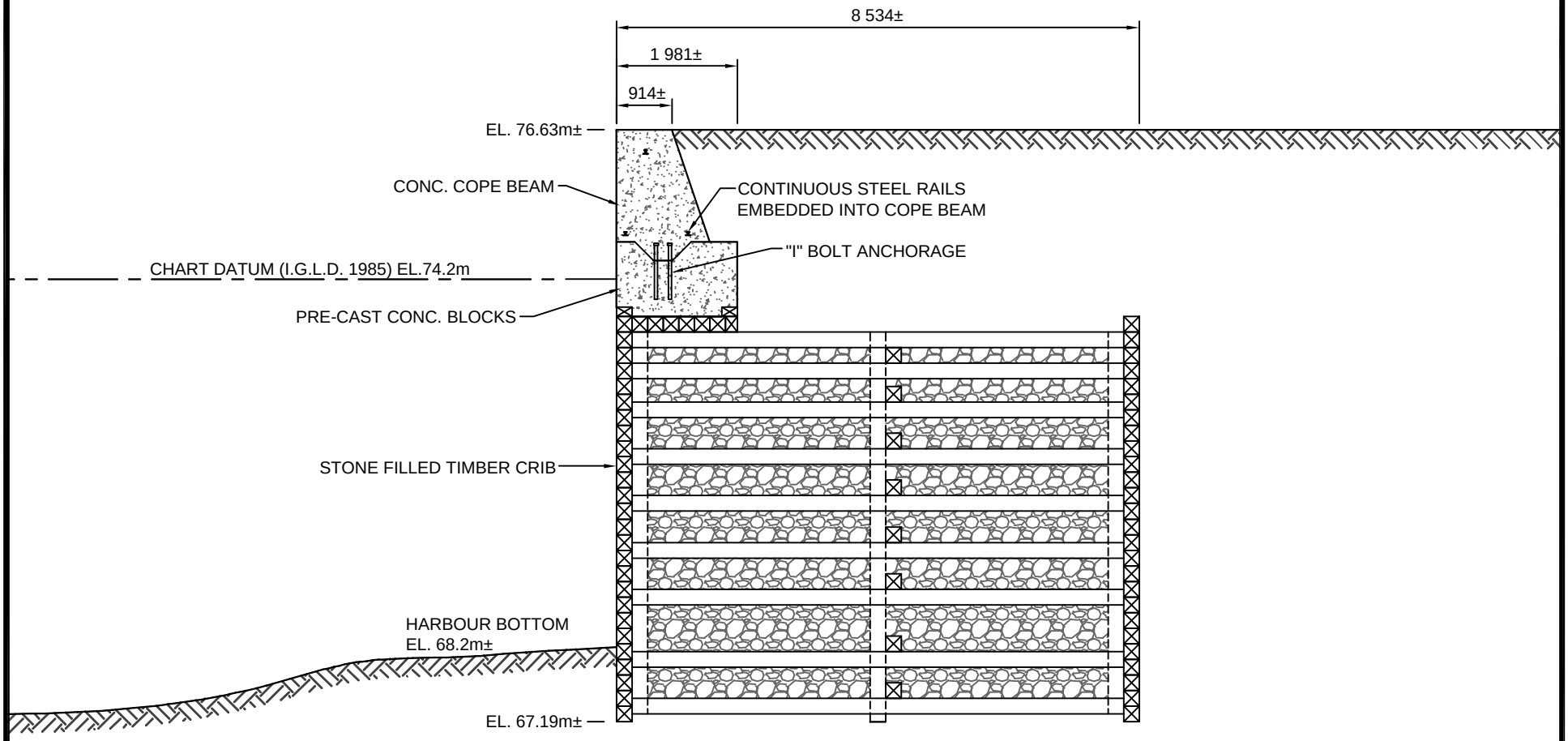
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS E 0+120.8± TO E 0+544.1±

FIGURE 4-26

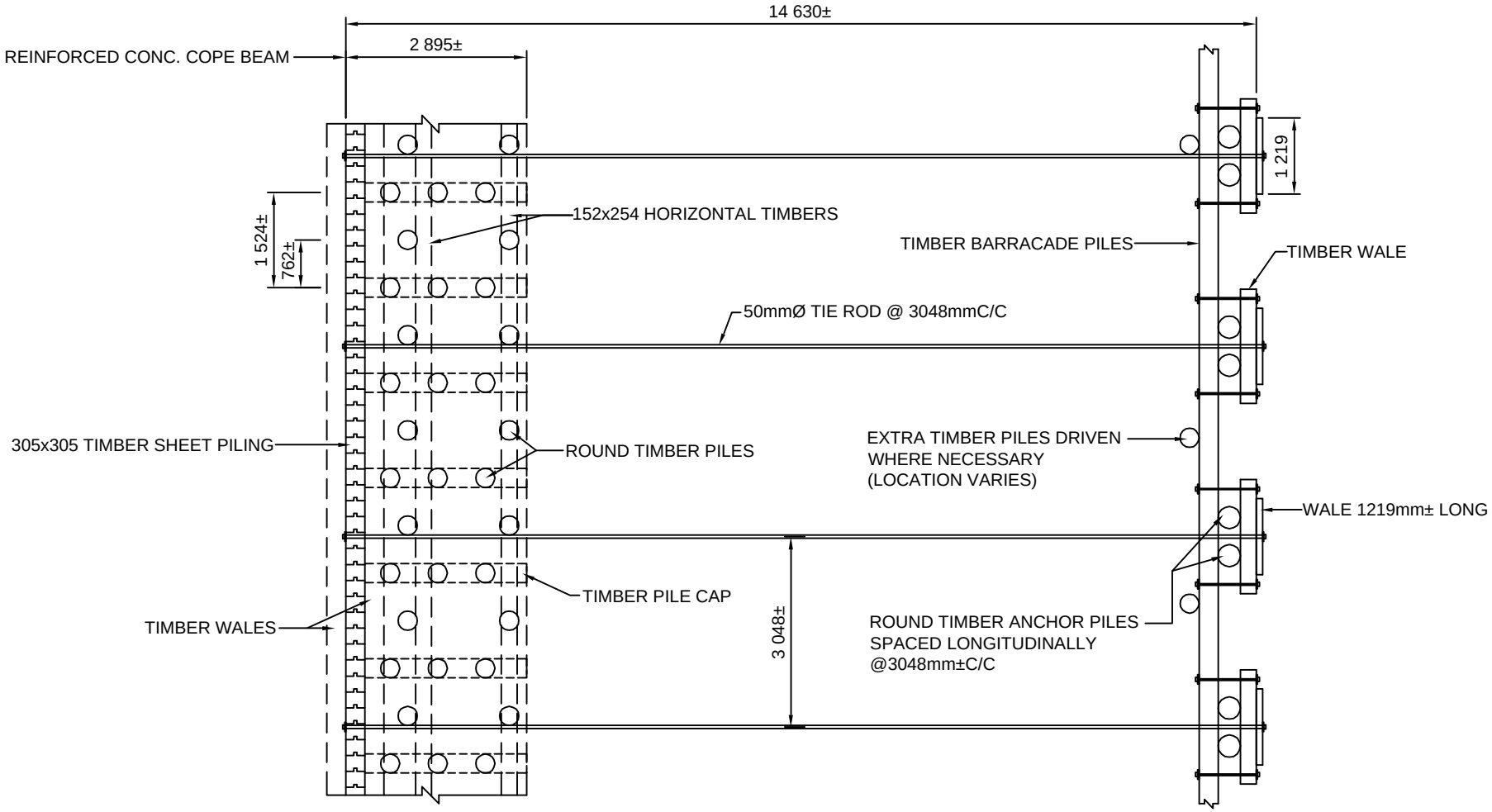
ESSROC CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100



STATIONS PQ 0+000 TO PQ 0+270.6±

FIGURE 4-27

POLSON QUAY TYPICAL PLAN

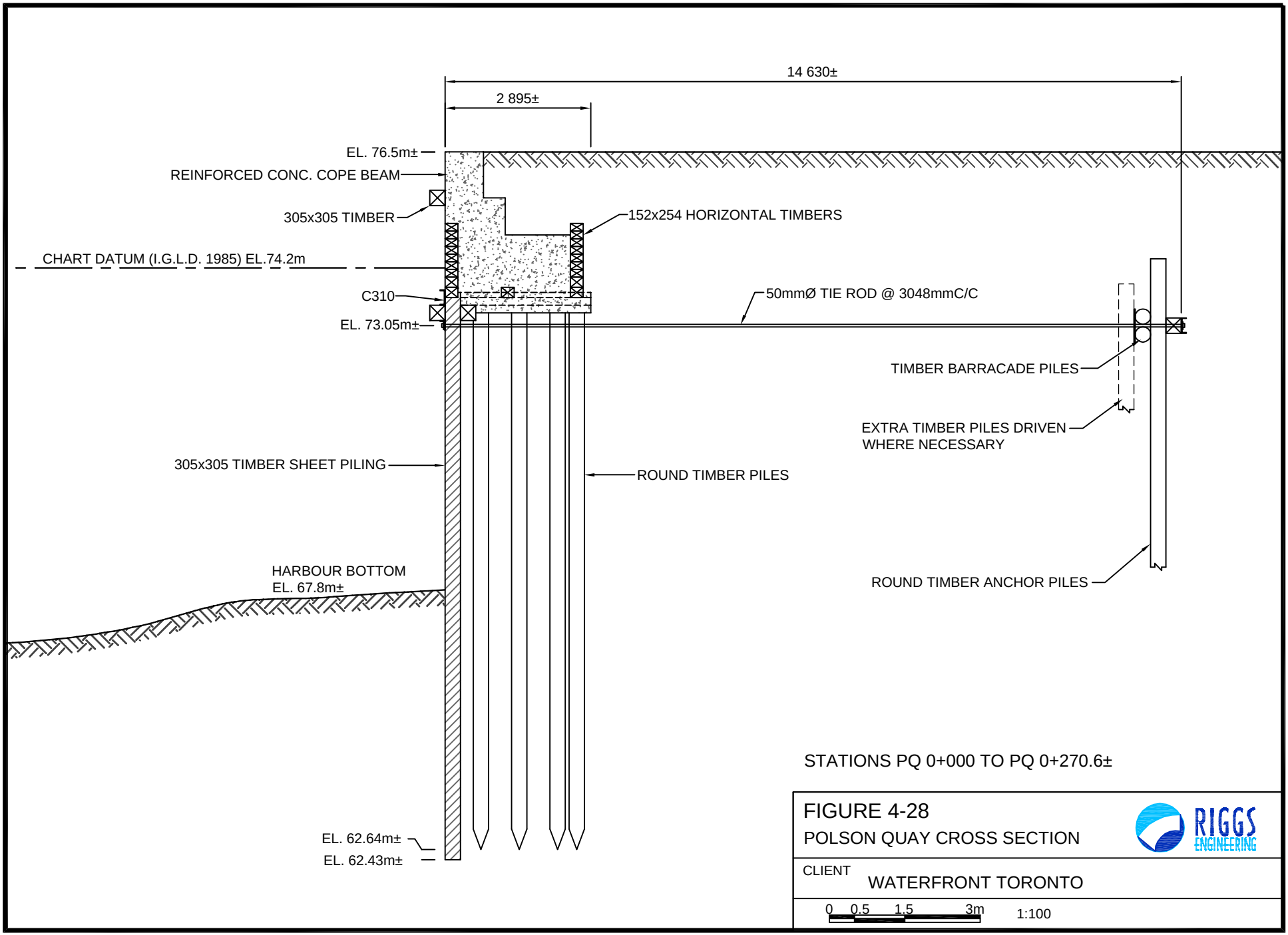
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS PQ 0+000 TO PQ 0+270.6±

