TETRA TECH

October 4, 2019

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Engineering Services
Integrated Infrastructure Services
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Attention: Dr. Paul R. Lach, Ph.D., P.Eng.

Subject: Preliminary Geotechnical Assessment Report
North Shore Promenade
River Bank between Walterdale Bridge and Groat Road Bridge, Edmonton, Alberta

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the City of Edmonton (COE) to provide geotechnical engineering services for the Touch The Water Promenade (TTWP) and North Shore Promenade (NSP) projects. The Request for Proposal (RFP) for the geotechnical services of TTWP and NSP was received from the COE on August 30, 2018. The detailed scope of services was described in a proposal issued on September 19, 2018 (Reference No. PENG.EGEO03422-01) in response to the RFP from COE. Authorization to proceed with this work was provided on October 31, 2018 by Dr. Paul Lach, P.Eng. of COE under Reference Code C#4000003242 Line # 1 and 2.

As part of the work scope of the initial stage, Tetra Tech conducted a preliminary geotechnical assessment for the project areas. The work included a review of existing available borehole data, published geological information, historical aerial photographs, and records of existing structures relevant to the geotechnical aspects of the site, site reconnaissance and the preparation of this preliminary geotechnical assessment report. The objective of the preliminary geotechnical report is to summarize the collected relevant information, interpret the geological setting, and identify the geotechnical constraints and hazards.

This report presents the findings of Tetra Tech's preliminary geotechnical assessment for the NSP area and is subject to the limitations on the use of this report attached in Appendix A. The preliminary geotechnical assessment report for the TTWP is provided separately.

Figure 1 shows the study area and the proposed locations of the TTWP and NSP Projects at the time of the proposal. Based on direction from the COE, two retaining walls located north of River Valley Road between the High Level Bridge and the Legislature Power Plant should be added to the NSP Project. The additional area where these two retaining walls are located is shown on Figure 1.

2.0 PROJECT BACKGROUND

The NSP Project aims to create an iconic public space along the north shore of the river bank of the North Saskatchewan River, between the Walterdale Bridge and about 250 m west of Groat Road Bridge in Edmonton, Alberta. Based on information provided by the COE, the NSP project limits consist of a narrow strip of land between the top of the river bank where an existing paved walking trail is located and the toe of the river bank at the river level. The total length of the NSP area is approximately 2.9 km.

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The west end of the area is at the west side of the existing Groat Road Bridge which is undergoing rehabilitation works. The east end of the project area is connected to the newly constructed trail at the north abutment of the Walterdale Bridge. The area north of the existing trail is bounded by the existing River Valley Road. The project area is bounded by the North Saskatchewan River along the south side. The exposed shoreline area will change at different times of the year based on the variable water level and flow in the river.

Preliminary information available from the COE shows that the promenade may include terraces, walkways and viewing decks within the proposed site area.

A meeting was held with the COE, the design team and Tetra Tech on July 29, 2019 to discuss the preliminary geotechnical issues and concerns of the TTWP and NSP projects. Based on these discussions, it is understood the design team and the COE are still at the early stage of the design development. The locations of the proposed walkways and viewing decks are yet to be determined and will go through public consultations in early 2020. Tetra Tech was requested to proceed with the preliminary geotechnical assessment report without specific details of the proposed developments.

3.0 DESKTOP STUDY

Tetra Tech has conducted a detailed desktop review of the existing available borehole data, current and historical aerial photographs, LIDAR survey and published geological maps. The following sections summarize the findings from the desktop study for the NSP area.

3.1 Geological Review

Tetra Tech conducted a search of published geological maps for the site area. A publication titled Urban Geology of Edmonton prepared by C.P. Kathol and R.A McPherson, under Bulletin 32 of the Alberta Research Council, dated 1975, provided a variety of surficial and bedrock information.

Based on Surficial Geological Map of Edmonton (Figure 23 of Bulletin 32), the surficial geology near the west end of the project area, around the Groat Road Bridge, and near the east end of the project area, west of Walterdale Bridge, is described as gully, creek valley and scarp materials, which consist of thin colluvium, thin alluvium, and mixed glacial and bedrock materials. The central portion of the project area is mainly river terrace deposits comprising alluvial gravel, sand and silt from the North Saskatchewan River. The Geological Section No.15 on Figure 26 of Bulletin 32 crosses the project area and the stratigraphy indicates approximately 6 m of alluvium originating from river terrace and flood plain deposits consisting of clay, silt and gravel, underlain by bedrock.

According to the Bedrock Topography Map on Figure 20 of Bulletin 32, the top of the bedrock near the project area is at an approximate elevation of 616 m. The bedrock is part of the Edmonton Formation which consists of interbedded bentonitic shales and sandstones with numerous coal seams.

3.2 Aerial Photo Review

Aerial photographs of varying scales were obtained from the COE library spanning a period from 1978 to 2009 at an approximate interval of 10 years. The last aerial photograph is at a scale of 1:20,000 and was taken in 2014.

The aerial photographs are presented on Figures 3 to 7, appended to this report.

The primary purpose of reviewing the aerial photographs was to determine locations of any discernible river bank instabilities, caused by either construction or erosion of the shoreline.

The following key points have been identified from the review:

- For the portion of the North Saskatchewan River where the proposed NSP project is located, the flow in the river is generally from west to east. The shoreline near the Groat Road bridge is located on the outside bend of the river and more susceptible to river erosion impacts. The shoreline from Victoria Golf course to Royal Glenora Club is a moderate inside bend and deposition of river deposits has occurred along the toe of the bank slope leading to shallow deposits and formation of a sand bar that are apparent on aerial photographs. From Royal Glenora Club to the Walterdale Bridge, the river bank is on a gradual outside bend and deposition along the shoreline for this portion is apparently less;
- The aerial photographs showed changes between 1978 and 1982 for the Government House Park area west of the Groat Road Bridge and the Groat Road Bridge North Abutment, and through to 1997. This area was also the east end of the MacKinnon Ravine Freeway development project which began in late 1960's with tree clearing within the MacKinnon Ravine. Fill was end dumped off the river bank as part of the earthworks for the freeway. However, the MacKinnon Freeway development project was terminated in early 1970's. The freeway was never built, and the area has become a multi-use trail and park area;
- The multi-use trail along River Valley Road east of Groat Road Bridge extended to the entrance of Victoria Park Golf Course by 1978, and was linked to the MacKinnon Ravine trail commencing from Government House Park as mentioned above between 1982 and 1997;
- The outfall locations as presented on Figure 2 are not readily visible from the aerial photographs except for what appears to be evidence of significant discharge near Outfall #175 and #176 in 1978;
- Erosion mitigation using rip rap protection is evident in the 2014 aerial photograph near Outfall #33;
- Localized bank erosion downstream from outfall locations can be expected during significant discharge events;
- Works for the construction of the new Walterdale Bridge began in 2013 and are evident in the 2014 photograph, and;
- There are currently ongoing construction changes as part of the Groat Road Bridge Rehabilitation Project. Observations made during site reconnaissance are presented in Section 5.0 of this report.

3.3 Existing Report Review

Tetra Tech reviewed 35 reports obtained from the COE Engineering Services Library, adjacent to the NSP subject site. Many of these reports either did not contain boreholes, had illegible site plans and/or no coordinate or borehole location information, and many were significantly north of the Top of Bank (TOB). Seven reports provided both site plans and relevant geotechnical boreholes close to the TOB and for the additional area east of the High Level Bridge.

The above noted seven reports are listed on Table 1, appended to this report, and excerpts from these reports have also been presented in Appendix B. The project locations and associated boreholes are shown on Figure 8. Several other reports utilize this information, and a full list of the 35 reports is shown in Table 2, appended to this report.

In general, the subsurface conditions from TOB consist of fills underlain by fluvial deposits, overlying bedrock of the Edmonton Formation. The thickness of the fills and fluvial deposits typically range between 1 m and 7 m, and the bedrock is expected to be encountered below these surficial deposits at an approximate elevation of 616 m (with variance of a couple metres based on the boreholes closest to the TOB). Top of bedrock generally increases in elevation based on boreholes north of River Valley Road and east of the High Level Bridge. The subsurface conditions described in the previous applicable seven reports are summarized below. All depths are in metres below existing ground surface on the terrace lands unless stated otherwise.

3.3.1 Project Number 931-36-16-01 322 (Borehole T85-N4, N5, N7 and R1)

This geotechnical report was completed in 1985 for the South Light Rail Transit (SLRT) Extension Phase II project. The following borehole information near the river bank was extracted and would be relevant at corresponding locations near the existing SLRT Bridge.

Borehole T85-N4 was drilled at the TOB and indicated a clay fill layer extending to 1.8 m overlied sand and silt to approximately 11.6 m (elevation 613.1 m), underlain by very weak bedrock to the termination depth of 24 m. The bedrock comprised claystone interbedded with sandstone, siltstone and bentonitic layers. A 200 mm thick bentonite layer was encountered at approximately 605.9 m.

Groundwater was recorded at 12.6 m within the bedrock and is approximated to be at an elevation of 612.1 m.

Borehole T85-R1 was drilled near river level and indicated bedrock at an elevation of 612 m underlying a 2 m thick gravel layer.

Based on the request to include the retaining walls north of the River Valley Road east of the High Level Bridge, T85-N5 and T85-N7 had also been included in Appendix B and Figure 8.

Borehole T85-N5 was located close mid-height of the slope between River Valley Road and Fortway Drive. The borehole log indicated fill to approximately 3 m below grade (elevation of 620.2 m), underlain by clay, silt, and clay till to an approximate elevation of 617.5 m where it encountered claystone bedrock. The borehole was terminated at 10.4 m below grade.

Borehole T85-N7 was located close to Fortway Drive and indicated clay fill from ground surface to 7 m below grade. The clay fill was underlain by claystone. The borehole was terminated at 21 m. Ground elevation was not provided for this borehole.

3.3.2 Project Number 931-36-16-18 1816 (Borehole 87-1 to 87-5)

This geotechnical investigation report was completed in 1987 for a portion of the River Valley Road between High Level Bridge and 105 Street. These boreholes were drilled east of the High Level Bridge, north of the River Valley Road, south of Fortway Drive, and on the east side and west side of the Legislature Power Plant. Surficial deposits comprising fill, clay, sand and gravel are encountered from surface to depths between 1.5 m and 5 m. Bedrock was encountered from an approximate elevation between 631 and 635 m. Groundwater level readings taken a month after drilling completion varied between elevations of 629 m and 623 m. Original ground varied between elevations 638 m and 634 m along the roadway alignment. No recovery zones were encountered in all boreholes at elevation between 626 m to 633 m. Slope inclinometers were installed in Boreholes 87-2, 87-4 and 87-5. The report also provided information for existing inclinometers and past instability at an area approximately 50 m east of the High Level Bridge and south of Fortway Drive (Inclinometer TILT115). Some of the existing monitoring readings indicated movements occurred at approximately 8.8 m below grade.

3.3.3 Project Number 931-36-16-24 6141 (Borehole 10-01)

This report was completed in 2011 for a slope Inclinometer installation on Fortway Drive east of the High Level Bridge. This borehole was drilled on Fortway Drive, situated immediately east of the High Level Bridge to replace an existing inclinometer (SI110) that was destroyed. Previous inclinometer readings indicated movement at approximately 5 m below existing grade. The ground elevation of Borehole 10-01 was 642.6 m, which was about 15 m above River Valley Road. Clay fill underlying asphalt extended to approximately 3.5 m (or elevation of 639 m). Bedrock from the Edmonton Formation underlies the fill, and extended to the termination depth of the borehole of 21.4 m (elevation 621.2 m).

3.3.4 Project Number 934-32-02-23 5585 (Borehole 09-11 to 09-13)

The geotechnical report was completed for the Government House Park in 2010 located west of Groat Road and Groat Road Bridge North Abutment. The boreholes located near the river bank encountered topsoil or asphalt at the surface, underlain by surficial fill (clay and/or gravel) that extended up to a depth of 2.1 m. The fill was underlain by native clay, silt and sand, overlying hard clay shale bedrock. The bedrock was encountered at depths of 6.7 m to 7.0 m (at an approximate elevation of 618.2 m to 619.7 m). Groundwater was noted at 617 m to 619.8 m near the top of the bedrock.

3.3.5 Project Number 934-32-02-57 8838 (Borehole 16-2)

This is a 2017 report for the Groat Road Bridge Rehabilitation Project. Although it was an Environmental Impact Assessment, it was appended with a geotechnical investigation report completed in 2016. Borehole 16-2 is located immediately east of the Groat Road Bridge North Abutment. Topsoil was encountered at surface, underlain by clay extended to an approximate elevation of 620.2 m, which overlied gravel to 615 m. Bedrock which underlied the gravel was described as very hard, and the groundwater level was measured at an elevation of 618 m, approximately one month after completion of drilling.

3.3.6 Project Number 931-36-16-02 367 (Borehole T88-N25 and T88-N26)

This is a monitoring report for the SLRT Phase II completed in 1992. Two additional inclinometers were found in this report east of the existing SLRT Bridge, north of River Valley Road and south of Fortway Drive which is close to the additional area requested by COE. In Borehole T88-N25, gravel fill was encountered at surface underlain by sand that extended to an approximate elevation of 614.9 m, where claystone bedrock was encountered. The borehole was terminated at 32 m below grade. An inclinometer was installed in this borehole. In Borehole T88-N26, clay fill was encountered at the ground surface and was underlain by sand to about 615.0 m. Sand was underlain by clay till to 614.4 m where siltstone bedrock was encountered. Borehole was terminated at 24.6 m below grade. Thin bentonite seam was encountered approximately at elevation of 612.6 m. A vibrating wire piezometer was installed in this borehole.

3.3.7 Project Number 19-598-370 (Borehole TH12-14)

This geotechnical investigation was completed in 2013 for the Walterdale Bridge Replacement Project. One borehole located west of the north abutment of the new Walterdale Bridge Project was found relevant to the NSP Project. Topsoil and clay fill was encountered from the surface to an approximate elevation of 625.4 m, overlying silt fill to elevation of 624. 6 m, overlying silt to 618.1 m, and gravel and sand with some clay to 616.3 m. Clay shale was encountered at 616.3 m, with occasional sandstone layers, to the termination depth of the borehole at 603.2 m. Groundwater was recorded at elevation 616 m, measured approximately one month after drilling completion.

3.4 Existing Timber Retaining Wall West of Legislature Power Plant

In addition to the reports described in Section 3.3, photo records of a timber retaining wall (or timber parapet wall) located west of the Legislature Power Plant provided by COE are also presented in Appendix B. Based on the photo records, the timber retaining wall height was highest in the middle and lower at the east and west ends. The wall height varied from 0.5 m to 1.4 m above the trail elevation. Since the top of the wall was higher than the soil retained behind, the maximum retained soil height was in the order of 0.3 m to 0.8 m. The depth of embedment and foundation type were unknown.