FIGURE 4-28

POLSON QUAY CROSS SECTION

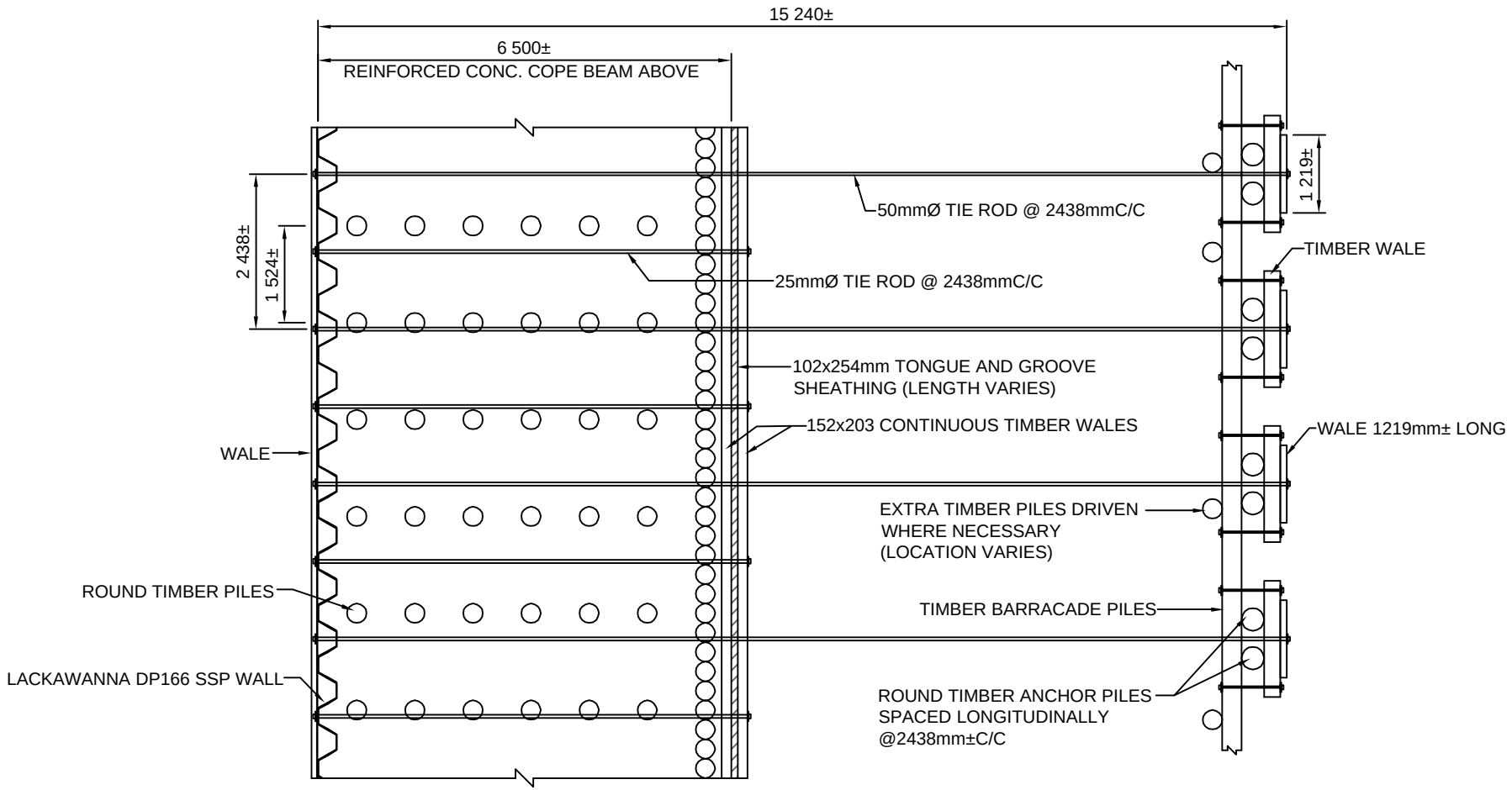
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATION PQ 0+270.6± TO PQ 0+501±

FIGURE 4-29

POLSON QUAY TYPICAL PLAN

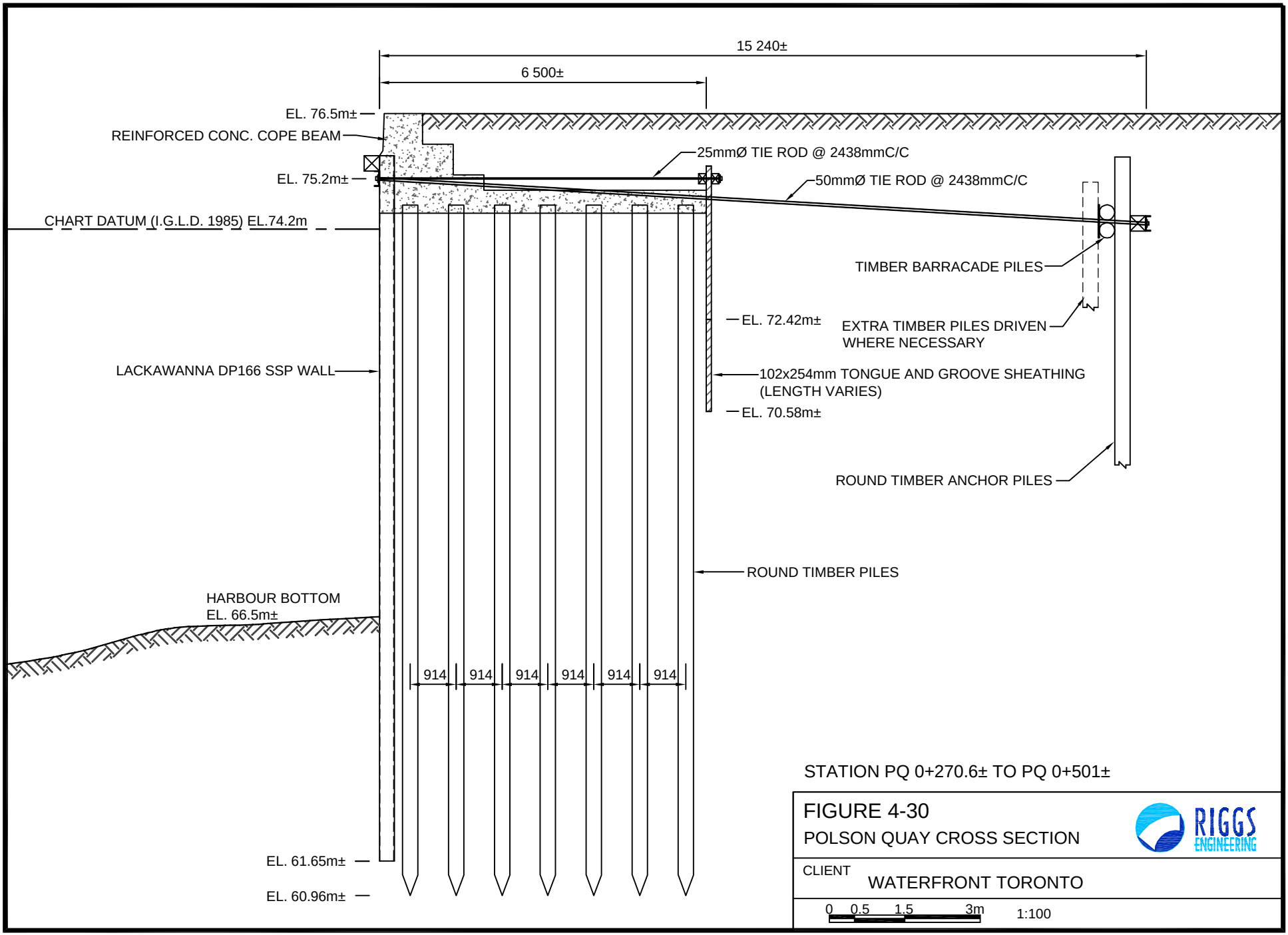
RIGGS ENGINEERING

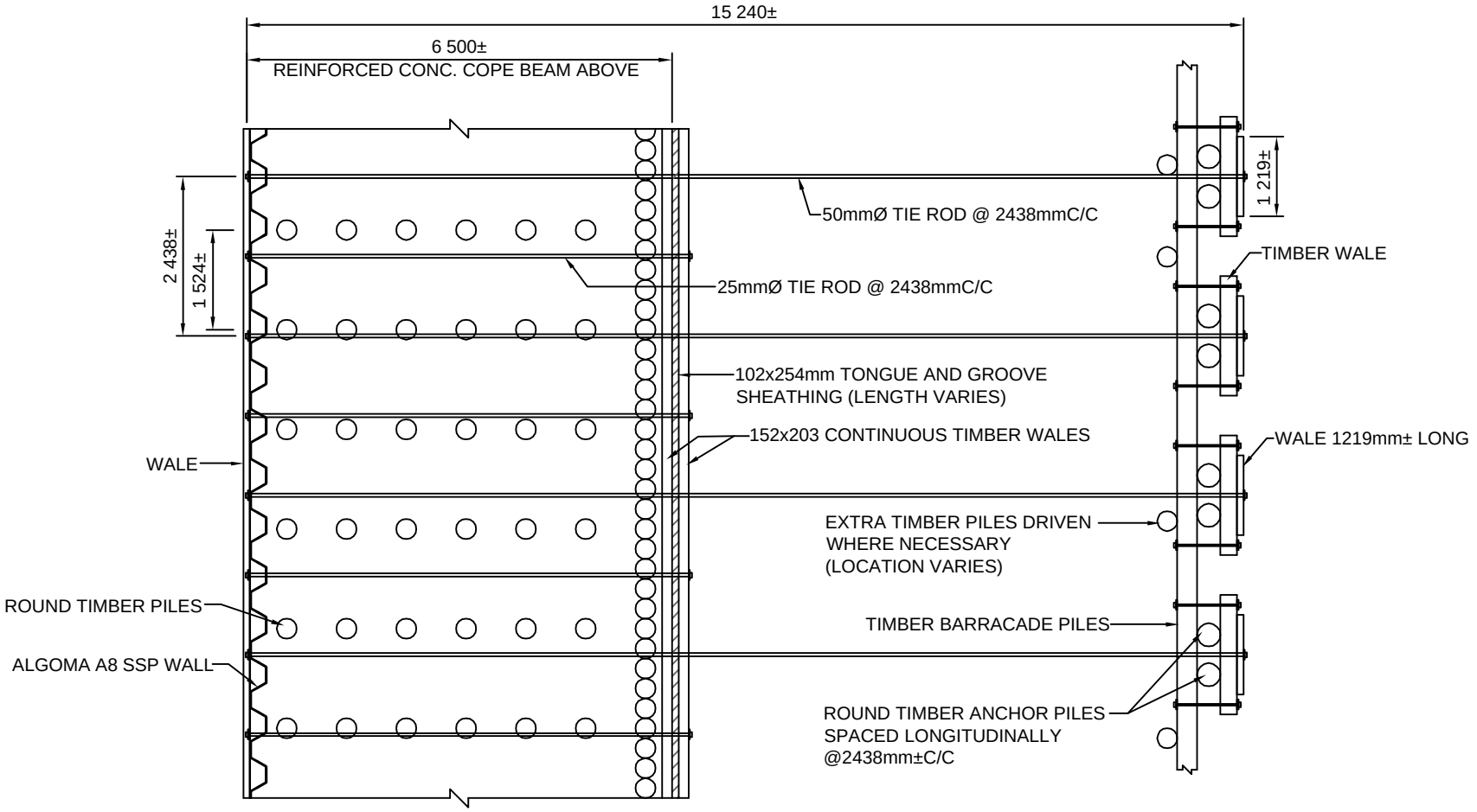
CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100


15 240±
6 500±
EL. 76.5m±
REINFORCED CONC. COPE BEAM
25mmØ TIE ROD @ 2438mmC/C
EL. 75.2m±
50mmØ TIE ROD @ 2438mmC/C
CHART DATUM (I.G.L.D. 1985) EL.74.2m
TIMBER BARRACADE PILES
EL. 72.42m±
EXTRA TIMBER PILES DRIVEN
WHERE NECESSARY
LACKAWANNA DP166 SSP WALL
102x254mm TONGUE AND GROOVE SHEATHING
(LENGTH VARIES)
EL. 70.58m±
ROUND TIMBER ANCHOR PILES
ROUND TIMBER PILES
HARBOUR BOTTOM
EL. 66.5m±
914
914
914
914
914
914
EL. 61.65m±
EL. 60.96m±
STATION PQ 0+270.6± TO PQ 0+501±
FIGURE 4-30
POLSON QUAY CROSS SECTION
RIGGS ENGINEERING
CLIENT
WATERFRONT TORONTO
0 0.5 1.5 3m
1:100