Based on observations made by COE in 2017, the wall appeared to be a timber retaining wall structure. The portion of the wall exposed above grade appeared to be in relatively good condition, other than a pronounced lean of the

wall to the south. No advanced rot or broken timbers were observed at the time of the site inspection. The eastern and western ends showed very little lean. The major lean was situated in the middle portion of the wall. There were signs of accumulated run off and snow retention behind the wall that might have contributed to the leaning. According to COE, existing geotechnical instrumentations located approximately 50 m west and 150 m east of the wall had showed signs of a deep-seated instability in the past, but had not exhibited further movement since approximately 1996 to 2000. Based on field review, the portion of the slope behind the wall might have exhibited a slow and shallow creep movement. In general, the wall condition appeared to be in a usable state but should be reviewed and confirmed by a structural engineer. Long-term maintenance and/or visual inspection were recommended.

4.0 SUBSURFACE DATA GAP

Figure 8 shows the locations of existing boreholes from the seven applicable previous reports discussed in Section 3.3.

Tetra Tech conducted a geotechnical investigation at the Royal Glenora Club in 2008. The locations of the three boreholes are also shown on Figure 8. Based on these boreholes, in general the bedrock was encountered at an elevation from 615 m, underlying clay and silt from surface. Groundwater level measurements were recorded at elevations ranging from 612 m to 617 m.

Tetra Tech double checked the reports available from COE Engineering Services Library and confirmed that there was no additional monitoring stations found between Groat Road Bridge and LRT Bridge along the TOB in the existing reports or observed on site.

The most significant investigative data gap identified was the lack of geotechnical information along the TOB between Groat Road Bridge and the LRT Bridge, and along the shoreline for the entire NSP project extent. There is no current access route to allow drilling equipment to reach or work on the shoreline. However, the locations of the geotechnical investigations and the required access will depend on the types and locations of the promenade structures proposed by the project team. If drilling close to the shoreline is required, cut lines or benches may be formed to allow cleared paths or work areas to locations closer to the river. The locations of these cut lines and benches may coincide with the future accesses to the proposed promenade structures to minimize disturbance to the existing river bank slope and existing trees.

If drilling along the river's edge is considered critical, another option would involve drilling in the winter and include constructing an ice bridge at Emily Murphy Park near the south abutment of the Groat Road bridge. This would allow the drill to traverse the river and then travel along the river's edge supported by grounded shore ice.

Access to and drilling at the edge of the river would be difficult and very costly. The most cost effective approach at this stage would be to drill boreholes near the TOB. This will involve some cutting of trees, however, it is likely that the stratigraphy at the TOB and river edge will not vary greatly.

5.0 SITE RECONNAISSANCE

Tetra Tech conducted a site reconnaissance of the TTWP project area on November 14, 2018. During the site visit, the weather conditions were partly cloudy and -1 °C in the morning and 1 °C in the afternoon. Most of the ground surface was clear, although some of the ground surface was lightly covered by snow. The following summarized the key observations made during the site reconnaissance:

- There are outfalls at various locations along the project area. According to a drawing provided by COE, there should be 15 outfalls along the riverbank between Groat Road Bridge and Walterdale Bridge. During the site visit, some of the outlet pipes of the outfalls were visible but some were not. The position outlet points of the

outfalls varied and some of them were at mid-height of the river bank slope as shown on Photo 1. Gullies and eroded channels were formed below the outlet pipes on the river bank slope surface (Photo 2). The exception is Outfall No. 33 which is located about 280 m west of the High Level Bridge. The area downstream of the pipe at Outfall No. 33 was protected by riprap (Photo 3);

- The first northern pier of Groat Road Bridge was located at the slope toe of the river bank slope (Photo 4). The bridge structure spanned over the multiuse trail and River Valley Road, and was supported on the north abutment of the Groat Road Bridge. At the time of the site visit, construction work for a rehabilitation project of Groat Road Bridge and River Valley Road was in progress;

- On the east side of the Groat Road Bridge, the existing multi-use trail was supported on a gabion wall. The gabion wall was located near the top of the river bank slope and was covered in heavy vegetation (Photo 5). The length and dimensions of the gabion wall were uncertain, and the wall was estimated to be approximately 1.5 m high and 100 m in length;

- There were four existing viewing areas along the multi-use trail at the top of the river bank slope at approximately 190 m, 240 m, 280 m and 320 m east of the Groat Road Bridge. These viewing areas were generally level graded surfaces at the approximate elevation of the multi-use trail (Photos 6 and 7). The river bank slope supporting or immediately next to the viewing areas was relatively steep locally and was estimated to be around 1 Horizontal to 1 Vertical (i.e. 1H:1V) as shown on Photo 8.

- In general, the river bank slope angle between Groat Road Bridge to Walterdale Bridge varied between approximately 2H:1V and 3H:1V;

- At various locations along the river bank slope from about 100 m east of Groat Road Bridge North Abutment to approximately the access road of Victoria Golf Course, large blocks of broken concrete were observed at mid-slope (Photos 9 and 10). Large blocks of concrete were observed close to river level from east of High Level Bridge to about 105 Street and were likely used as erosion protection (Photos 11, 12 and 13). Other portions of the river bank slope that were heavily vegetated and not accessible at the time during site reconnaissance may also have large blocks of broken concrete on the slope surface;

- Towards the east side of the project limits and about 720 m west of the Walterdale Bridge, there is a Light Rail Transit (LRT) bridge across the North Saskatchewan River. The LRT bridge pier was located on the river bank slope. Adjacent to this LRT bridge pier was a spiral ramp leading to the footbridge underneath the LRT bridge. The spiral ramp structure was supported on multiple piers (Photos 14 and 15);

- About 70 m east of the LRT Bridge is the High Level Bridge. The bridge pier of the High Level Bridge was located near the top of the river bank slope (Photo 16). A concrete retaining wall is located at the toe of the slope between River Valley Road and Fortway Drive as shown on Photo 16 immediately east of High Level Bridge. The maximum wall height of this retaining wall is about 4 m. The west end of the retaining wall is below the High Level Bridge and the east end of the retaining wall is about 100 m east of the High Level Bridge. The existing report mentioned in Section 3.3.2 (Project no. 931-36-16-18 1816) recommended a pile wall with tie-back anchors near this location;

- At the east end of the project area, the existing paved trail connects to the newly constructed retaining wall and trail of the Walterdale Bridge (Photo 17). The retaining wall was approximately 2 m in height. The headslope of the Walterdale Bridge North Abutment was protected with rip rap armouring (Photo 18), and;

- Evidence of a major slope failure was not observed during the site visit. Minor cracks were observed on the paved trails occasionally that may be associated with creep slope movement. Active erosion was observed along the river bank slopes at several locations with exposed tree roots as shown in Photo 19.

6.0 GEOHAZARDS AND CONCERNS

Based on the information collected in this preliminary geotechnical assessment report, the following potential geohazards and concerns have been identified at the NSP project area. These geohazards and concerns may not

become a significantly adverse issue for the project depending on the final locations and extents of the proposed developments.

- At the west end of the project area, any new development must take into account or be integrated with the existing pier of the Groat Road Bridge. The proposed foundations of the promenade should not affect or be affected by the existing foundation, based on a geotechnical evaluation
- At the Groat Road Bridge, the updated records of the ongoing road and bridge rehabilitation works should be reviewed and evaluated as existing structures may have been altered due to the rehabilitation works.
- If the existing gabion wall east of Groat Road Bridge is to remain after the rehabilitation works, and it is part of the promenade development, then a geotechnical evaluation should be conducted to investigate the area and to check for stability. Potentially, upgrading work or stabilization work might be required as part of the NSP development.
- The steep slopes below the existing viewing areas should be investigated and checked for stability and stabilization requirements.
- If fill construction is proposed along the toe of the riverbank, some form of stabilization such as geogrid reinforcement supplemented by erosion protection measures, such as rip rap armouring, will be required to provide stability and erosion protection.
- The proposed foundation of the promenade must not affect or be affected by the existing piers and associated headslope area of the LRT Bridge, ramp structure of the existing pedestrian footbridge, and the High Level Bridge, based on a geotechnical evaluation.
- If the proposed development requires new structures to be constructed along the river bank slope crest or slope toe, additional geotechnical investigation should be conducted to obtain geotechnical design parameters. Currently, there is no access to the river bank slope toe for drilling rigs and there is no work area along the river bank slope toe. Depending on the type and location of the proposed promenade structures, drilling from the top of the bank to obtain geotechnical information for deep foundation design may potentially be an alternative to forming cut lines on the existing river bank slope.
- Significant quantities of concrete blocks or fragments placed as part of historical bank erosion protection measures may obstruct future geotechnical investigations and any proposed development. The presence of these existing large pieces of concrete, including buried pieces, should be addressed in the construction contract. It will be important to recognize that this concrete debris is likely providing significant erosion protection for the existing riverbank and therefore would be of benefit to leave in place.
- If the bottom of the river bank along the project area is to be investigated, multiple access locations using cut lines or benches may be necessary to provide drill rig access to the slope toe or mid-slope areas. If these access locations can be planned such that they are at the same locations of the future public access routes to the new development at river level, it would reduce the amount of tree clearing and disturbance to the river bank. All of these investigative requirements are an important consideration for future geotechnical work and must be evaluated based on information to be provided concerning the proposed development.
- Eroded slope surfaces and unstable slopes along the river bank should be reviewed to determine whether slope stabilization works are required to improve public safety if the new development is to provide public access to the slope toe area at the river level.
- Many portions of the lower slopes are eroded with very steep or almost vertical slopes. Construction of a trail near the river level will result in excavation of the river bank that will likely require some type of stabilization measures (such as soil nails or anchors) above the proposed trail.
- Unstable trees, impacted by river erosion, may require removal as part of the permanent design if they are close to the proposed promenade due to public safety.

- Where existing outfall structures discharge on the middle or upper portion of the river bank, these outlets may need to be extended down to river level. For outfalls that exit close to river level, it would be advisable to raise the elevation of the promenade to be founded above the outfalls. Additional erosion protection and stabilization measures may be required where development is planned near the outfall locations.
- The new NSP development design must not adversely affect the stability of the newly constructed headslope, retaining wall and abutment foundations of the Walterdale Bridge, based on a geotechnical evaluation.
- The slope area east of the High Level Bridge, west of the Legislature Power Plant, north of the River Valley Road currently and south of Fortway Drive has two existing retaining walls where slope movement has occured in the past. The cause of the movement may be due to deep-seated failure along existing weak bentonite seams. If the NSP Project includes proposed structures on this slope surface, the design must incorporate and mitigate the short-term and long-term stability of the slope. Methods to integrate, modify or reconstruct the existing retaining walls may be needed.
- Existing fill was encountered in many of the existing boreholes. The extent and depths of the existing fill should be investigated based on the proposed promenade locations.

7.0 SUMMARY

Based on the review data and findings presented in this preliminary geotechnical assessment report, the proposed promenade development is considered geotechnically feasible provided that the geotechnical constraints and concerns presented in this report are appropriately addressed. These geotechnical constraints and concerns include bank slope stability, existing and proposed foundations and structures, long-term erosion, and presence of existing fill. Other factors that require further geotechnical investigation include deep seated instability and other unexpected obstructions. The detailed geotechnical investigations and evaluations should be based on the locations of the proposed promenade structures. At the time of this report, the proposed designs are still under development. Once the proposed design has been determined, a review of the locations and the types of geotechnical foundations required to support the proposed designs should be conducted and a geotechnical evaluation should be planned and implemented accordingly.

It is understood hydrogeology, archeology and environmental engineering support will be provided by the design team. It is expected that other hazards such as flood mitigation, presence of historic artifacts, former coal mines, past land use impacts and other environmental issues such as contaminations will be addressed by the design team.

8.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of The City of Edmonton and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than The City of Edmonton, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

9.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Tetra Tech Canada Inc.

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TABLES

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Table 1 – Existing Reports as presented on Figure 8

City of Edmonton Accession Number or Report Number	Author	Title	Date
931-36-16-01 322	Thurber Consultants Ltd.	South Light Rail Transit Extension Phase II, North River Bank to University Station, Subsurface Conditions from Station 301+070 to 302+560, Geotechnical Report No. 1, Volume 1 & Volume 2	August 1985
931-36-16-02 367	Thurber Consultants Ltd.	South Light Rail Transit Extension - Phase II, North Valley Slope and Portal Area, Slope Stability and Monitoring Summary	August 1985
931-36-16-18 1816	Thurber Consultants Ltd.	River Valley Road Upgrading, Geotechnical Investigation	May 1997
934-32-02-23 5585	City of Edmonton, Engineering Services	Proposed Groat Surface Wetland Geotechnical Investigation Government House Park Southwest of Groat Road at Victoria Park Road	February 2010
931-36-16-24 6141	City of Edmonton, Engineering Services	Slope Inclinometer Installation - Fortway Drive near 109 Street, East of the High Level Bridge	February 2011
934-32-02-57 8838	Spencer Environmental Management Services Ltd	Groat Road Bridges Rehabilitation Project, Roadworks at Groat Road Interchange, Environmental Impact Assessment- Draft Report	March 2017
Thurber Report #: 19-598-370	Thurber Consultants Ltd.	Walterdale Bridge Replacement Edmonton, Alberta, Geotechnical Investigation	January 2013

Table 2 – List of Reviewed Reports

City of Edmonton Accession Number or Report Number	Author	Title	Date
931-32-21-11 8503	EPCOR	EPCOR Distribution & Transmission Inc., River Valley Splice Repair	December 2014
931-36-16-01 322 Volume 1 & 2 *	Thurber Consultants Ltd.	South Light Rail Transit Extension Phase II, North River Bank to University Station, Subsurface Conditions from Station 301+070 to 302+560, Geotechnical Report No. 1, Volume 1 & Volume 2	August 1985
931-36-16-02 367 *	Thurber Consultants Ltd.	South Light Rail Transit Extension - Phase II, North Valley Slope and Portal Area, Slope Stability and Monitoring Summary	April 1992
931-36-16-03 2385	Kipen Gibbs Landscape Architects Ltd.	High Level Bridge Rehabilitation, Environmental Screening Report	September 1994
931-36-16-05 636	Thurber Consultants Ltd.	South Light Rail Transit - Phase II Geotechnical Evaluation - North Portal, Geotechnical Report No. 8	April 1997
931-36-16-06 617	Thurber Consultants Ltd.	SLRT Extension - Phase II, North River Bank to University Station, North Valley Slope Stability Analysis Geotechnical Report No. 4	January 1996
931-36-16-07 616	Thurber Consultants Ltd.	South Light Rail Transit Extension - Phase II North Valley Slope and Portal Area - Supplementary Geotechnical Evaluation	March 1989
931-36-16-08 1338	City of Edmonton, Materials & Testing	Slope Indicator / Standpipe Installation Fortway Drive December 1978, July 1979, September 1980, April 1983, November 1985	December 1993
931-36-16-09 1406	City of Edmonton, Materials & Testing	Subsoil Investigation of the River Road East of the High Level Bridge	October 1965
931-36-16-11 1583	R.M. Hardy & Associates Ltd.	Soils Report RE: Proposed Hill-Side Road, 97 Avenue and 110 Street to Riverside Road	May 1959