STATION PQ 0+501± TO PQ 0+578.5±

FIGURE 4-31

POLSON QUAY TYPICAL PLAN

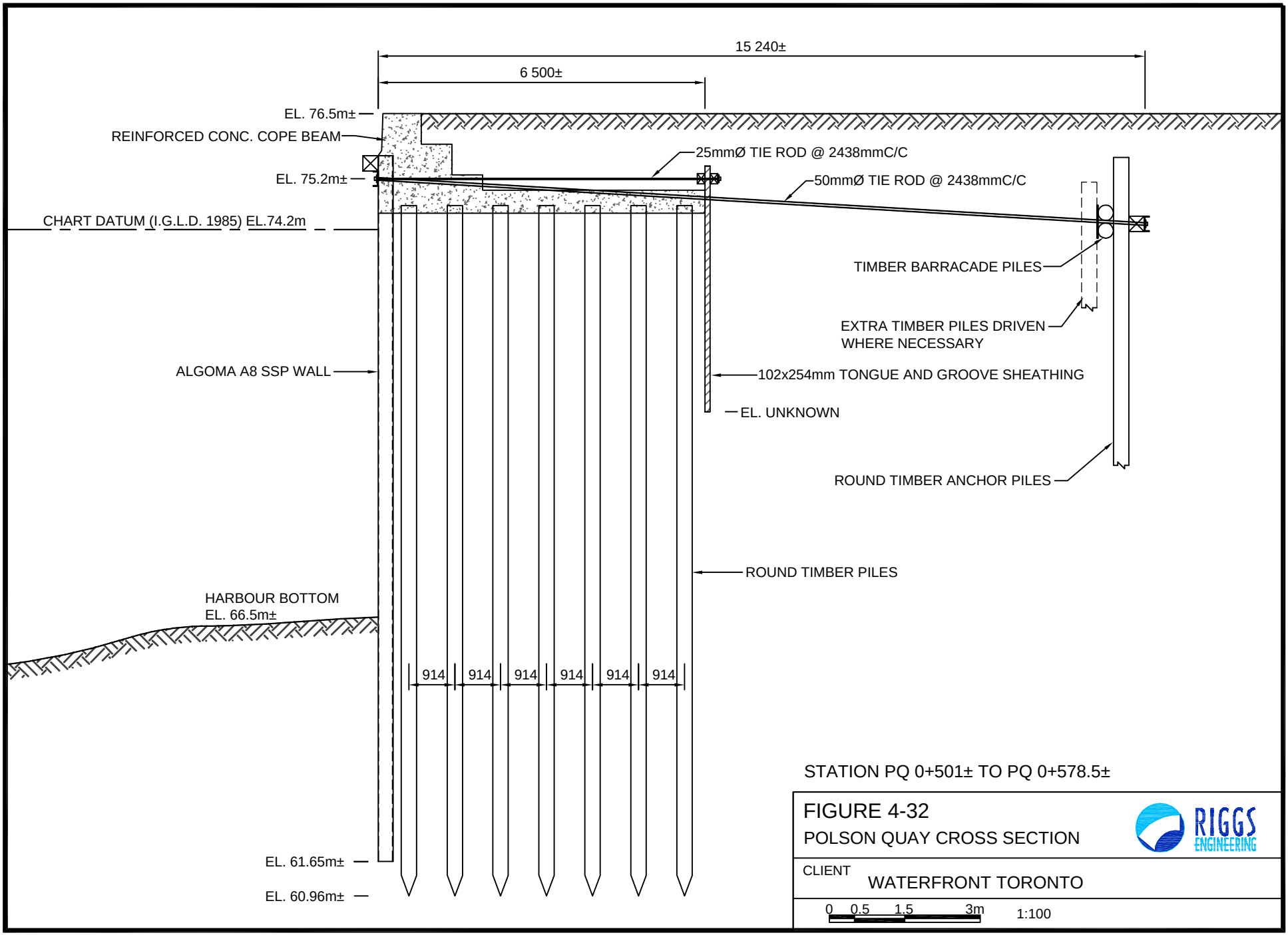
RIGGS ENGINEERING

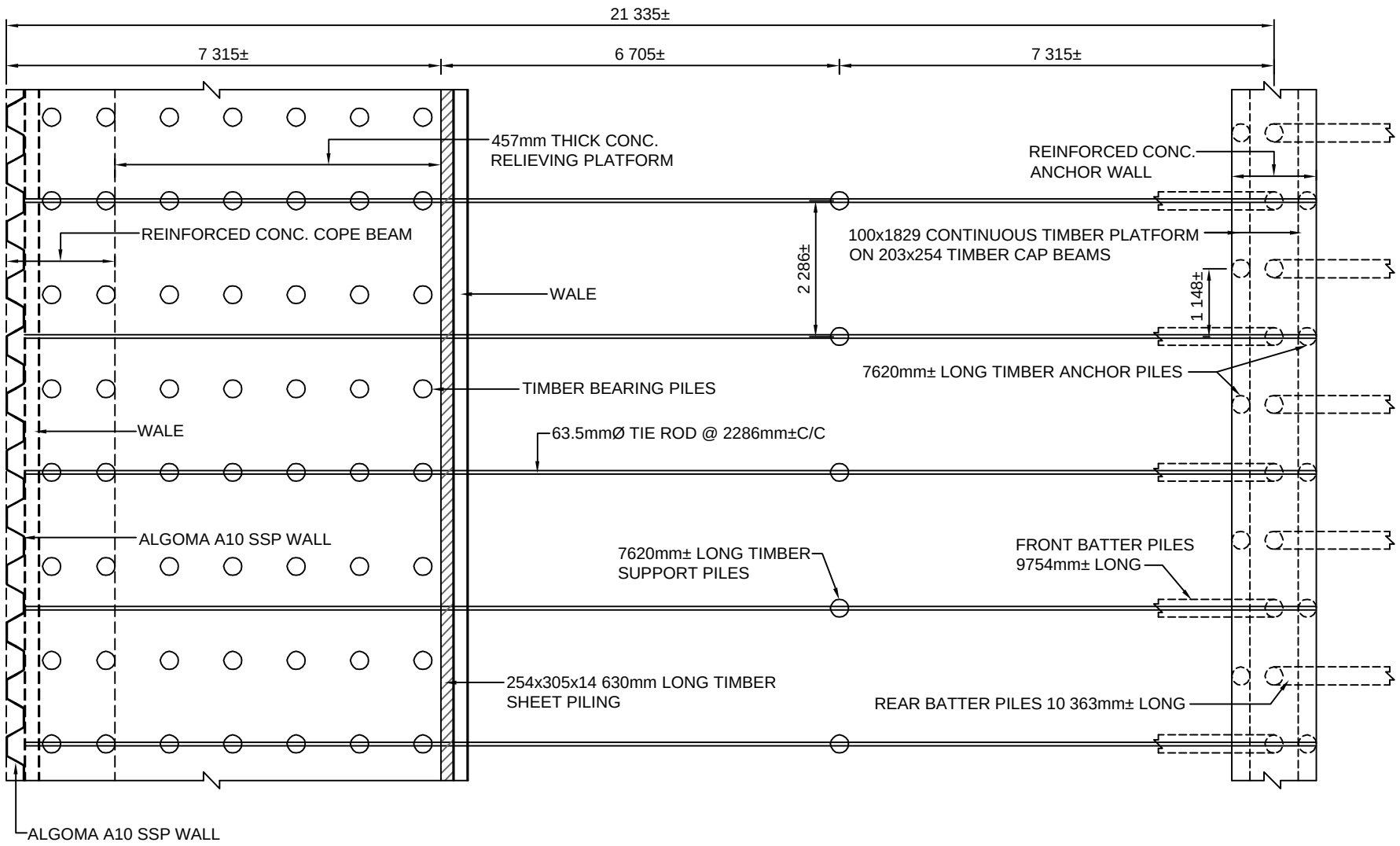
CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100


15 240±
6 500±
EL. 76.5m±
REINFORCED CONC. COPE BEAM
25mmØ TIE ROD @ 2438mmC/C
EL. 75.2m±
50mmØ TIE ROD @ 2438mmC/C
CHART DATUM (I.G.L.D. 1985) EL.74.2m
TIMBER BARRACADE PILES
EXTRA TIMBER PILES DRIVEN
WHERE NECESSARY
ALGOMA A8 SSP WALL
102x254mm TONGUE AND GROOVE SHEATHING
EL. UNKNOWN
ROUND TIMBER ANCHOR PILES
ROUND TIMBER PILES
HARBOUR BOTTOM
EL. 66.5m±
914
914
914
914
914
914
EL. 61.65m±
EL. 60.96m±
STATION PQ 0+501± TO PQ 0+578.5±
FIGURE 4-32
POLSON QUAY CROSS SECTION
RIGGS ENGINEERING
CLIENT
WATERFRONT TORONTO
0 0.5 1.5 3m
1:100



STATIONS PQ 0+578.5± TO PQ 0+915.2±

FIGURE 4-33

POLSON QUAY TYPICAL PLAN

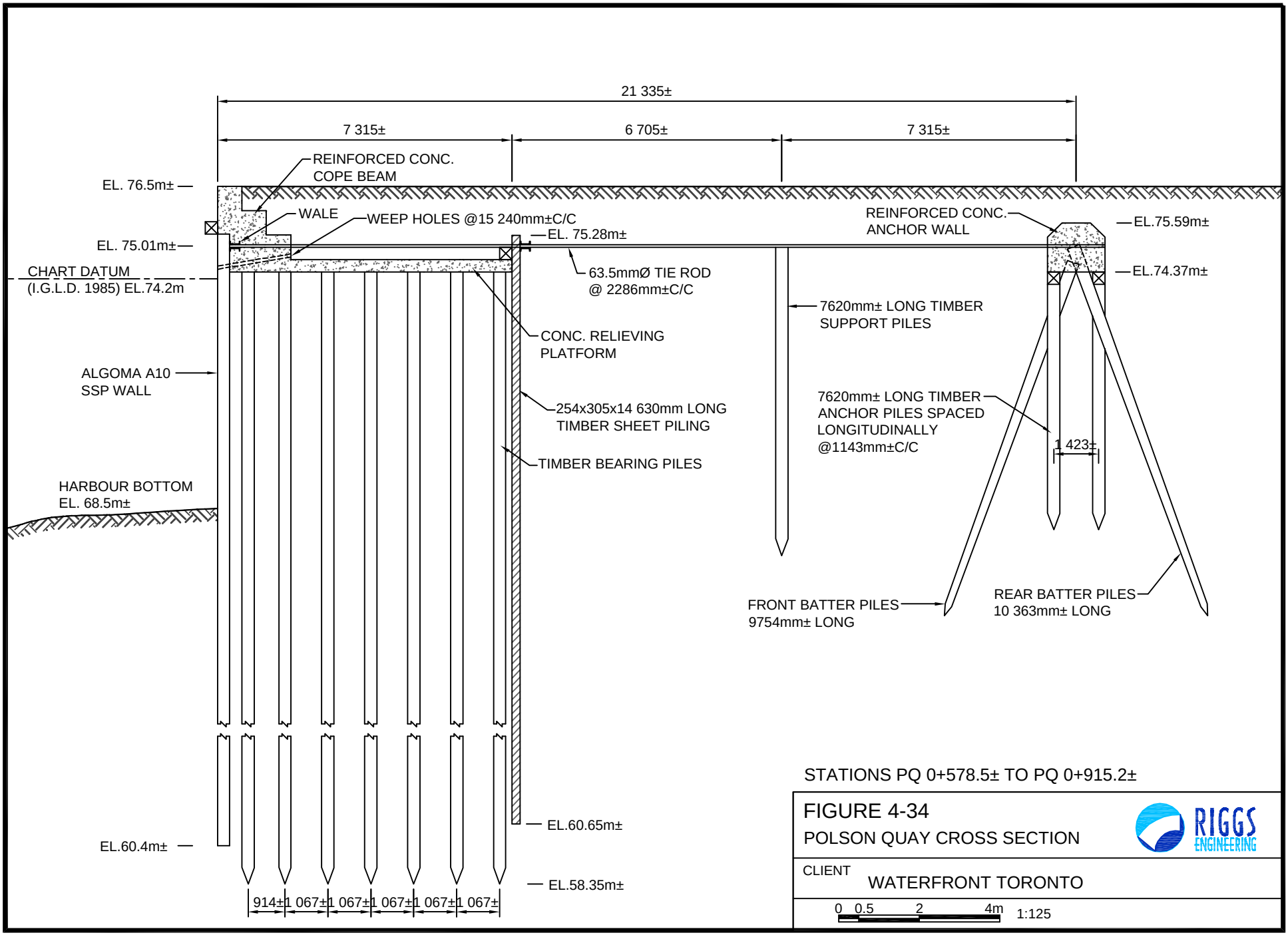
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS PQ 0+578.5± TO PQ 0+915.2±

FIGURE 4-34

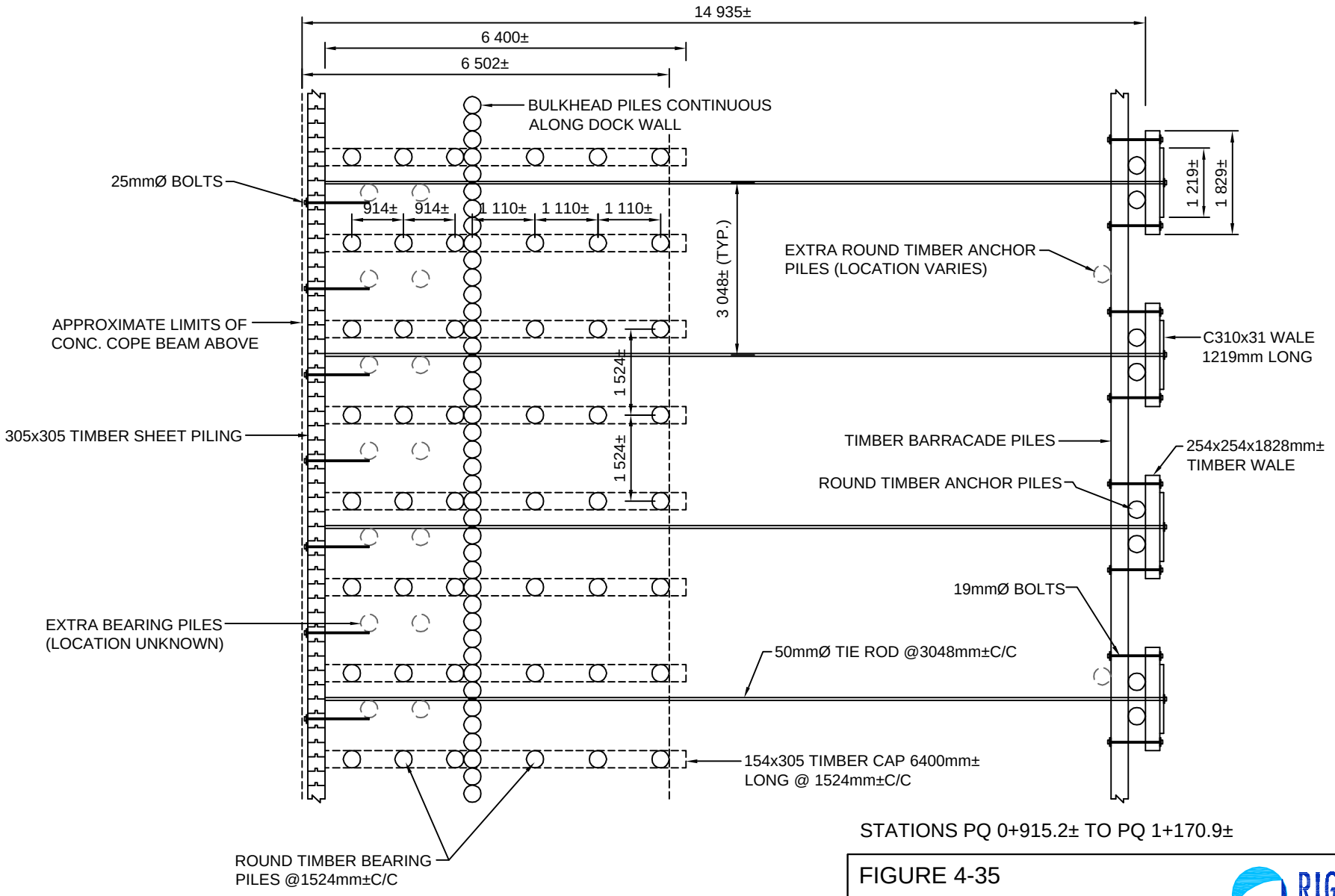
POLSON QUAY CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 2 4m 1:125



STATIONS PQ 0+915.2± TO PQ 1+170.9±

FIGURE 4-35

POLSON QUAY TYPICAL PLAN

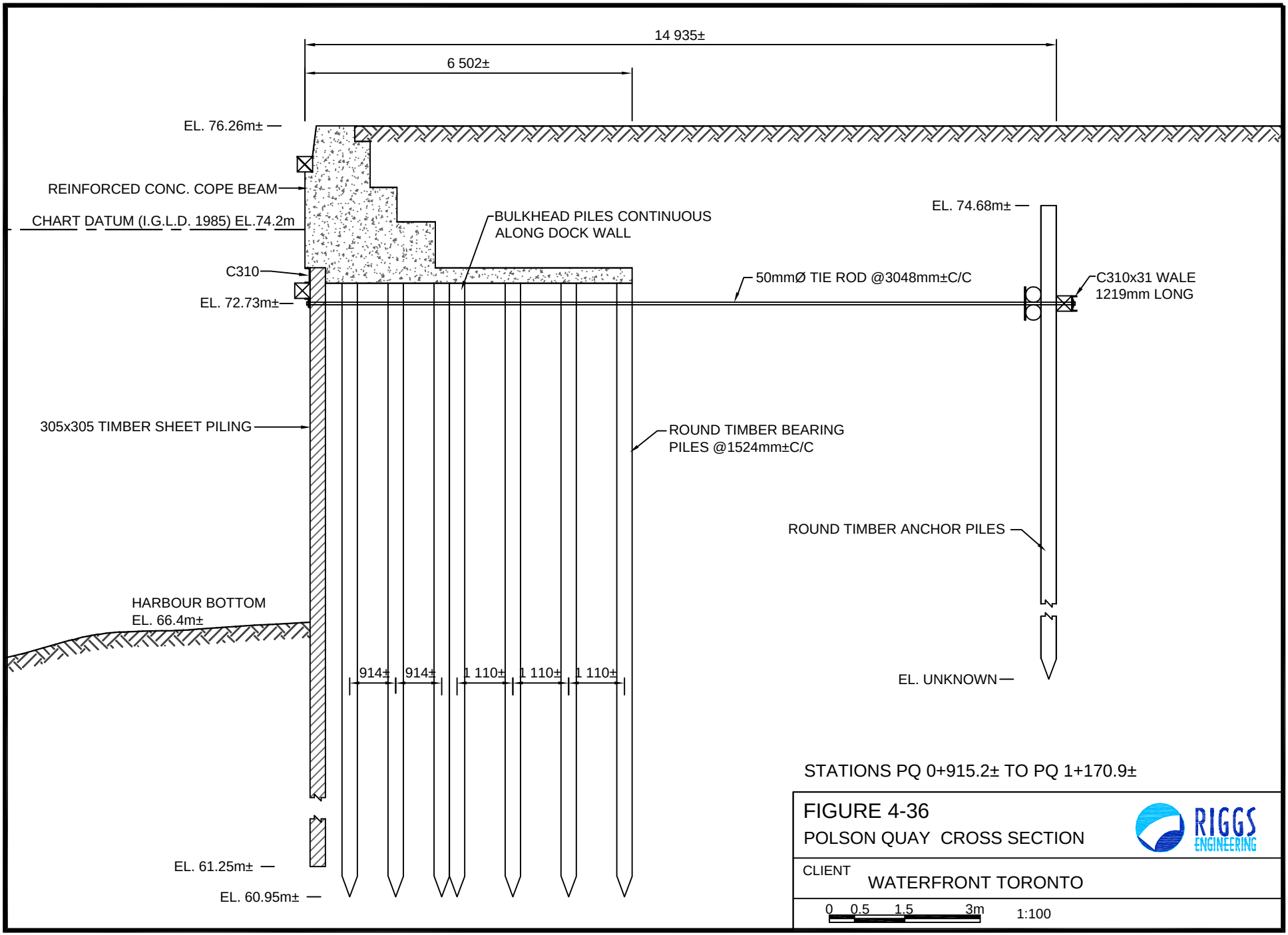
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS PQ 0+915.2± TO PQ 1+170.9±

FIGURE 4-36

POLSON QUAY CROSS SECTION

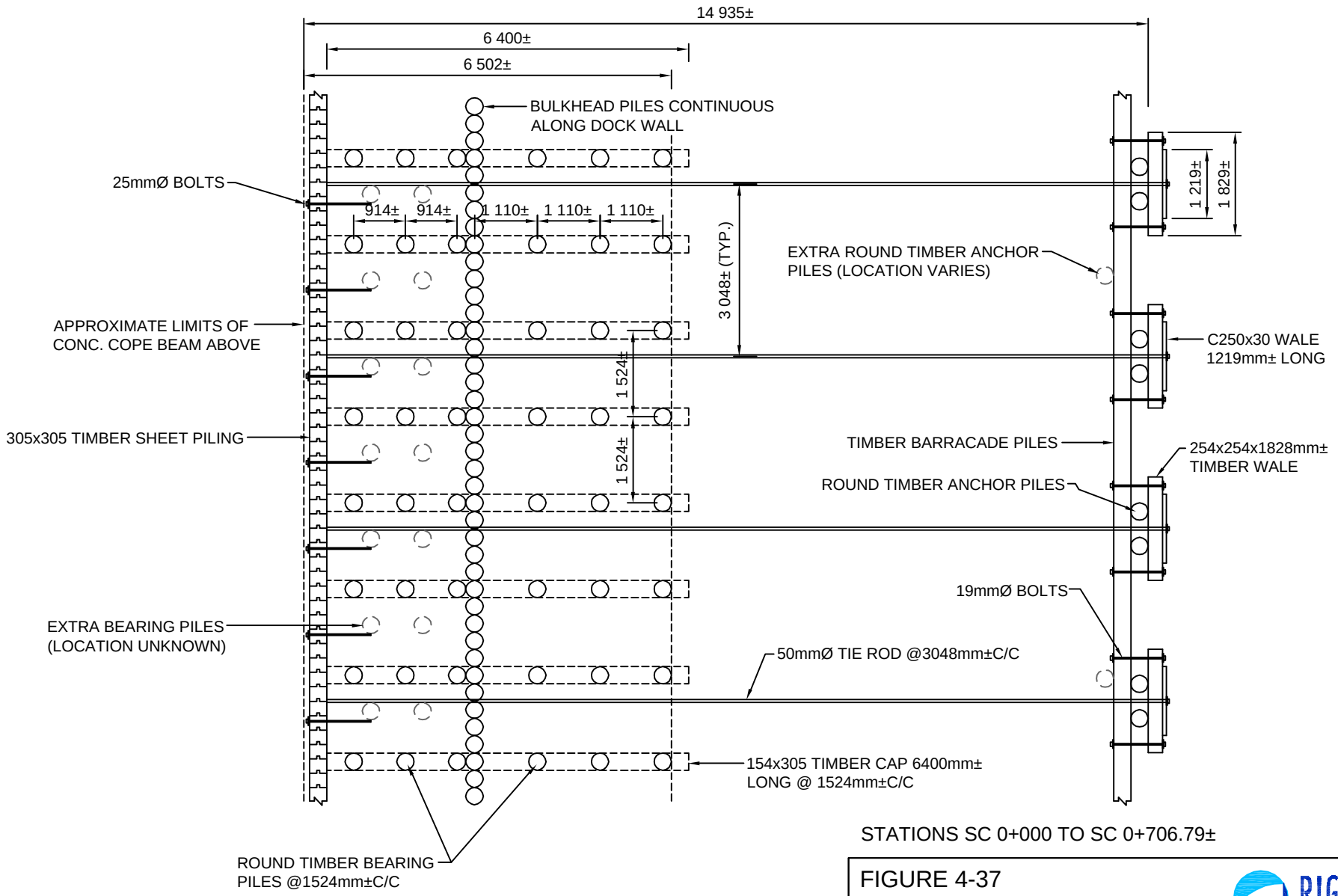
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS SC 0+000 TO SC 0+706.79±