City of Edmonton Accession Number or Report Number	Author	Title	Date
931-36-16-16 1802	City of Edmonton, Materials & Testing	Government Centre Generating Plant Seepage in Slope South	December 1974
931-36-16-17 1804	Thurber Consultants Ltd.	River Valley Road	July 1987
931-36-16-18 1816 *	Thurber Consultants Ltd.	River Valley Road Upgrading, Geotechnical Investigation	May 1987
931-36-16-19 1884	Thurber Consultants Ltd.	Fortway Drive Relocation, Stability Evaluation and Recommendations	August 1986
931-36-16-22 321	Hardy BBT Ltd.	Repairs to existing instability, 109 Street North of Walterdale Hill Road - Volume 1	December 1987
931-36-16-24 6141 *	City of Edmonton, Engineering Services	Slope Inclinometer Installation - Fortway Drive near 109 Street, East of the High Level Bridge	February 2011
931-36-16-33 6435	Stantec Consulting Ltd.	Outfall 33 Revitalization and Repair, Environmental Screening Report, Edmonton, Alberta	August 2011
931-36-16-34 6458	Stantec Consulting Ltd.	Outfall 33 Revitalization and Repair, Environmental Screening Report, Edmonton, Alberta	August 2011
931-36-16-37 6505	Stantec Consulting Ltd.	Outfall 33 Revitalization and Repair, Environmental Screening Report, Edmonton, Alberta (Revised)	September 2011
931-36-25-03 118	Hardy Associates (1978) Ltd.	Stage II Interim Geotechnical Report South LRT Extension Corona Station to the North Bank of the North Saskatchewan River	October 1985
931-36-25-09 5084	EBA Engineering Consultants Ltd.	Phase I Environmental Site Assessment, 11160 River Valley Road, Blocks B and C, Plan 445MC, Edmonton, Alberta	September 2008

City of Edmonton Accession Number or Report Number	Author	Title	Date
931-36-25-10 1613	Hardy Associates (1978) Ltd.	Interim Engineering Report for Large Diameter Hole (LDH-I) Investigation, 110 Street, South of 97 Avenue	March 1986
931-36-25-11 5085	EBA Engineering Consultants Ltd.	Royal Glenora Club - Redevelopment Plan 2008, Environmental Screening Report	October 2008
931-36-25-14 1764	Thurber Consultants Ltd.	SLRT Phase II, North Portal Instrumentation	January 1991
931-36-25-15 1761	Thurber Consultants Ltd.	South Light Rail Transit Extension Phase II North Tunnel Instrumentation and Monitoring, Grandin Station to Crossover Cavity, Instrumentation Report No. 2	July 1988
931-36-25-20 1785	Thurber Consultants Ltd.	South Light Rail Transit (SLRT) - Phase II, North Portal Substation, Temporary/Permanent Retaining Wall (14-31-54)	August 1988
931-36-25-23 1837	R.M. Hardy & Associates Ltd.	Soils Report, Proposed Hillside Road, 97 Avenue and 110 Street to Riverside Road	April 1959
934-32-02-14 1704	EBA Engineering Consultants Ltd.	Proposed Space Sciences Centre Government Hill Site, Edmonton, Alberta (Includes Addendum No. 1 of August 1981)	June 1981
934-32-02-23 5585 *	City of Edmonton, Engineering Services	Proposed Groat Surface Wetland Geotechnical Investigation Government House Park Southwest of Groat Road at Victoria Park Road	February 2010
934-32-02-42 7151	CT & Associates Engineering Inc.	Geotechnical Evaluation, Victoria Promenade, Shallow Slope Failure Rehabilitation, Viewpoint at 100 Avenue and 121 Street, Edmonton, Alberta	November 2012
934-32-02-56 8837	Spencer Environmental Management Services Ltd.	Site Location Study for Groat Road Bridges Rehabilitation Project: Roadworks at Groat Road Interchange Draft Report	March 2017

City of Edmonton Accession Number or Report Number	Author	Title	Date
934-32-02-57 8838 *	Spencer Environmental Management Services Ltd	Groat Road Bridges Rehabilitation Project, Roadworks at Groat Road Interchange, Environmental Impact Assessment- Draft Report	March 2017
934-32-02-59 8983	Spencer Environmental Management Services Ltd.	Groat Road Bridges Rehabilitation Project: Groat Road Bridge over North Saskatchewan River (B059), Groat Road Bridge over Victoria Park Road (B060) and Emily Murphy Park Road Bridge over Groat Road (B099) Environmental Impact Assessment- Draft Report	April 2017
934-32-02-61 9294	CT & Associates Engineering Inc.	DIGITAL COPY ONLY: Geotechnical Investigation, Victoria Golf Course Renewal, 12030 River Valley Road NW, Edmonton, Alberta	April 2018
Thurber File #: 19-598-370 *	Thurber Consultants Ltd.	Walterdale Bridge Replacement Edmonton, Alberta, Geotechnical Investigation	January 2013

Note: * One of the seven reports summarized in Section 3.3, Table 1, and Figure 8

FIGURES

NOTE:
1. THE ABOVE LAYOUT PLAN WAS EXTRACTED FROM CITY OF EDMONTON WEB SITE.
2. ADDITIONAL AREA TO BE INCLUDED FOR NORTH SHORE PROMENADE BASED ON EMAIL ON SEPTEMBER 11, 2019

CLIENT:

CITY OF EDMONTON

TETRA TECH

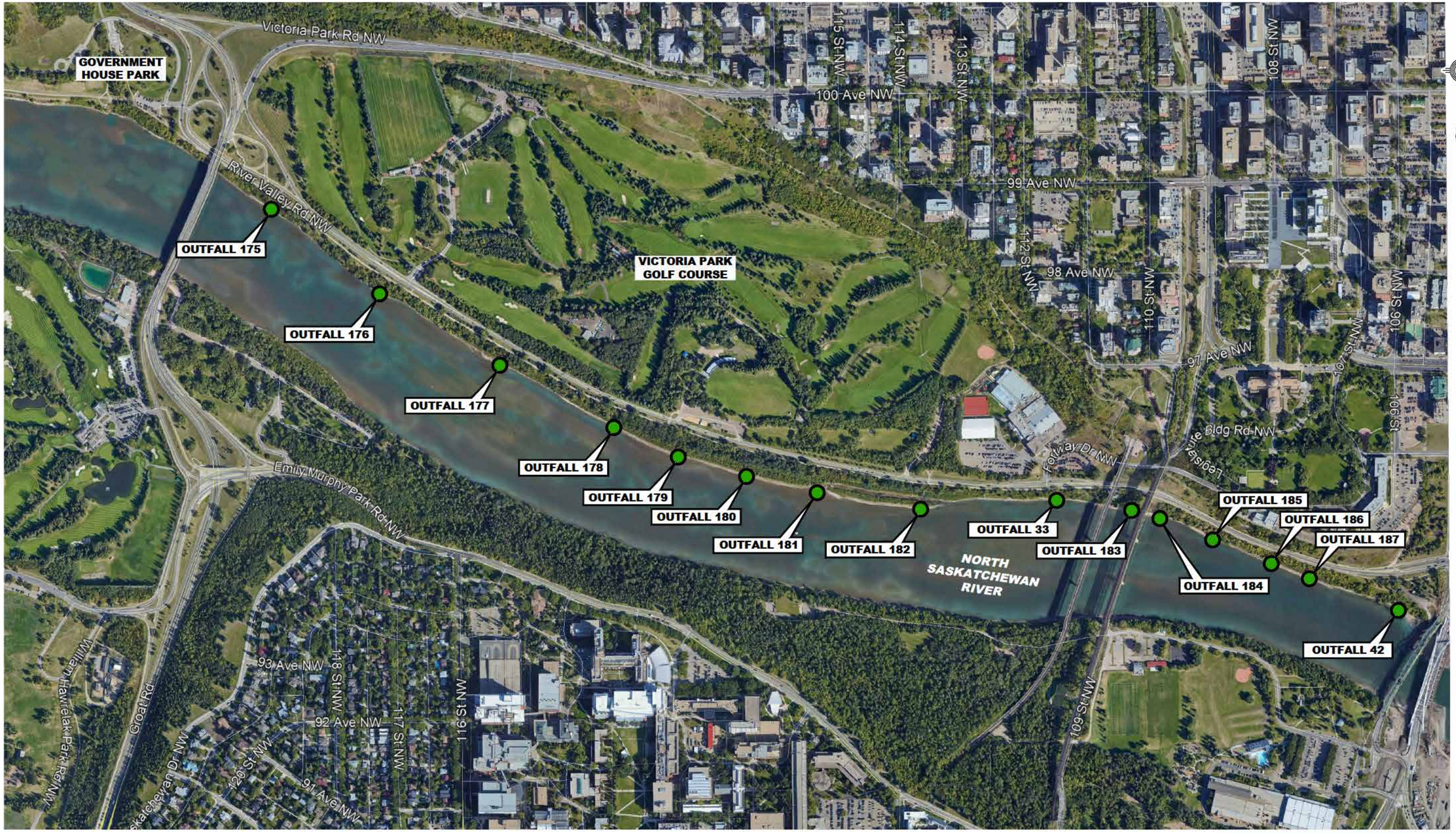
TOUCH THE WATER AND NORTH SHORE PROMENADE PROJECT, EDMONTON, AB

SITE LOCATION PLAN

PROJECT:	DGN:	RVW:	PMT:	REV:
ENG.EGEO03422-01	TT	TR	AO	1

OFFICE:	DATE:
EDMONTON	SEPTEMBER 2019

FIGURE 1



LEGEND:

- OUTFALL LOCATION

0 250 m

Scale: 1: 7 500
(Approximate)

NOTE:

BASE IMAGE IS TAKEN FROM GOOGLE EARTH
IMAGERY YEAR: AUGUST 2017

CLIENT: THE CITY OF Edmonton

NORTH SHORE PROMENADE EDMONTON, ALBERTA

OUTFALL LOCATIONS

TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENG.EGEO03422.01.012	DBD	KJ	0

OFFICE: EDM
DATE: August 2019

Figure 2

LEGEND

From City of Edmonton Library

NOTES

STATUS
FOR INTERNAL USE ONLY

CLIENT
THE CITY OF Edmonton

TETRA TECH

NORTH SHORE PROMENADE
EDMONTON, ALBERTA

AERIAL PHOTOGRAPH
1978

PROJECT NO.	DWN	CKD	APVD	REV
ENG EGEO03422-01		KJ		
OFFICE: EBA-EDM	DATE: August 15, 2019			

Figure 3

LEGEND

From City of Edmonton Library

NOTES

STATUS
FOR INTERNAL USE ONLY

CLIENT
THE CITY OF Edmonton

NORTH SHORE PROMENADE
EDMONTON, ALBERTA

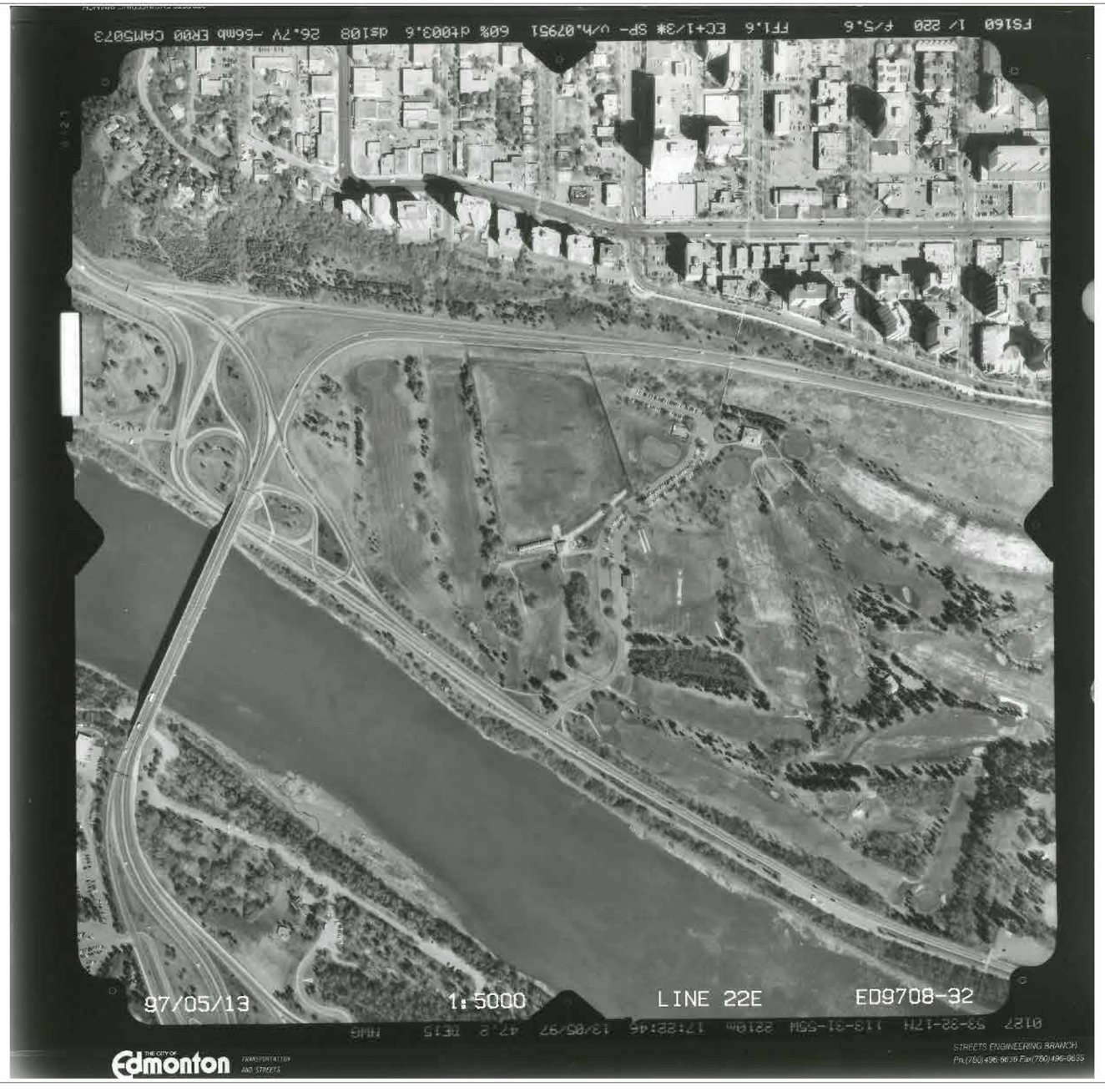
AERIAL PHOTOGRAPH
1982

TETRA TECH

PROJECT NO.	DWN	CKD	APVD	REV
ENG EGEO03422-01		KJ		

OFFICE	DATE
EBA-EDM	August 15, 2019

Figure 4



LEGEND

From City of Edmonton Library

NOTES
SCALE 1:5,000

STATUS
FOR INTERNAL USE ONLY

CLIENT
THE CITY OF Edmonton

NORTH SHORE PROMENADE
EDMONTON, ALBERTA

AERIAL PHOTOGRAPH
1997

TETRA TECH

PROJECT NO.	DWN	CKD	APVD	REV
ENG EGEO03422-01		KJ		
OFFICE: EBA-EDM	DATE: August 15, 2019			

Figure 5

LEGEND

From City of Edmonton Library

NOTES
SCALE 1 5,000

STATUS
FOR INTERNAL USE ONLY

CLIENT
THE CITY OF Edmonton

TETRA TECH

NORTH SHORE PROMENADE
EDMONTON, ALBERTA

AERIAL PHOTOGRAPH
2009

PROJECT NO.	DWN	CKD	APVD	REV
ENG EGEO03422-01		KJ		

OFFICE	DATE
EBA-EDM	August 15, 2019

Figure 6

LEGEND

From City of Edmonton Library

NOTES
SCALE 1 20,000

STATUS
FOR INTERNAL USE ONLY

CLIENT
THE CITY OF Edmonton

TETRA TECH

NORTH SHORE PROMENADE EDMONTON, ALBERTA

AERIAL PHOTOGRAPH 2014

PROJECT NO.	DWN	CKD	APVD	REV
ENG EGEO03422-01		KJ		
OFFICE: EBA-EDM	DATE: August 15, 2019			

Figure 7

LEGEND:

- BOREHOLE LOCATION (PROJECT 322)
- BOREHOLE LOCATION (PROJECT 367)
- BOREHOLE LOCATION (PROJECT 1816)
- BOREHOLE LOCATION (PROJECT 5585)
- BOREHOLE LOCATION (PROJECT 6141)
- BOREHOLE LOCATION (PROJECT 8838)
- BOREHOLE LOCATION (PROJECT 598-370)
- BOREHOLE LOCATION (EBA PROJECT - ROYAL GLENORA CLUB)

NOTE:

BASE IMAGE IS TAKEN FROM GOOGLE EARTH
IMAGERY YEAR: AUGUST 2017

0 250 m

Scale: 1: 7 500
(Approximate)

CLIENT: THE CITY OF Edmonton

NORTH SHORE PROMENADE
EDMONTON, ALBERTA

EXISTING BOREHOLE LOCATIONS FOR NSP

TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENG.EGEO03422.01.012	DBD	KJ	1

OFFICE	DATE
EDM	September 2019

Figure 8

Photo 1: Outfall 178 at Mid-height of River Bank Slope

Photo 2: Outfall 33 with Rip Rap Protection

Photo 3: Eroded Channel on River Bank Slope

Photo 4: Groat Road Bridge Pier at Slope Toe

Photo 5: Existing Buried Gabion Wall at Top of River Bank Slope

Photo 6: Existing Viewing Areas

Photo 7: Existing Viewing Areas

Photo 8: Steep Slope in Front of Viewing Areas

Photo 9: Large Concrete Blocks on River Bank Slope

Photo 10: Large Concrete Blocks on River Bank Slope

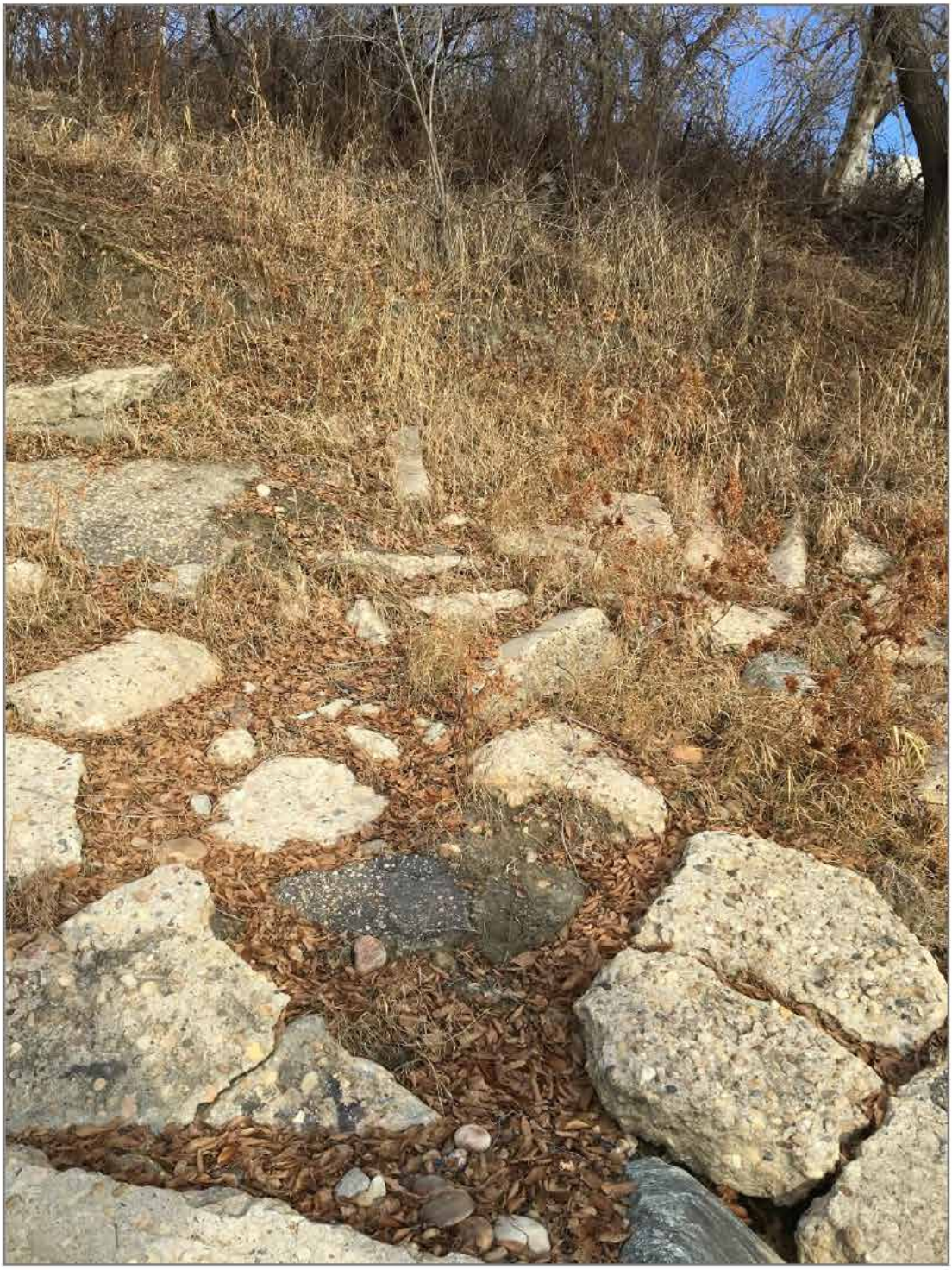


Photo 11: Large Concrete Blocks on River Bank Slope

Photo 12: Large Concrete Blocks close to River Level

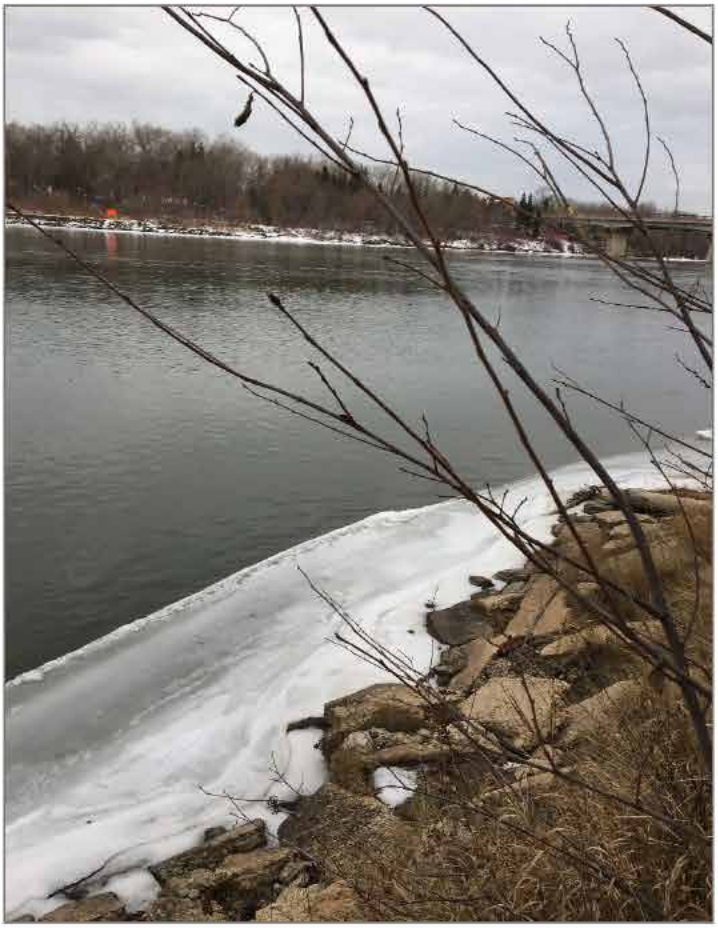


Photo 13: Large Concrete Blocks close to River Level

Photo 14: Piers of Existing Footbridge and LRT Bridge

Photo 15: Piers of Existing Footbridge and LRT Bridge

Photo 16: High Level Bridge Pier, Existing Concrete Retaining Wall and River Bank Slope

Photo 17: Existing Retaining Wall and Trail near Walterdale Bridge (Looking West)

Photo 18: Rip Rap at Walterdale Bridge Abutment

Photo 19: Eroded River Bank Slope and Exposed Tree Roots

APPENDIX A
TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no respons bility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

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The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B
EXTRACTED RELEVANT BOREHOLE INFORMATION