FIGURE 4-37

SHIP CHANNEL TYPICAL PLAN

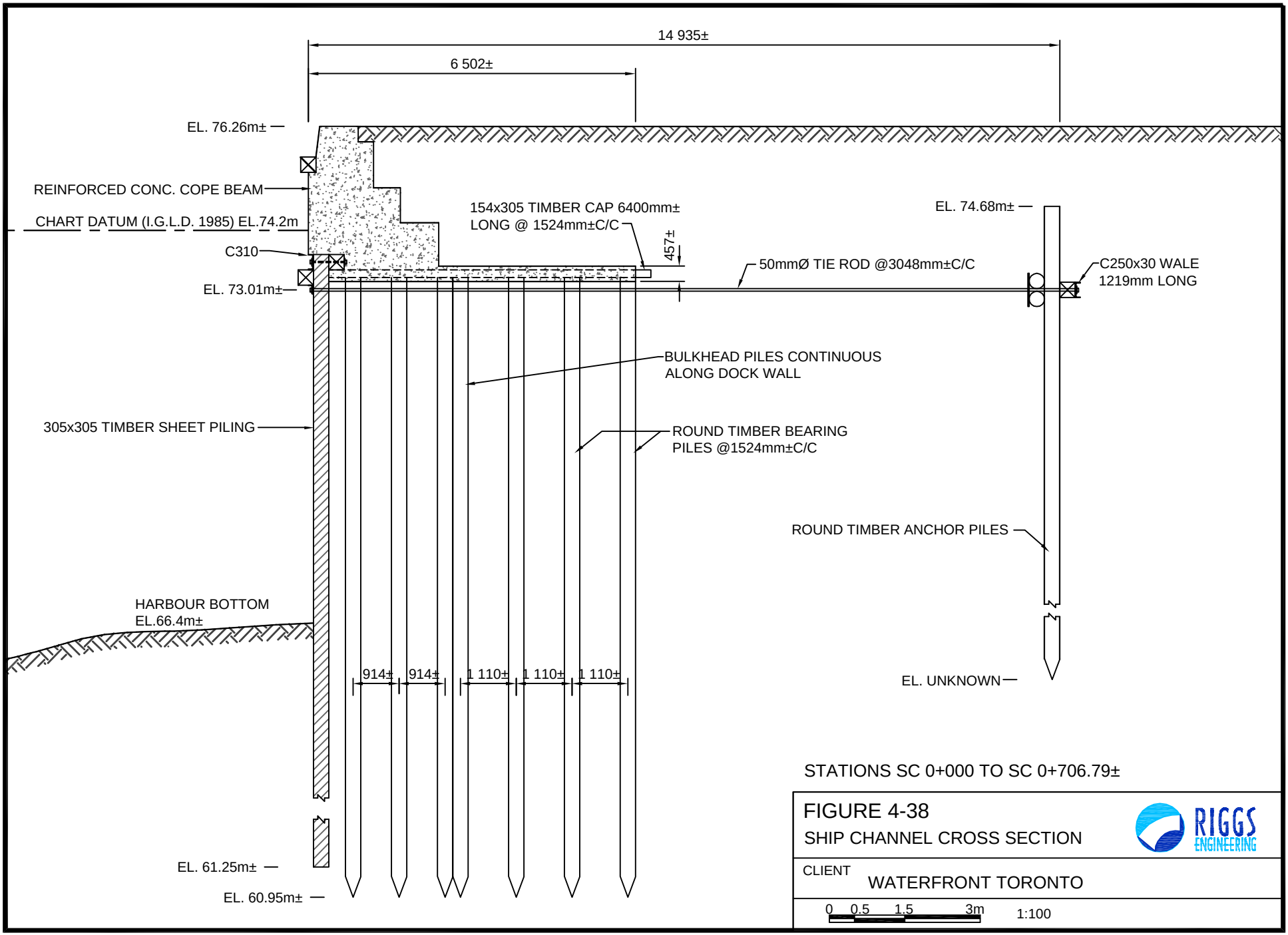
RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m

1:100



STATIONS SC 0+000 TO SC 0+706.79±

FIGURE 4-38

SHIP CHANNEL CROSS SECTION

RIGGS ENGINEERING

CLIENT

WATERFRONT TORONTO

0 0.5 1.5 3m 1:100

Appendix C
Keating Channel North Side Photos

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

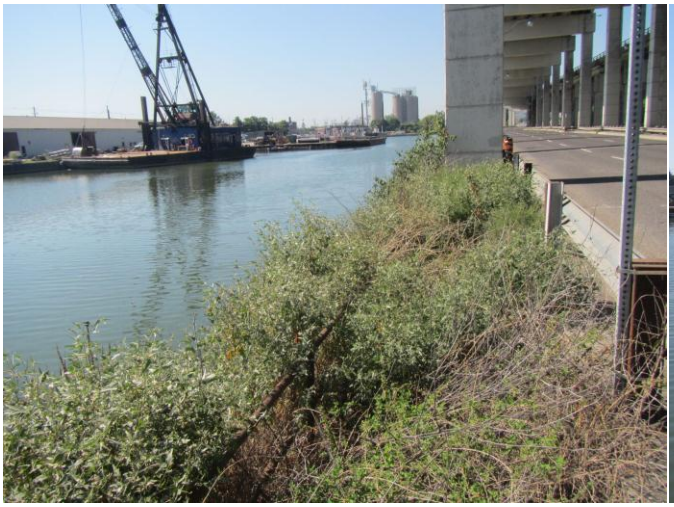


Photo #3: Sta. 0+100

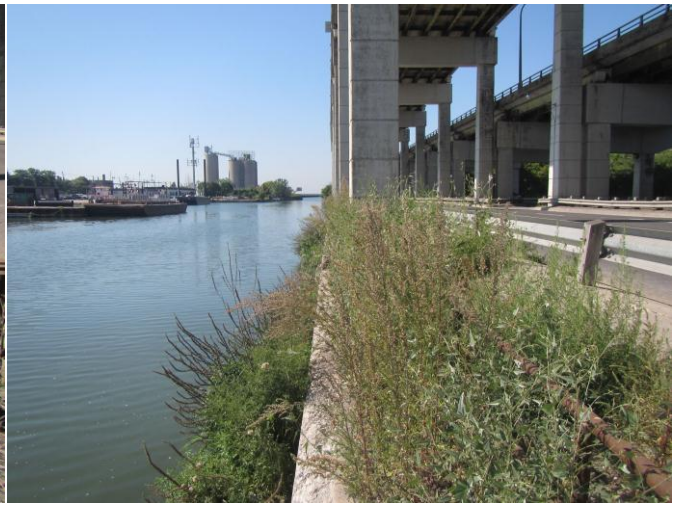


Photo #4: Sta. 0+150

Photo #5: Sta. 0+200

Photo #6: Sta. 0+250

Photo #7: Sta. 0+300

Photo #8: Sta. 0+350

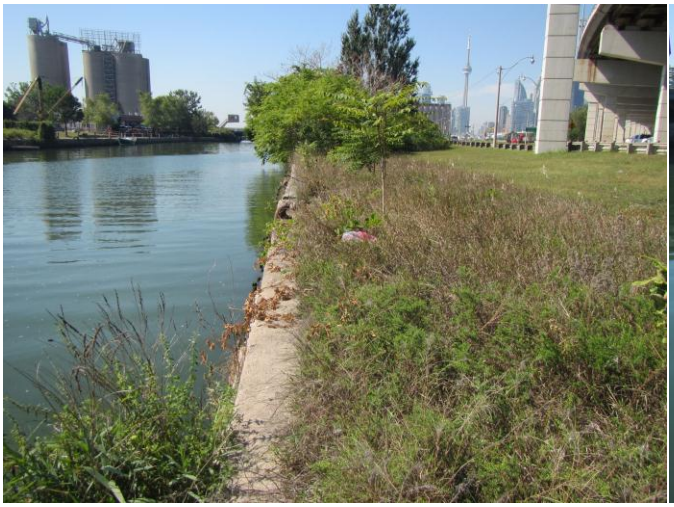


Photo #9: Sta. 0+400

Photo #10: Sta. 0+600

Photo #11: Sta. 0+620

Photo #12: Sta. 0+660

Photo #13: Sta. 0+700

Photo #14: Sta. 0+750

Photo #15: Sta. 0+800

Photo #16: Sta. 0+850

Photo #17: Sta. 0+900

Photo #18: Sta. 0+930

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+100

Photo #4: Sta. 0+150

Photo #5: Sta. 0+200

Photo #6: Sta. 0+250

Photo #7: Sta. 0+300

Photo #8: Sta. 0+350

Photo #9: Sta. 0+400

Photo #10: Sta. 0+450

Photo #11: Sta. 0+493 (Structure change)

Photo #12: Sta. 0+500

Photo #13: Sta. 0+550

Photo #14: Sta. 0+600

Photo #15: Sta. 0+639 (Structure change)

Photo #16: Sta. 0+650

Photo #17: Sta. 0+700

Photo #18: Sta. 0+750

Photo #19: Sta. 0+800

Photo #20: Sta. 0+850

Photo #21: Sta. 0+900

Photo #22: Sta. 0+950

Photo #23: Sta. 1+000

Photo #24: Sta. 1+050

Photo #25: Sta. 1+100

Photo #26: Sta. 1+115.6

Appendix D
Keating Channel South Side Photos

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+100

Photo #4: Sta. 0+150

Photo #5: Sta. 0+200

Photo #6: Sta. 0+215

Photo #7: Sta. 0+250

Photo #8: Sta. 0+265

Photo #9: Sta. 0+270

Photo #10: Sta. 0+285

Photo #11: Sta. 0+300

Photo #12: Sta. 0+350

Photo #13: Sta. 0+400

Photo #14: Sta. 0+450

Photo #15: Sta. 0+475

Photo #16: Sta. 0+490

Photo #17: Sta. 0+500

Photo #18: Sta. 0+550

Photo #19: Sta. 0+600

Photo #20: Sta. 0+650

Photo #21: Sta. 0+665

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+060 (Structure change)

Photo #4: Sta. 0+100

Photo #5: Sta. 0+150

Photo #6: Sta. 0+200

Photo #7: Sta. 0+212 (Structure change)

Photo #8: Sta. 0+237 (Corner)

Photo #9: Sta. 0+241 (Structure change)

Photo #10: Sta. 0+250

Photo #11: Sta. 0+269 (Corner)

Photo #12: Sta. 0+292 (Corner)

Photo #13: Sta. 0+300

Photo #14: Sta. 0+350

Photo #15: Sta. 0+400

Photo #16: Sta. 0+450

Photo #17: Sta. 0+476 (Corner)

Photo #18: Sta. 0+500 (Corner)

Photo #19: Sta. 0+540 (Structure change)

Photo #20: Sta. 0+550

Photo #21: Sta. 0+600

Photo #22: Sta. 0+650

Photo #23: Sta. 0+664 (Structure change)