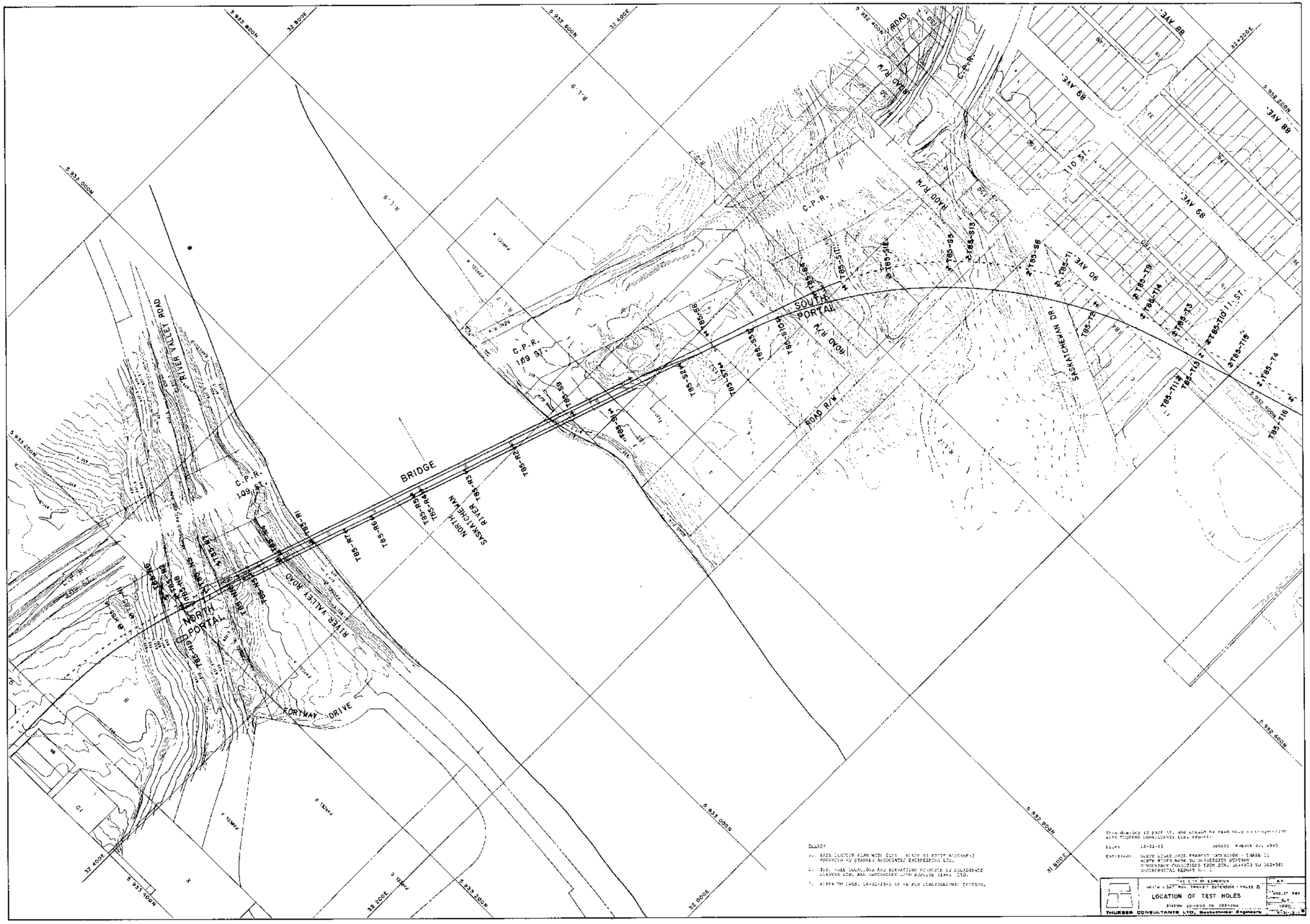
891-36-16-01

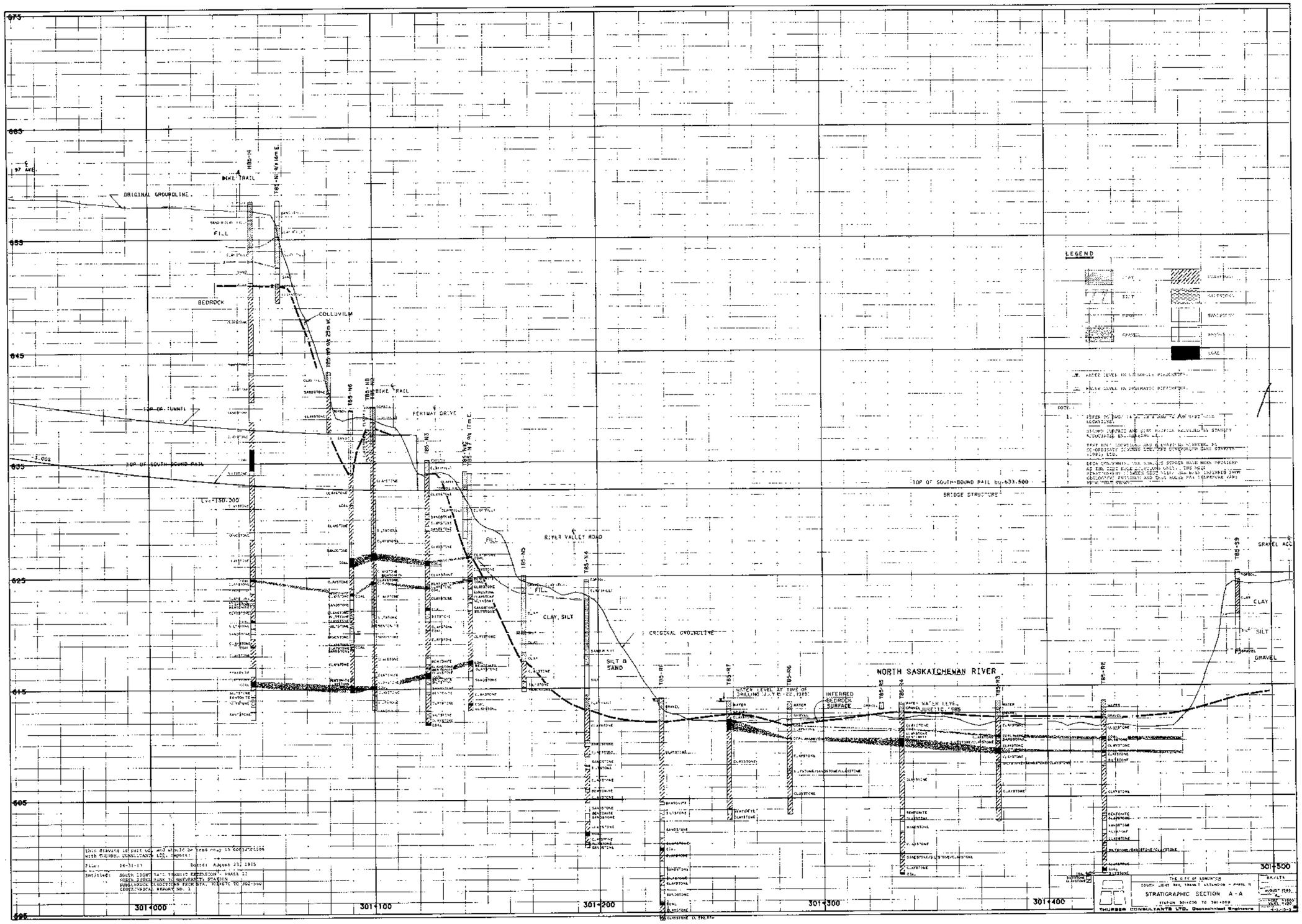
Volume 1

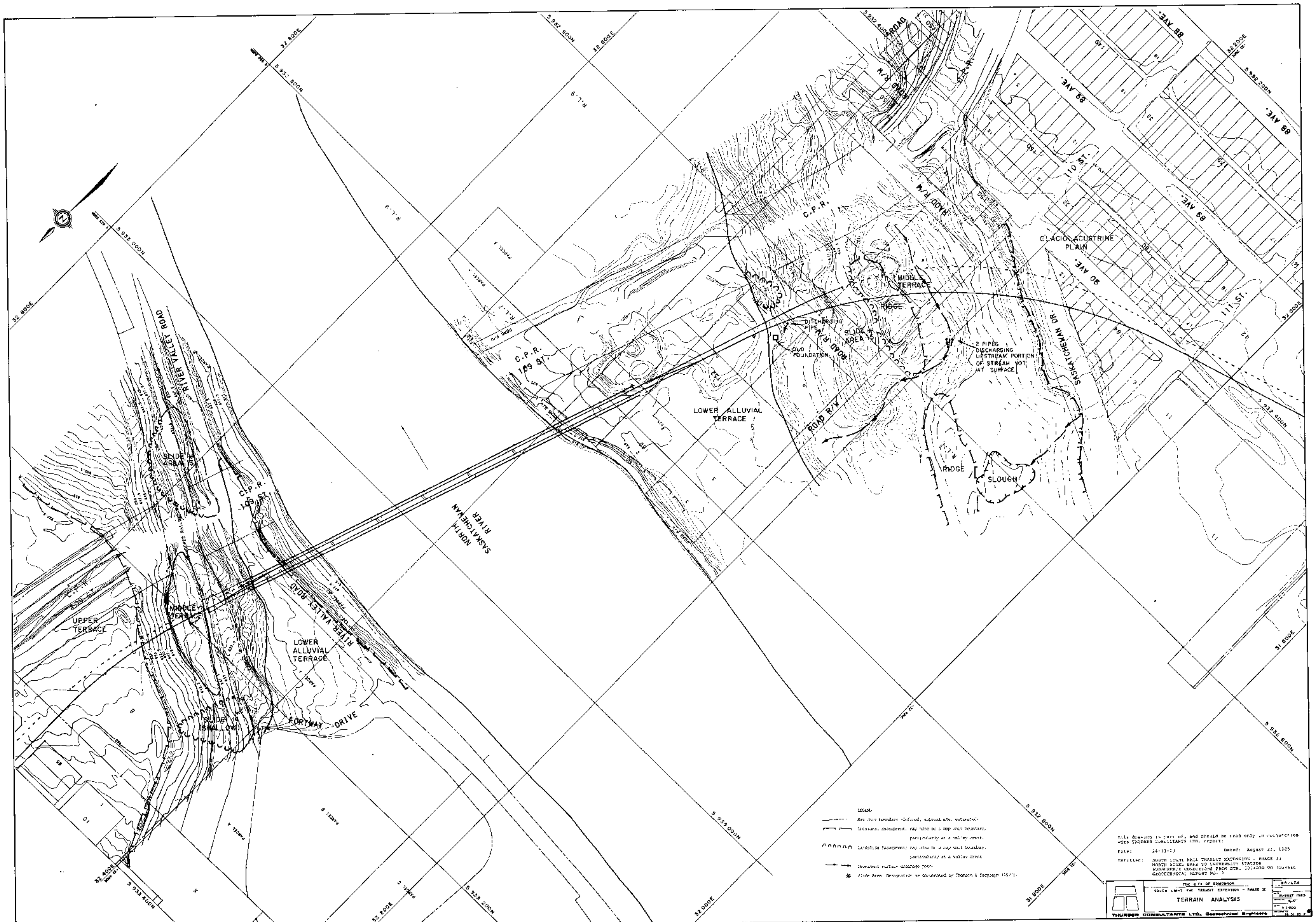
[redacted]

891-36-16-01

Volume 1


C.P.R.
109 ST.
ROAD R/W
SOUTH PORTAL
89 AVE.
90 AVE.
110 ST.
SASKATCHEWAN DR.
NORTH SASKATCHEWAN RIVER
BRIDGE
RIVER VALLEY ROAD
NORTH PORTAL
FORTWAY DRIVE
LOCATION OF TEST HOLES
THURBER CONSULTANTS LTD. Geotechnical Engineers


675
665
655
645
635
625
615
605
595
97 AVE
ORIGINAL GROUNDLINE
BIKE TRAIL
FILL
BEDROCK
COLLUVIUM
TOP OF TUNNEL
TOP OF SOUTH BOUND RAIL
FERTWAY DRIVE
RIVER VALLEY ROAD
CLAY, SILT
SILT & SAND
ORIGINAL GROUNDLINE
TOP OF SOUTH-BOUND RAIL Elev.633.500
BRIDGE STRUCTURE
NORTH SASKATCHEWAN RIVER
WATER LEVEL AT TIME OF DRILLING JULY 11-22, 1985
INFERRED BEDROCK SURFACE
GRAVEL ACC
CLAY
SILT
GRAVEL
LEGEND
CLAY
SILT
SAND
GRAVEL
COAL
NOTE:
STRATIGRAPHIC SECTION A-A
301+000
301+100
301+200
301+300
301+400
301+500
THURBER CONSULTANTS LTD. Geotechnical Engineers


RIVER VALLEY ROAD
SLIDE AREA 13
C.P.R. 109 ST.
MIDDLE TERRACE
UPPER TERRACE
LOWER ALLUVIAL TERRACE
FORTWAY DRIVE
NORTH SASKATCHEWAN RIVER
C.P.R. 109 ST.
C.P.R.
ROAD R/W
LOWER ALLUVIAL TERRACE
DISCHARGING PIPE
OLD FOUNDATION
SLIDE AREA 12
MIDDLE TERRACE
RIDGE
2 PIPES DISCHARGING UPSTREAM PORTION OF STREAM NOT AT SURFACE
SASKATCHEWAN DR.
GLACIOLACUSTRINE PLAIN
RIDGE
SLOUGH
110 ST.
111 ST.
88 AVE.
89 AVE.
90 AVE.
Dated: August 22, 1985
THE CITY OF EDMONTON
TERRAIN ANALYSIS
THURBER CONSULTANTS LTD., Geotechnical Engineers

TEST HOLE No T85-N4

THURBER CONSULTANTS LTD.
Geotechnical Engineers

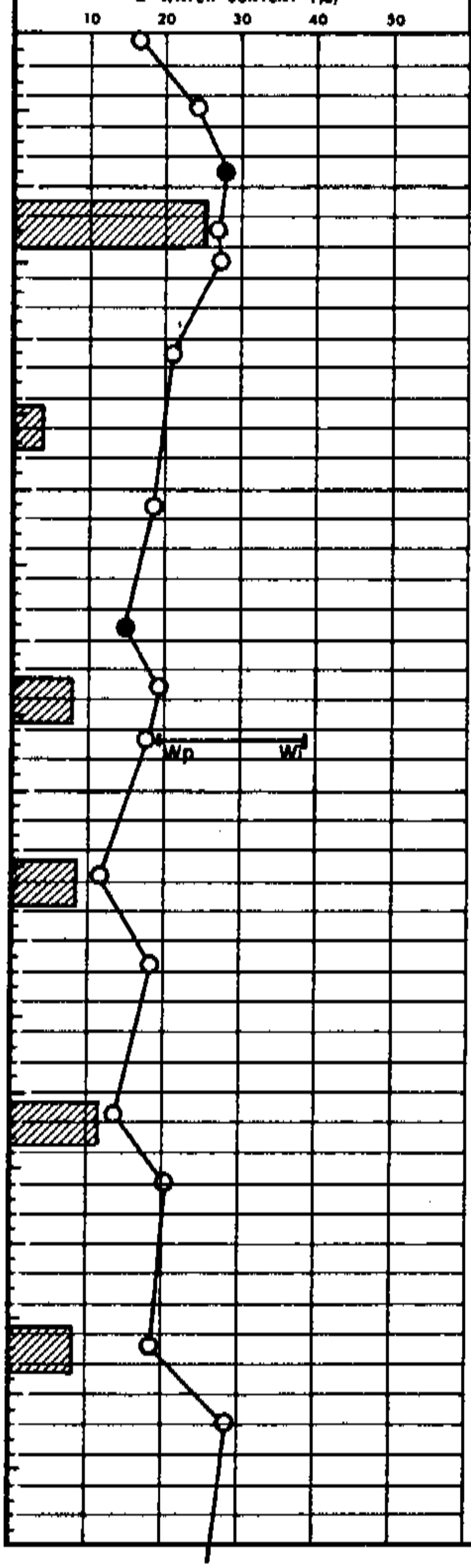
LOG OF TEST HOLE

LOCATION N5933109.4, E32479.6

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE May 3/85
METHOD B-61 Solid Stem
DRILLING Co Mobile Augers
INSPECTOR D. Proudfoot

LEGEND:
SAMPLED: Disturbed / Undisturbed / No recovery
WATER CONTENT: ○ / ●
WATER LEVEL
WL LIQUID LIMIT
Wp PLASTIC LIMIT

PENETRATION (blows per 300mm) & WATER CONTENT (%)



ELEVATION (METRES)

REMARKS

TOP OF HOLE ELEV. 624.69m

Cpen= 80kPa

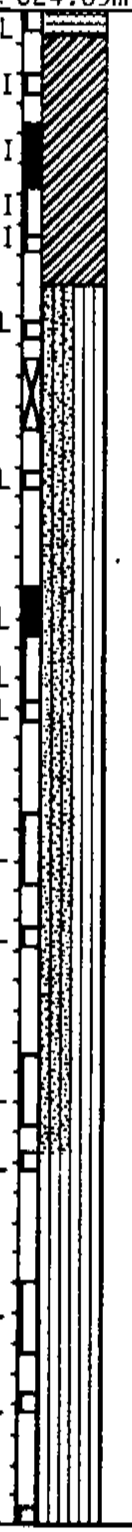
Cpen=100kPa

SO_4=0.00%

SAND | SILT | CLAY
100% 86 | 19 | 0

UNIFIED SOIL CLASSIFICATION SYSTEM

OL
CI
CI
CI
CI
SM-ML
SM-ML
SM-ML
SM-ML
CI-ML
SM-ML
SM-ML
SM-ML
ML
ML
ML



LOG

TOPSOIL

CLAY (FILL)
stiff, black to brown, silty, sandy, gravel particles, brick inclusion

SAND and SILT
loose to compact, very fine sand, brown, poorly graded
-clayey

some clay

SILT
loose to compact, fine, sandy, brown,

occasional clay stringer

DEPTH (METRES): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

SCALE: 1:50 FILE No 14-31-15

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 4

TEST HOLE Nº T85-N4

LOG OF TEST HOLE

LOCATION .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE May 3/85
METHOD B-61 Solid Stem
DRILLING Cº Mobile Augers
INSPECTOR D. Proudfoot

LEGEND:
SAMPLES: Disturbed, Undisturbed, No recovery
WATER CONTENT:
WATER LEVEL
W_L LIQUID LIMIT
W_P PLASTIC LIMIT

PENETRATION (blows per 300 mm)
& WATER CONTENT (%)
10 20 30 40 50

ELEVATION (METRES)

REMARKS

LOG

DEPTH (METRES)

TOP OF HOLE ELEV.