Photo #24: Sta. 0+700

Appendix E
Former Essroc Facility Photos

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+065

Photo #4: Sta. 0+100

Photo #5: Sta. 0+120

Photo #6: Sta. 0+150

Photo #7: Sta. 0+200

Photo #8: Sta. 0+250

Photo #9: Sta. 0+300

Photo #10: Sta. 0+305

Photo #11: Sta. 0+330

Photo #12: Sta. 0+350

Photo #13: Sta. 0+360

Photo #14: Sta. 0+370

Photo #15: Sta. 0+400

Photo #16: Sta. 0+450

Photo #17: Sta. 0+500

Photo #18: Sta. 0+540

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+065 (Corner)

Photo #4: Sta. 0+100

Photo #5: Sta. 0+120.3 (Structure change)

Photo #6: Sta. 0+150

Photo #7: Sta. 0+200

Photo #8: Sta. 0+250

Photo #9: Sta. 0+300

Photo #10: Sta. 0+305 (Corner)

Photo #11: Sta. 0+350

Photo #12: Sta. 0+359 (Corner)

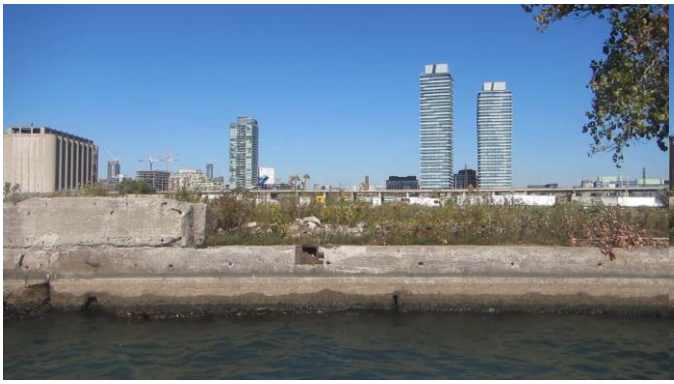


Photo #13: Sta. 0+400

Photo #14: Sta. 0+450

Photo #15: Sta. 0+500

Photo #16: Sta. 0+544.1

Appendix F
Marine Terminal 35 Photos

Photo #1: Sta. 0+000

Photo #2: Sta. 0+040

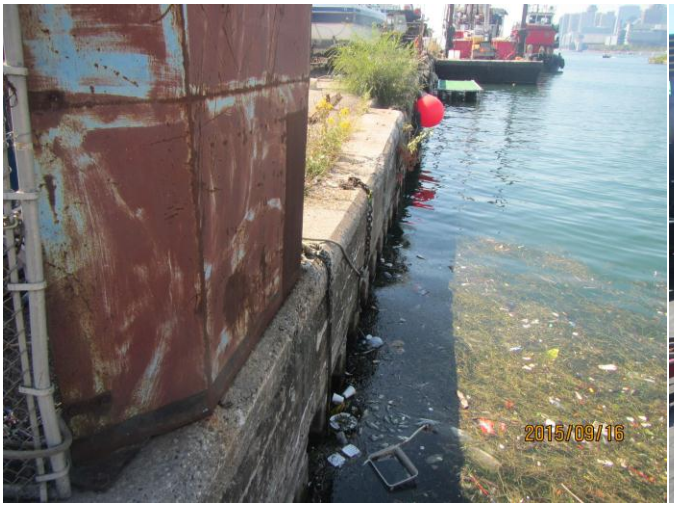


Photo #3: Sta. 0+060

Photo #4: Sta. 0+100

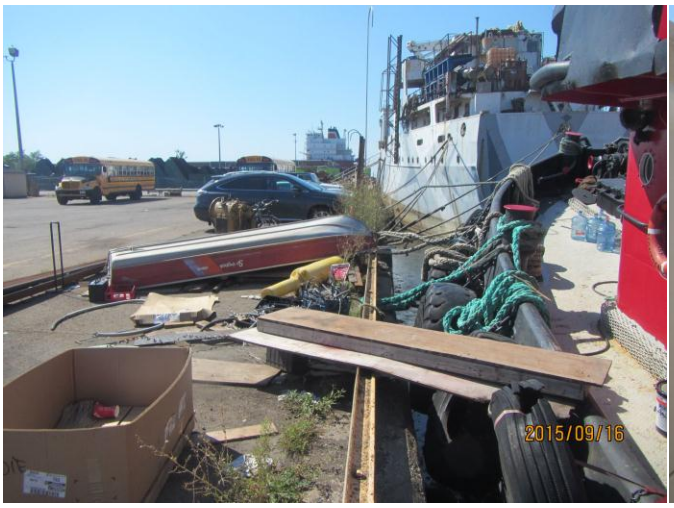


Photo #5: Sta. 0+150

Photo #6: Sta. 0+200

Photo #7: Sta. 0+250

Photo #8: Sta. 0+300

Photo #9: Sta. 0+350

Photo #10: Sta. 0+400

Photo #11: Sta. 0+445

Photo #12: Sta. 0+500

Photo #13: Sta. 0+550

Photo #14: Sta. 0+600

Photo #15: Sta. 0+650

Photo #16: Sta. 0+680

Photo #17: Sta. 0+700

Photo #18: Sta. 0+750

Photo #19: Sta. 0+800

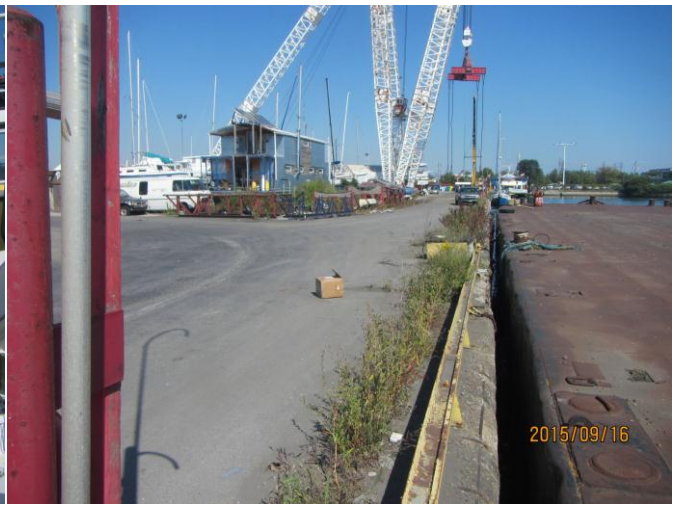


Photo #20: Sta. 0+850

Photo #21: Sta. 0+900

Photo #22: Sta. 0+950

Photo #23: Sta. 1+000

Photo #24: Sta. 1+050

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+060 (Structure change)

Photo #4: Sta. 0+100

Photo #5: Sta. 0+150

Photo #6: Sta. 0+200

Photo #7: Sta. 0+250

Photo #8: Sta. 0+300

Photo #9: Sta. 0+350

Photo #10: Sta. 0+400

Photo #11: Sta. 0+455 (Corner)

Photo #12: Sta. 0+450

Photo #13: Sta. 0+500

Photo #14: Sta. 0+600

Photo #15: Sta. 0+650

Photo #16: Sta. 0+682 (Corner)

Photo #17: Sta. 0+682 (Corner)

Photo #18: Sta. 0+700

Photo #19: Sta. 0+750

Photo #20: Sta. 0+770

Photo #21: Sta. 0+800

Photo #22: Sta. 0+850

Photo #23: Sta. 0+890

Photo #24: Sta. 0+900

Photo #25: Sta. 0+950

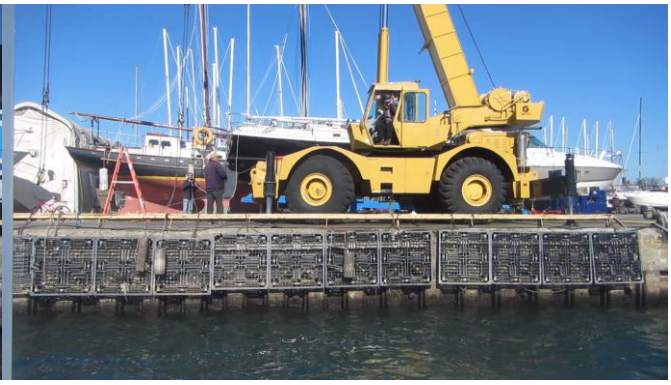


Photo #26: Sta. 1+000

Photo #27: Sta. 1+050

Photo #28: Sta. 1+067 (Corner)

Photo #29: Sta. 1+100 (Structure change)

Photo #30: Sta. 1+130 (Corner)