Cpen= 20kPa
Cpen=255kPa
Cpen=380kPa
Cpen=335kPa

UNIFIED SOIL CLASSIFICATION SYSTEM

CL
CH
CH

interlayered silt and sand, grey-brown, some clay

CLAY - SILT
soft, brown-grey, gravelly, occasional rust stains — 11

CLAYSTONE
very weak, grey-brown, silty, sandy, coal inclusions carbonaceous — 12

13

End of hole at 13.0m

Water level at completion at 12.6m — 14

15

SCALE: 1:50

FILE Nº 14-31-15

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

TEST HOLE NO. T85-N4

LOG OF TEST HOLE CORING

LOCATION N5933109.4, E32479.6
RIG TYPE Cyclone 300
BIT
CASING DIA. 168mmØ to 13.0m
CORE BARREL Christiansen
CORE DIA. 75mm
GROUND ELEV. 624.69m
WATER LEVEL

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE May 8/85
DRILLING CO. Garrity & Baker
INSPECTOR D. Proudfoot

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
11								11
12								12
13	T85-N4 START OF CORING AT 13.0m				13.0			13
	CLAYSTONE very weak, silty, moderately weathered, occasional coal stringer, dark grey			-bedding plane fracture, horizontal	66 (66) 13.5	29.1		
14	-sandstone stringer, 30mm			-thickly bedded -bedding plane fracture	97 (61)	20.2 24.0		14
	SANDSTONE, weak, very fine, moderately weathered, grey							
15	CLAYSTONE weak, silty, slightly weathered, some sandstone stringers and ironstone, dark grey			-vertical fracture: closed -medium bedded	15.0	21.9 18.1		15
16	SANDSTONE weak, silty, bentonitic, slightly weathered, light grey					14.9		16
17	SILTSTONE, weak, some sand, bentonitic, slightly weathered, grey			-bedding about 10° to horizontal	104 (100)	18.9		17
	CLAYSTONE weak, silty, slightly weathered, some siltstone laminations and ironstone nodules, dark grey			-fracture: 60°, planar		18.1 18.8		
18	-carbonaceous			-subvertical fracture, 90mm long -rubbly core	18.0	15.4 18.3		18
19	BENTONITE, light grey, weak							
	CLAYSTONE weak, silty, trace of sand, moderately weathered, some coal stringers			-thickly bedded -coal parting, 10° to horizontal	102 (100)	60.3 18.9	Cpen=142kPa Cpen= 73kPa W_p=41% W_L=547% Ip=506%	19
20								20

SCALE 1:50

FILE No. 14-31-15

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 4 of 4

TEST HOLE NO. T85-N4

LOG OF TEST HOLE CORING

LOCATION .....
.....
RIG TYPE .....
BIT ..... CASING DIA. .....
CORE BARREL ..... CORE DIA. .....
GROUND ELEV. ..... WATER LEVEL .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE May 8/85
DRILLING CO. Garrity & Baker
INSPECTOR D. Proudfoot

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUTIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	SANDSTONE very weak, silty, bentonitic, moderately to slightly weathered, light grey			-coal parting, 10° to horizontal		16.0		
				-subvertical fracture, 80mm long		14.7		
21	-very weak, occasional iron-stone nodules and coal parting			-thin bentonite seam, 20mm thick	21.0	6.1		21
				-bedding: 20° to horizontal		17.4		
	-calcareous					16.2		
	CLAYSTONE							
22	very weak, silty, bentonitic, slightly weathered, dark grey			-thickly bedded		16.1		22
	COAL, black, slightly weathered			-vertical fracture, entire thickness of seam	97 (97)	16.2		
23	CLAYSTONE weak, very silty, slightly weathered, grey			-23.3-23.4: joints, slickensided 30°-35°		21.6		23
						16.9		
	SILTSTONE, very weak, trace of fine sand, bentonitic, grey					15.5		
				-coal parting				
24	SANDSTONE, very weak, silty, bentonitic, grey				24.0	14.4		24
	End of hole at 24.0m							
25								25

SCALE 1:50

FILE No. 14-31-15

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE No. T85-N5

LOG OF TEST HOLE

LOCATION N5933136.7, E32487.0

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE July 11/85
METHOD B-61 Solid Stem
DRILLING CO. Mobile Augers
INSPECTOR D. Proudfoot

LEGEND:
SAMPLES: Disturbed; Undisturbed; No recovery
WATER CONTENT:
WATER LEVEL
w_L LIQUID LIMIT
w_p PLASTIC LIMIT

PENETRATION (blows per 300mm) & WATER CONTENT (%)
10 20 30 40 50

ELEVATION (METRES)

REMARKS

TOP OF HOLE ELEV. 625.16m

LOG

Pneumatic Piezometer (#7971)

DEPTH (METRES)

UNIFIED SOIL CLASSIFICATION SYSTEM

	GM	GRAVEL-CLAY (FILL) silty gravel and silty clay fill, mixed, occasional organic pockets and coal	1
	CI		
	GM		
	CI		
Cuttings		CLAY (FILL) very stiff, sandy, silty, brown, occasional black streaks, rust staining	2
Cpen=210kPa	CI		
Cpen= 80kPa	CI		3
Cpen= 85kPa	ML	CLAY stiff, silty with silt pockets, mottled brown and grey, oxide staining	4
	CL		
Cpen= 50kPa	CL		
		SILT, stiff, sandy, brown, wet	5
	CL	CLAY (TILL) very stiff, silty, sandy, dark brown, occasional fine gravel, coal fragments and oxides	6
Cpen=170kPa	CI-CH		
Cpen=110kPa	CI-CH	CLAY stiff, silty, bentonitic, brownish grey, transition to claystone	7
	CH		
	CI		
		CLAYSTONE very weak, silty, highly weathered, grey to dark grey, coal fragments, sandy pockets	8
Bentonite seal Cpen=105kPa	CI-CH		
	CI		9
Pneumatic Piezometer tip No. 7971 Frac sand			
		SILTSTONE, weak, fine sand, slightly weathered, grey	
Cpen=140kPa	CI		

SCALE: 1:50

FILE No. 14-31-15

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE NO T85-N5

LOG OF TEST HOLE

LOCATION .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE July 11/85
METHOD B-61 Solid Stem
DRILLING CO Mobile Augers
INSPECTOR D. Proudfoot

LEGEND:
SAMPLES: Disturbed, Undisturbed, No recovery
WATER CONTENT:
WATER LEVEL
W_L LIQUID LIMIT
W_P PLASTIC LIMIT

PENETRATION (blows per 300mm)
& WATER CONTENT (%)
10 20 30 40 50

ELEVATION (METRES)

REMARKS

TOP OF HOLE ELEV.

Cpen=400kPa
85 Blows/150mm

Water level table

July 19/85	5.51m
July 31/85	5.23m
Aug. 19/85	5.58m

UNIFIED SOIL CLASSIFICATION SYSTEM

LOG

CH
CI

SANDSTONE
weak, fine grained, silty, slightly weathered, light grey

End of hole at 10.40m

DEPTH (METRES)
11
12
13
14
15

SCALE: 1:50

FILE NO 14-31-15

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 4

TEST HOLE No. T85-N7

LOG OF TEST HOLE

LOCATION .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE Aug. 13/85
METHOD Mayhew 100, Wet Rotary
DRILLING CO Garrity & Baker
INSPECTOR S. Bean

LEGEND:
SAMPLES: Disturbed; Undisturbed; No recovery
WATER CONTENT:
WATER LEVEL
LIQUID LIMIT
PLASTIC LIMIT

WATER CONTENT (%) 10 20 30 40 50

ELEVATIONS (METRES)

REMARKS

LOG

Slope Indic. & Pneumatic Piez.

DEPTH (METRES)

TOP OF HOLE ELEV.

CI
CI
CI
CI
CI
CI-CH
SC-CH
CI
CI-CH

Cpen=190kPa

Grout

Cpen=105kPa

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY (FILL)
stiff, brown, sandy,
silty (till-like),
occasional coal, brick,
coarse gravel, organic
debris and rust stains, mixed

sandy zone

CLAYSTONE, very weak,
highly weathered, carbonaceous
COAL, black
CLAYSTONE (as above)

End of hole at 7.6m

1 2 3 4 5 6 7 8 9

SCALE: 1:50

FILE No. 14-31-15

THURBER CONSULTANTS LTD., Sheet 2 of 4
Geotechnical Engineers

TEST HOLE NO. T85-N7

LOG OF TEST HOLE CORING

LOCATION .....
.....
RIG TYPE Mayhew 1000
BIT ..... CASING DIA. .....
CORE BARREL Christiansen CORE DIA. 75mm
GROUND ELEV. ..... WATER LEVEL .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE Aug. 13/85
DRILLING CO. Garrity & Baker
INSPECTOR S. Bean

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
1								1
2								2
3								3
4								4
5								5
6								6
7				Grout Slope Indicator & Adjac. Pneumatic Piezometer Installation (#7961)				7
	T85-N7 START CORING AT 7.6m				7.6			
8	CLAYSTONE, very weak, moderately weathered, very silty, brown, carbonaceous			-thinly bedded		22.1		8
	SANDSTONE, weak, moderately weathered, fine grained, grey, very calcareous			-medium bedded, rubbly zone -coal seam: 30mm horizontal	63 (53)	23.7 18.4		
9	CLAYSTONE, as above, some siltstone laminations				9.2			9
	BENTONITE, very weak, white COAL, weak, slightly weathered, black, shiny			-thinly bedded, highly fractured		59.4		
10	CLAYSTONE, weak, sl. weath., br., carbonaceous, occas. coal frag. -bentonitic and silty zones			-shear: 40°, planar, medium bedded -shear: 50°, planar	96 (89)	17.8		10

SCALE 1:50 FILE No. 14-31-15

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 3 of 4

TEST HOLE NO. T85-N7

LOG OF TEST HOLE CORING

LOCATION .....
.....
RIG TYPE ... Mayhew 1000 .....
BIT ..... CASING DIA. .....
CORE BARREL ... Christiansen ... CORE DIA. ....75mm .....
GROUND ELEV. ..... WATER LEVEL .....

CLIENT ... THE CITY OF EDMONTON .....
PROJECT ... SLRT PROJECT .....
... NORTH VALLEY & PORTAL .....
DATE ... Aug. 13/85 .....
DRILLING CO. ... Garrity & Baker .....
INSPECTOR ... S. Bean .....

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	CLAYSTONE SANDSTONE, weak, sl. weathered, benton.,med. gr.,light grey,sl. calcar.,occas. coal laminations			-medium bedded	96 (89)	14.3		
	CLAYSTONE, weak, slightly weathered, silty, carbonaceous			-coal parting -coal seam: 60mm, horizontal	11.0	19.8		
11	SILTSTONE, moderately weak, slightly weathered,light brown					9.9		11
	SANDSTONE moderately weak, slightly weathered, medium grained, light grey, very calcareous			-thickly bedded	100 (89)	17.3		
12					12.2	4.7		12
	SILTSTONE, moderately strong, slightly weathered, grey-brown, calcareous			-medium bedded, rubbly core -thickly bedded, rubbly zones		3.0		
	CLAYSTONE weak, slightly weathered, silty, brown, carbonaceous, some sandy lenses, locally bentonitic zones			Grout		18.0		
13				Slope Indicator & Adjac. Pneumatic Piezometer Installation	92 (82)	20.5		13
14	CLAYSTONE/SANDSTONE interbedded beds 1-25mm thick			-very thinly bedded, random spacing		15.7		14
	CLAYSTONE weak, slightly weathered, silty, grey, occasional siltstone lamination			-thickly bedded, rubbly zone				
15					15.2	33.1		15
	-extremely bentonitic (15.2-16.2) -occasional bentonite stringer					39.2		
16						40.4		16
	COAL, very weak, slightly weathered, black, very pyritic			-medium bedded, highly fractured	93 (83)	23.3		
17	CLAYSTONE, weak, sl. weathered, dark brown, very carbonaceous, thin bentonitic laminat.(16.95)			-Pneumatic Piezometer Tip #7961 Installed in Adjacent Hole to Slope Indicator		14.3		17
	SANDSTONE weak, slightly weathered, slightly clayey, medium grained, light grey, calcareous, occasional coal fragments and stringers			-thickly bedded				
18					18.3	16.1		18
	CLAYSTONE weak, slightly weathered, very silty, greyish brown, occasional siltstone layers			-thickly bedded, rubbly zone	98 (91)	13.0 14.8		19
	-siltstone layer (30mm)					13.7		
20								20

SCALE 1:50 FILE No. 14-31-15

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 4 of 4

TEST HOLE NO. T85-N7

LOG OF TEST HOLE CORING

LOCATION .....
.....
RIG TYPE Mayhew 1000
BIT ..... CASING DIA. .....
CORE BARREL Christiansen CORE DIA. 75mm
GROUND ELEV. ..... WATER LEVEL .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH VALLEY & PORTAL
DATE Aug. 13/85
DRILLING CO. Garrity & Baker
INSPECTOR S. Bean

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUTIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	CLAYSTONE (continued)			Grout Slope Indicator	98 (91)	16.2		
	COAL, v.weak,sl. weathered,bl.							
	CLAYSTONE, as above			-thinly bedded,highly fr. -medium bedded		15.4		
21					21.0			21
	End of hole at 21.0m							
	Water level table							
22	Aug. 19/85 9.4m							22
23								23
24								24
25								25

SCALE 1:50 FILE No. 14-31-15

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 4

TEST HOLE NO T85-R1

LOG OF TEST HOLE

LOCATION N5933077.8, E32469.1

CLIENT THE CITY OF EDMONTON

PROJECT SLRT PROJECT - NORTH SASKATCHEWAN RIVER CROSSING

DATE May 16/85

METHOD Mayhew 1000-Mud Rotary

DRILLING CO Garrity and Baker

INSPECTOR D. Proudfoot

LEGEND:
SAMPLES: Disturbed; Undisturbed; No recovery
WATER CONTENT:
WATER LEVEL
W_L LIQUID LIMIT
W_P PLASTIC LIMIT

PENETRATION (blows per 300mm) & WATER CONTENT (%)
10 20 30 40 50

ELEVATION (METRES)

REMARKS

LOG

TOP OF HOLE ELEV. 614.09

1.3m Stickup Standpipe Piezo.

Bulk Sample 0-0.2m GC
Bulk Sample 0.2-0.45m

GRAVEL
compact, brown, sandy, silty, 50mm maximum size, well graded, rounded

GC-SC

red brown

Bentonite seal

CLAYSTONE, very weak, moderately weathered, dark, grey, silty, carbonaceous
-seam of SANDSTONE(weak,silty, fine grained, bentonitic)

SC
CH

N=85

End of hole at 3.15m

Cuttings

UNIFIED SOIL CLASSIFICATION SYSTEM

DEPTH (METRES)
1 2 3 4 5 6 7 8 9

SCALE: 1:50

FILE NO 14-31-17

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 2 of 4

TEST HOLE NO. T85-R1

LOG OF TEST HOLE CORING

LOCATION N5933077.8, E32469.1
RIG TYPE Mayhew 1000
BIT 143mm Tricone · CASING DIA. 171mmØ to 4.0m
CORE BARREL Christiansen · CORE DIA. 75mm
GROUND ELEV. 614.09m · WATER LEVEL

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH SASKATCHEWAN RIVER CROSSING
DATE May 16/85
DRILLING CO. Garrity & Baker
INSPECTOR D. Proudfoot

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
1				Standpipe Piezometer Installation 1.3m Stickup				1
2				Bentonite seal				2
3				Cuttings				3
4	T85-R1 START OF CORING AT 4.34m				4.34			4
5	CLAYSTONE very weak, silty, moderately weathered, occasional coal parting and siltstone/ironstone stringers, dark grey			-horizontal bedding, occasional vertical fractures -fracture: 55°, planar, closed -shear: 35°, slickensided	58 (58)	16.2 16.8 18.3	Wp=23%, W_L=121% Ip=98% %SAND= 3.0 %SILT=52.0 %CLAY=45.0 E=375-559MPa Cu=708kPa γ =21.16kN/m³ SO_4=0.00%	5
6	-slightly weathered			-thickly bedded	6.81			6
7				-joint: 70°, planar, rough	73 (73)	20.3 18.4		7
8				-2 joints: 70°-80°, rough, 1 shear, 50°, slickensided	8.15			8
9	-carbonaceous, black				104 (100)	17.0 20.4		9
	BENTONITE, light grey-green			-thinly bedded	9.52	58.2		
10	SILTSTONE					58.0	Cpen=70-140kPa W_p=41%, W_L=588% Ip=544%	10

SCALE 1:50 FILE No. 14-31-17

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

TEST HOLE NO. T85-R1

LOG OF TEST HOLE CORING

LOCATION .....
RIG TYPE .....
BIT ..... CASING DIA. .....
CORE BARREL ..... CORE DIA. .....
GROUND ELEV. ..... WATER LEVEL .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH SASKATCHEWAN RIVER CROSSING
DATE May 16/85
DRILLING CO. Garrity & Baker
INSPECTOR D. Proudfoot

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUTIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	SILTSTONE (continued) very weak, silty to sandy, trace of clay, carbonaceous, slightly weathered, some coal partings, brownish grey			-medium bedded -joint: 70°, planar, rough		24.2		
11				-joint: 45°, planar, rough	95 (95)	10.7 28.5		11
	SANDSTONE very weak, fine to very fine grained, silty, bentonitic, slightly weathered, light grey			-joint: 65°, planar, rough		22.7		
12	-moderately strong				12.57	5.7		12
13	CLAYSTONE very weak, silty, slightly weathered, some bentonitic partings, dark grey			-horizontal bedding, (some bedding plane fractures)		14.5		13
	COAL, black, claystone seams					14.8		
14	CLAYSTONE very weak, silty, slightly weathered, coal partings, dark brown			Cuttings		28.3		14
15	SANDSTONE very weak, fine to very fine grained, bentonitic, slightly weathered, occasional claystone lamination, light grey			-medium bedded -laminations at 5° to horizontal	92 (92)	15.9 14.3		15
16	SILTSTONE, very weak, clayey, trace of sand, slightly weathered				15.62	18.5		16
	CLAYSTONE, very weak, silty, slightly weathered, sandstone layers, 100mm				96 (96)	14.2		
17	SANDSTONE very weak, silty, bentonitic, locally calcareous, slightly weathered, light grey					14.8		17
18				Frac sand		23.3		18
	COAL, black, slightly weathered			-fractured and jointed core		29.2		
19	CLAYSTONE very weak, silty, carbonaceous, slightly weathered, coal stringers, dark brown			-thickly bedded -sub-horizontal joint, planar, rough -joints: 100mm intervals, 30°-70°, planar, rough to smooth (to bottom	18.66	27.0 20.6 17.1		19
20								20

SCALE 1:50

FILE No. 14-31-17

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 4 of 4

TEST HOLE NO. T85-R1

LOG OF TEST HOLE CORING

LOCATION .....
.....
RIG TYPE .....
BIT ..... CASING DIA. .....
CORE BARREL ..... CORE DIA. .....
GROUND ELEV. ..... WATER LEVEL .....

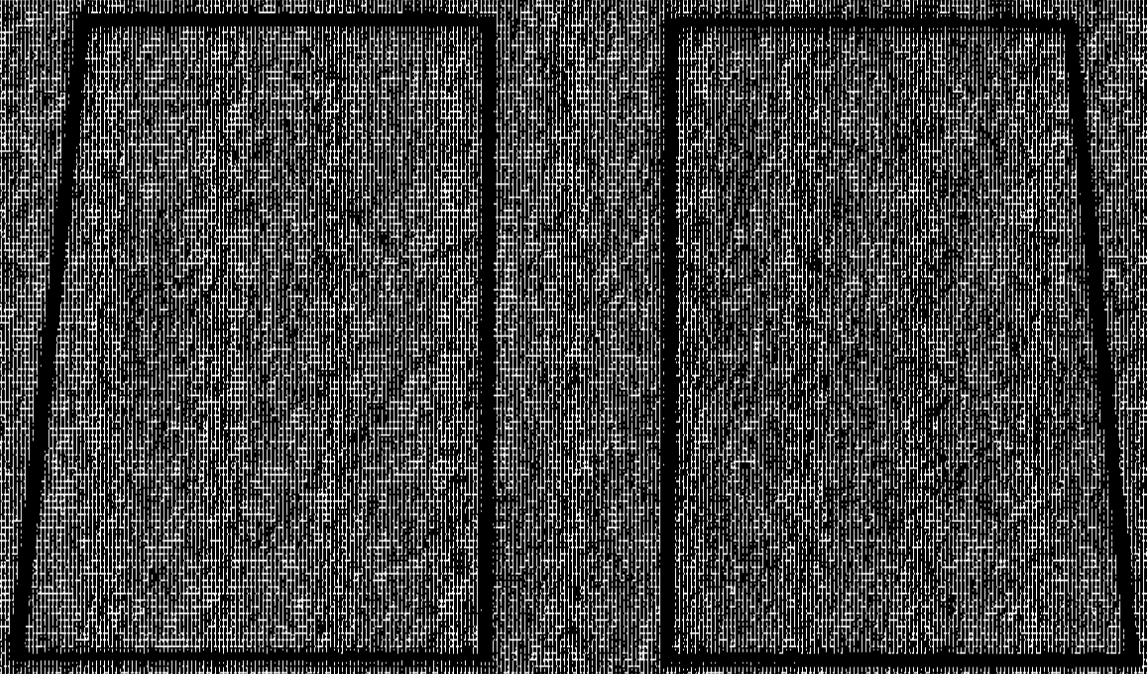
CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT
NORTH SASKATCHEWAN RIVER CROSSING
DATE May 16/85
DRILLING CO. Garrity & Baker
INSPECTOR D. Proudfoot

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	CLAYSTONE, (continued)			of hole), occasional slickenside	97 (97)	16.0		
	SANDSTONE, very weak, silty, bentonitic			Frac sand -thinly bedded		16.0		
21	CLAYSTONE very weak, silty, slightly weathered, greyish brown			Piezometer tip Slough		17.3		21
					21.72	17.6		
22	End of hole at 21.72m						Water level table June 7/85 0.0m June 28/85 0.75m above ground surface July 4/85 0.75m above ground surface July 19/85 0.75m above ground surface	22
23								23
24								24
25								25

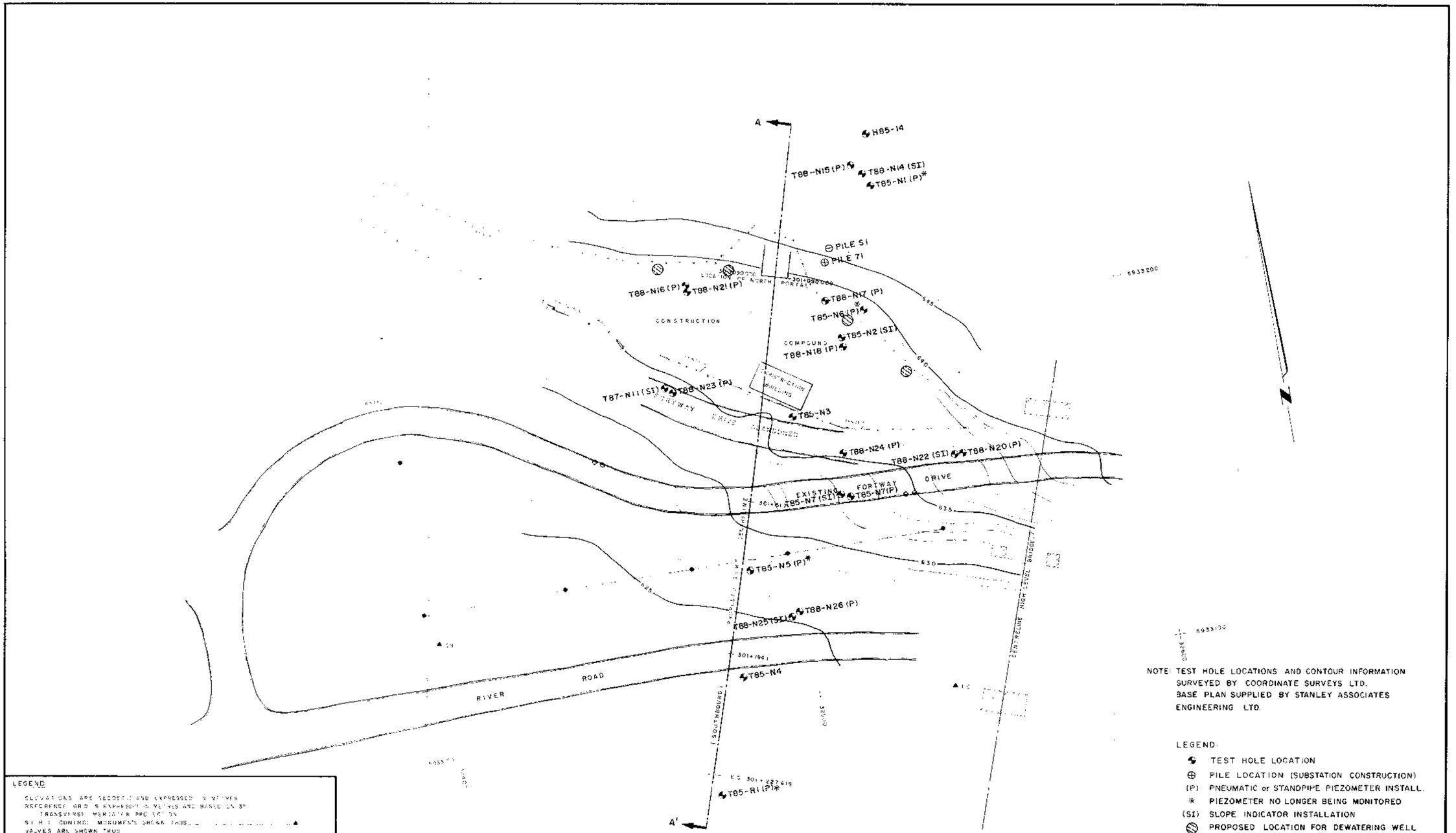
SCALE 1:50

FILE No. 14-31-17

SOUTH LIGHT RAIL TRANSIT EXTENSION - PHASE 1
NORTH VALLEY SLOPE AND PORTAL AREA SLOPE STABILITY AND MONITORING SUMMARY
GEOTECHNICAL REPORT NO. 16



TRANSIT CONSULTANTS LLC
Geotechnical Engineers



NOTE: TEST HOLE LOCATIONS AND CONTOUR INFORMATION SURVEYED BY COORDINATE SURVEYS LTD.
BASE PLAN SUPPLIED BY STANLEY ASSOCIATES ENGINEERING LTD.

LEGEND:

- TEST HOLE LOCATION
- ⊕ PILE LOCATION (SUBSTATION CONSTRUCTION)
- (P) PNEUMATIC or STANDPIPE PIEZOMETER INSTALL.
- * PIEZOMETER NO LONGER BEING MONITORED
- (SI) SLOPE INDICATOR INSTALLATION
- ⊘ PROPOSED LOCATION FOR DEWATERING WELL INSTALLATION

LEGEND

ELEVATIONS ARE RECORDED AND EXPRESSED IN METRES
REFERENCE GRID IS EXPRESSED IN METRES AND BASED ON 3° TRANSVERSE MERCATOR PROJECTION
SURVEY CONTROL MONUMENTS SHOWN THUS ▲
VALVES ARE SHOWN THUS
CATCH BASINS ARE SHOWN THUS
POWER POLES ARE SHOWN THUS
CONCRETE FOUNDATIONS FOR BRIDGE SUPPORTS SHOWN THUS

THE CITY OF EDMONTON
SLRT PROJECT - PHASE II
NORTH SLOPE - TEST HOLE AND INSTRUMENTATION LOCATIONS
NORTH PORTAL SLOPE INVESTIGATION
THURBER CONSULTANTS LTD., Geotechnical Engineers

DATE: NOV. 1988
DRAWN: P.C.C.
SCALE: 1:500
M 31-54-1

NO.	DESCRIPTION	DATE	APPR.
18			
17			
16			
15			
14			
13			
12			
11			
10			

ISSUE DATE

NO.	DESCRIPTION	DATE	APPR.
9			
8			
7			
6			
5			
4			
3			
2			
1	ISSUED	504 87	

ISSUE DATE

NO.	DATE	DESCRIPTION	BY	APPR.

REVISIONS

SUB-CONSULTANT

CONSULTANT
COORDINATE SURVEYS LTD.
LAND SURVEYORS

DESIGNED BY: DATE:
DRAWN BY: R. THORSEN CHKD BY
SCALE: 1:500
CONSULTANT REFERENCE NO.

PERMIT

SEAL

Stanley
STANLEY ASSOCIATES ENGINEERING LTD.
Managing Consultants

TRANSPORTATION DEPARTMENT ACCEPTED FOR FINAL DESIGN
TRANSIT:
TRANSPORTATION PLANNING:
L.R.T. PROJECT ADMINISTRATION:
BRANCH MANAGER:

TRANSPORTATION DEPARTMENT ACCEPTED FOR CONTRACT TENDERING
L.R.T. PROJECT ADMINISTRATION:
BRANCH MANAGER:

THE CITY OF Edmonton
TRANSPORTATION DEPARTMENT
ENGINEERING DIVISION
DESIGN AND CONSTRUCTION BRANCH

SOUTH LIGHT RAIL TRANSIT — PHASE II

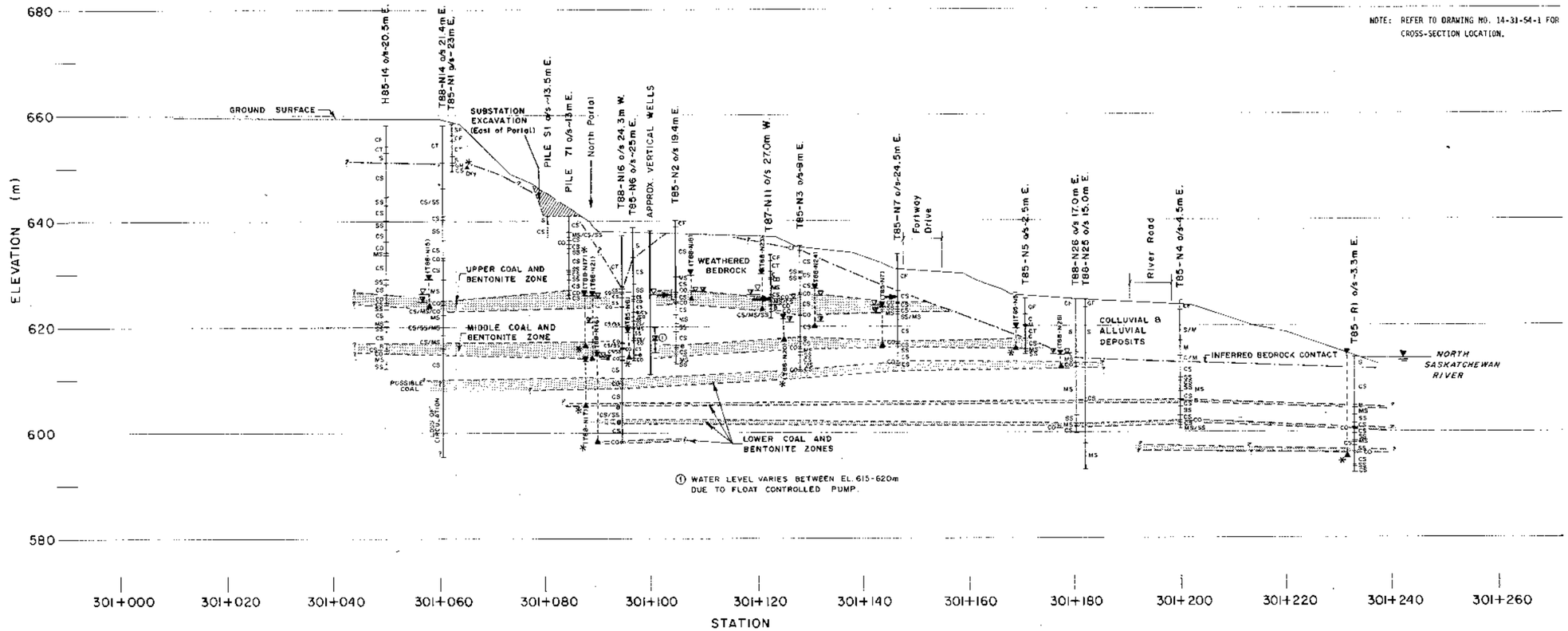
TOPOGRAPHIC SURVEY
FOR
VALLEY STRUCTURES

CONTRACT NO.
DRAWING NO. 502-1-P-731
SHEET of

LEGEND:

SYMBOL	DESCRIPTION
C	CLAY
CT	CLAY (TILL)
M	SILT
S	SAND
G	GRAVEL
CF	CLAY FILL
SF	SAND FILL
CS	CLAYSTONE
MS	SILTSTONE
SS	SANDSTONE
CO	COAL
B	BENTONITE
~^~^~	INTERBEDDED OR LAYERED STRATA
—•—	MOVEMENT NOTED SLOPE INDICATOR (SI)
▼	WATER LEVEL OBSERVATION
—▲—	PIEZOMETER TIP ELEVATION
*	PIEZOMETERS NO LONGER BEING MONITORED

NOTE: REFER TO DRAWING NO. 14-31-54-1 FOR CROSS-SECTION LOCATION.