Appendix G
Polson Quay Photos

Photo #1: Sta. 0+000

Photo #2: Sta. 0+050

Photo #3: Sta. 0+100

Photo #4: Sta. 0+150

Photo #5: Sta. 0+200

Photo #6: Sta. 0+240

Photo #7: Sta. 0+260

Photo #8: Sta. 0+400

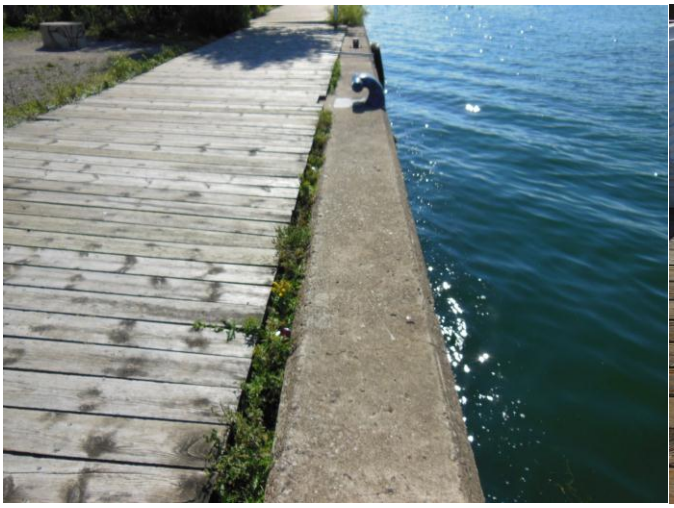


Photo #9: Sta. 0+450

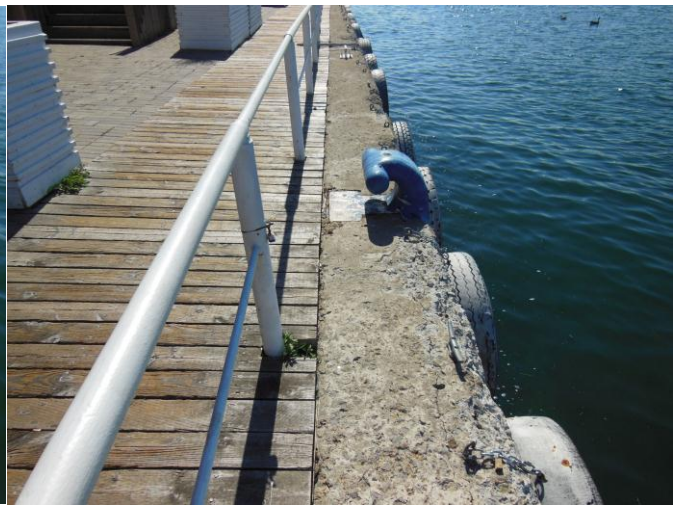


Photo #10: Sta. 0+500

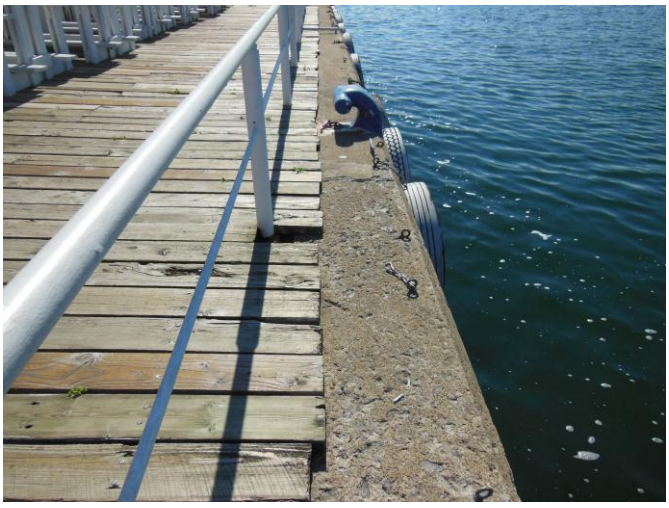


Photo #11: Sta. 0+550

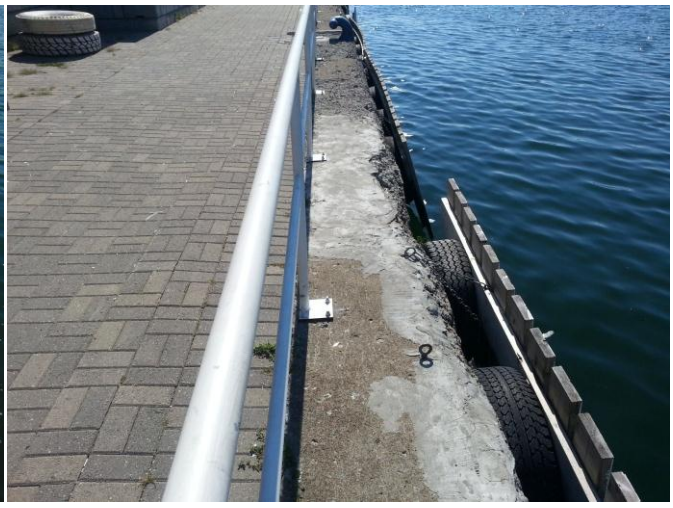


Photo #12: Sta. 0+600

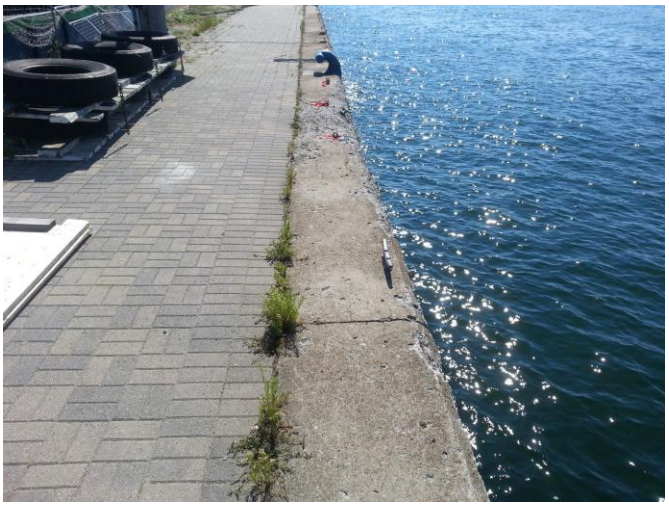


Photo #13: Sta. 0+650

Photo #14: Sta. 0+700

Photo #1: Sta. 0+000

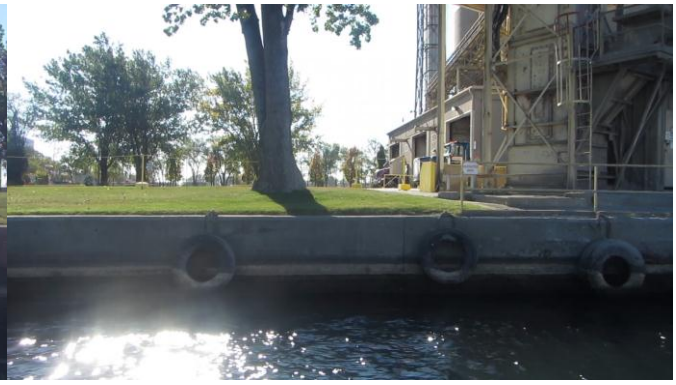


Photo #2: Sta. 0+050

Photo #3: Sta. 0+100

Photo #4: Sta. 0+150

Photo #5: Sta. 0+200

Photo #6: Sta. 0+250

Photo #7: Sta. 0+270 (Structure change)

Photo #8: Sta. 0+300

Photo #9: Sta. 0+350

Photo #10: Sta. 0+374.1 (Corner)

Photo #11: Sta. 0+400

Photo #12: Sta. 0+450

Photo #13: Sta. 0+500 (Structure change)

Photo #14: Sta. 0+550

Photo #15: Sta. 0+578 (Structure change)

Photo #16: Sta. 0+600

Photo #17: Sta. 0+650

Photo #18: Sta. 0+700

Photo #19: Sta. 0+711.4 (Corner)

Photo #20: Sta. 0+750

Photo #21: Sta. 0+800

Photo #22: Sta. 0+850

Photo #23: Sta. 0+900

Photo #24: Sta. 0+915 (Structure change)

Photo #25: Sta. 0+950

Photo #26: Sta. 1+000

Photo #27: Sta. 1+050

Photo #28: Sta. 1+100

Photo #29: Sta. 1+150

Photo #30: Sta. 1+171

Appendix H
Ship Channel Photos

Photo #1: Sta. 0-150

Photo #2: Sta. 0-100

Photo #3: Sta. 0-050

Photo #4: Sta. 0+000

Photo #5: Sta. 0+050

Photo #6: Sta. 0+100

Photo #7: Sta. 0+150

Photo #8: Sta. 0+200

Photo #9: Sta. 0+250

Photo #10: Sta. 0+300

Photo #11: Sta. 0+350

Photo #12: Sta. 0+400

Photo #13: Sta. 0+450

Photo #14: Sta. 0+500

Photo #15: Sta. 0+550

Photo #16: Sta. 0+600

Photo #17: Sta. 0+650

Photo #18: Sta. 0+700

Photo #1: Sta. 0-250

Photo #2: Sta. 0-200

Photo #3: Sta. 0-150

Photo #4: Sta. 0-100

Photo #5: Sta. 0-050

Photo #6: Sta. 0+000

Photo #7: Sta. 0+050

Photo #8: Sta. 0+100

Photo #9: Sta. 0+150

Photo #10: Sta. 0+200

Photo #11: Sta. 0+250

Photo #12: Sta. 0+300

Photo #13: Sta. 0+350

Photo #14: Sta. 0+400

Photo #15: Sta. 0+450

Photo #16: Sta. 0+500

Photo #17: Sta. 0+570

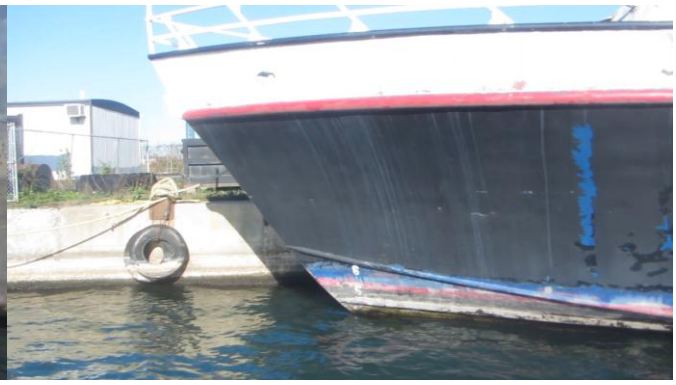


Photo #18: Sta. 0+600

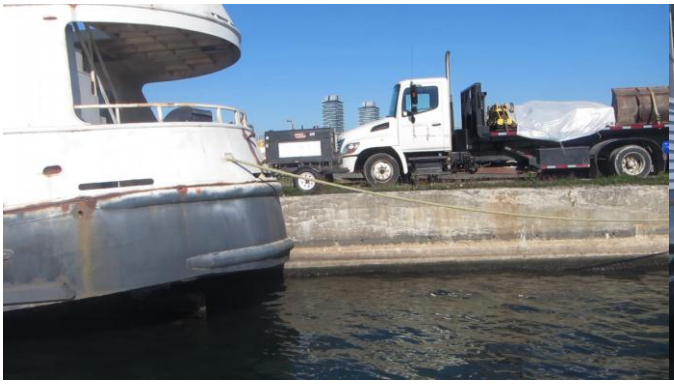


Photo #19: Sta. 0+640

Photo #20: Sta. 0+680

Photo #21: Sta. 0+700

Photo #22: Sta. 0+706.8 (Corner)