LEGEND FOR PIEZOMETRIC LEVELS

- ▼ BEFORE WELL INSTALLATION (MARCH-APRIL 1989)
- ▽ AFTER WELL INSTALLATION (BEFORE PUMPING - JUNE 1989)
- ▼ AFTER PUMPING (JAN. 1990)

NO	DATE	DESCRIPTION	BY	APPR.
R2	27-02-90	UPDATED PIEZOMETRIC LEVELS	BR	
R1	25-01-90	DEEP WELL 'AS-BUILT' LOCATIONS	LMKJ	

THE CITY OF EDMONTON
SLRT PROJECT - PHASE II
NORTH SLOPE –
STRATIGRAPHIC CROSS-SECTION A-A'
NORTH PORTAL SLOPE INVESTIGATION
THURBER CONSULTANTS LTD., Geotechnical Engineers

DESIGN
DRAWN
DATE NOV. 1988
APPROVED RC-C/BMB
SCALE 1:400
DRAWING NO. 14-31-54-2 R2

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE NO. T88-N25

LOG OF TEST HOLE

LOCATION N5933122.70 E32495.92

CLIENT THE CITY OF EDMONTON

PROJECT SLRT PROJECT PHASE II
NORTH SLOPE INVESTIGATION

DATE September 9, 1988

METHOD Wet Rotary

DRILLING CO Garritty & Baker

INSPECTOR T. Craplewe

LEGEND:
SAMPLES: Disturbed; Undisturbed; No recovery
WATER CONTENT:
WATER LEVEL
w_L LIQUID LIMIT
w_P PLASTIC LIMIT

WATER CONTENT (%) 10 20 30 40 50

ELEVATION (METRES)

REMARKS

LOG

TOP OF HOLE ELEV. 625.08m

DEPTH (METRES)

GRAVEL (FILL)
sandy, silty, wood pieces

Grout Backfill

SAND
brown, very silty, trace of clay, occasional gravel

CLAYSTONE
dark grey, silty, trace coal

- sandy siltstone layer

MODIFIED SOIL CLASSIFICATION SYSTEM

1:100

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE No T88-N25

LOG OF TEST HOLE

LOCATION .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT PHASE II
NORTH SLOPE INVESTIGATION
DATE September 9, 1988
METHOD Wet Rotary
DRILLING CO Garritty & Baker
INSPECTOR T. Craplewe

LEGEND:
SAMPLES: Disturbed; Undisturbed; No recovery
WATER CONTENT:
WATER LEVEL
W_L LIQUID LIMIT
W_P PLASTIC LIMIT

WATER CONTENT (%)
10 20 30 40 50

ELEVATION (METRES)

REMARKS

TOP OF HOLE ELEV

LOG

DEPTH (METRES)

CLAYSTONE (continued)

- sandstone layer, bentonitic

22
24
26

SILTSTONE
dark brown to black

28
30
32

End of Hole at 32.0m
Slope Indicator Installed
to 30.48m

34
36
38

UNIFIED SOIL CLASSIFICATION SYSTEM

SCALE: 1:100

FILE No 14-31-54

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE No T88-N26

LOG OF TEST HOLE

LOCATION N5933123.78 E32498.38

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT PHASE II
NORTH SLOPE INVESTIGATION
DATE September 14, 1988
METHOD Wet Rotary
DRILLING CO Garritty & Baker
INSPECTOR J. Hogan

LEGEND:
SAMPLES: Disturbed, Undisturbed, No recovery
WATER CONTENT:
WATER LEVEL
LIQUID LIMIT
PLASTIC LIMIT

WATER CONTENT (%) 10 20 30 40 50

ELEVATION (METRES)

REMARKS

TOP OF HOLE ELEV. 625.01m

LOG

DEPTH (METRES)

CLAY (FILL)
wood and concrete debris

SAND
brown, fine grained, silty

2

4

6

8

Grout Backfill

Bentonite Seal

10

CLAY (till-like)
grey, sandy, coal specks

SILTSTONE, dark brown

Tip No. 11168

12

COAL
thin bentonite seam

SILTSTONE
dark brown to grey, clayey, carbonaceous, coal laminations

Bentonite Seal

Cuttings Backfill

14

16

18

interbedded claystone

UNIFIED SOIL CLASSIFICATION SYSTEM

SCALE: 1:100

FILE No 14-31-54

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE No T88-N26

LOG OF TEST HOLE

LOCATION .....

CLIENT THE CITY OF EDMONTON
PROJECT SLRT PROJECT PHASE II
NORTH SLOPE INVESTIGATION
DATE September 14, 1988
METHOD Wet Rotary
DRILLING CO Garritty & Baker
INSPECTOR J. Hogan

LEGEND:
SAMPLES: Disturbed, Undisturbed, No recovery
WATER CONTENT:
WATER LEVEL
w_L LIQUID LIMIT
w_P PLASTIC LIMIT

WATER CONTENT (%) 10 20 30 40 50

ELEVATION (METRES)

REMARKS

TOP OF HOLE ELEV.

UNIFIED SOIL CLASSIFICATION SYSTEM

LOG

DEPTH (METRES)

SILTSTONE (continued)

22 SANDSTONE
light grey, bentonitic,
very fine grained

SILTSTONE, dark grey
24 COAL
CLAYSTONE
light grey, silty

End of Hole at 25.3m
Pneumatic Piezometer
Installed, Tip at 12.1m

26
28
30
32
34
36
38

SCALE 1:100

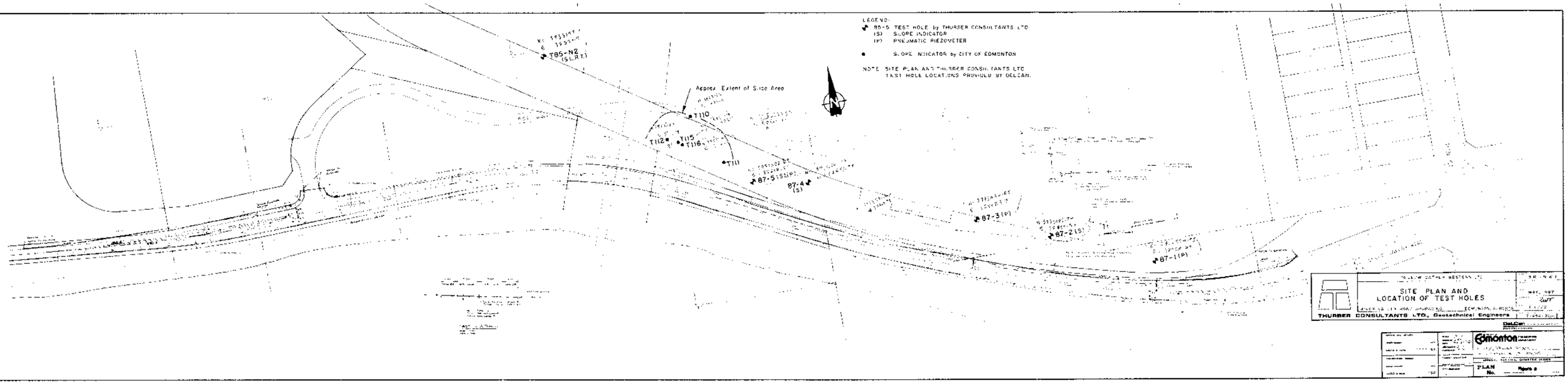
FILE No 14-31-54

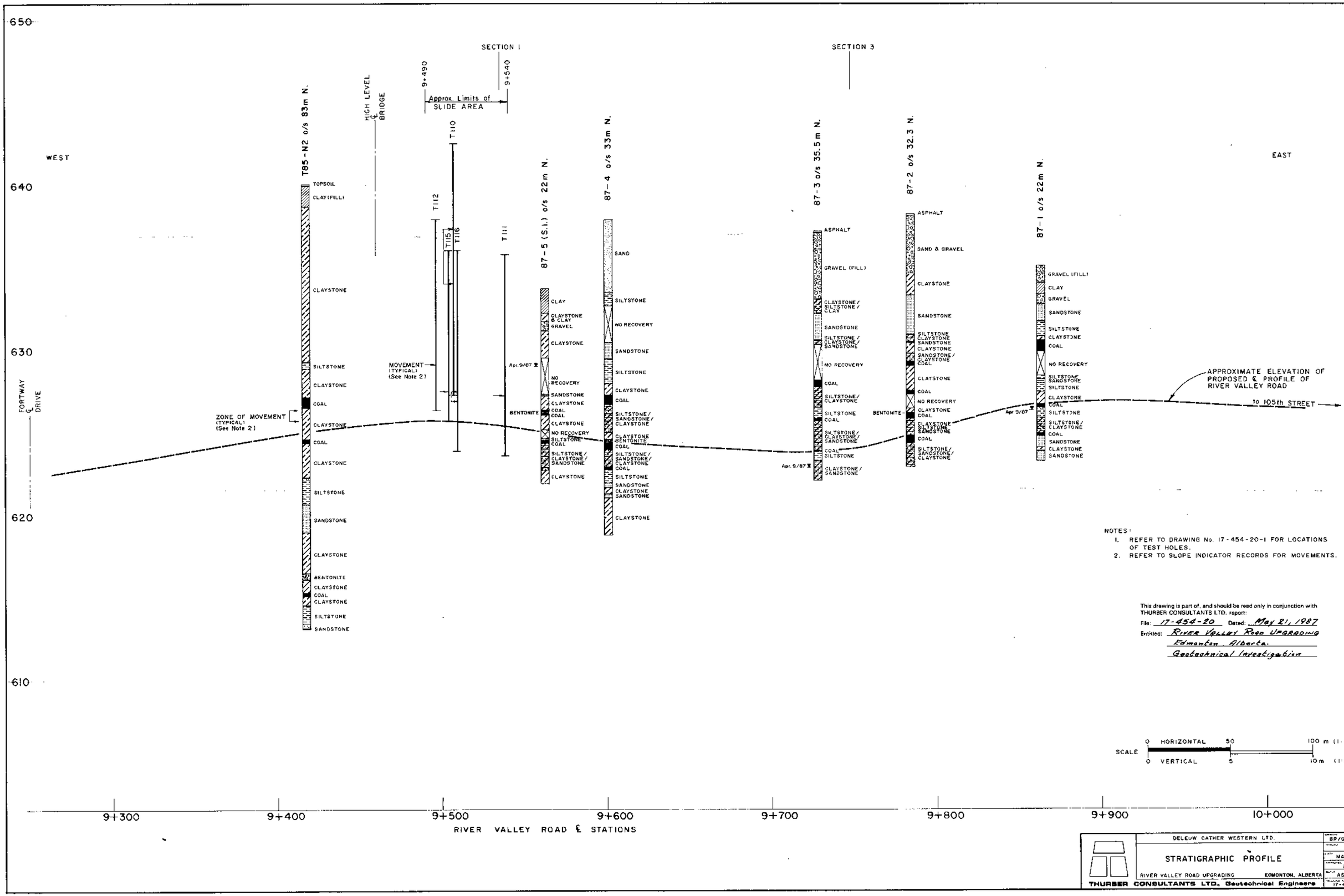
631-38-10-10

RIVER VALLEY ROAD UPGRADING
EDSON, ALBERTA
GEOTECHNICAL INVESTIGATION

Thurber Engineering Ltd.
Geotechnical Engineers
Calgary, Alberta

631-38-12-10


LEGEND:
85-5 TEST HOLE by THURBER CONSULTANTS LTD
(S) SLOPE INDICATOR
(P) PNEUMATIC PIEZOMETER
SLOPE INDICATOR by CITY OF EDMONTON
NOTE: SITE PLAN AND THURBER CONSULTANTS LTD TEST HOLE LOCATIONS PROVIDED BY DELCAN.
T85-N2 (S.L.R.T.)
Approx. Extent of Slide Area
T110
T112
T115
T116
T111
87-5(S)(P)
87-4 (S)
87-3(P)
87-2(S)
87-1(P)
N
SITE PLAN AND LOCATION OF TEST HOLES
MAY, 1987
THURBER CONSULTANTS LTD, Geotechnical Engineers
DelCan
Edmonton
PLAN No. Figure 2



DELEUW CATHER WESTERN LTD.

BR/GEG/RWT

STRATIGRAPHIC PROFILE

MAY, 1987

RIVER VALLEY ROAD UPGRADING EDMONTON, ALBERTA

AS SHOWN

THURBER CONSULTANTS LTD., Geotechnical Engineers

17-454-20-2

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE NO. 87-1

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
N 5932974.95, E 32928.67
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV. 635.03m
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 4, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	GRAVEL (FILL) sandy, brown, brick rubble, extensive coal inclusions			Pneumatic Piezometer installation				
1	CLAY brown, gravelly							1
2	GRAVEL, clayey, pebbles to 40mm					13.4	Sample 1 (Tube)	2
	SANDSTONE bentonitic, silty, grey, fine grained					26.3		
3	START OF CORING AT 3.35m				3.35			3
	SILTSTONE weak, bentonitic, grey, fresh, claystone laminations, coal and sandstone laminations			-randomly jointed -thickly bedded	100 (64)	18.9 15.4		
4	CLAYSTONE, weak, grey, fresh			-medium bedded	4.25			4
	COAL weak, black, fresh, occasional carbonaceaous claystone lamin.			-thickly bedded		16.8 23.3		
5	NO RECOVERY							5
6								6
	SILTSTONE, weak, clayey, brown to grey			-very thinly to thinly bedded	6.65	14.5		
7	SANDSTONE, weak, silty, f. grain.							7
	SILTSTONE, weak, clayey, grey, fresh, claystone laminations					15.4		
8	CLAYSTONE, weak, grey, fresh, carbonaceous -mod. strong ironstone layer				92 (8)	17.1	LL=101.4% PL= 30.7% PI= 71%	8
	COAL, weak, black, fresh			W.L. Apr. 9/87		24.2		
9	SILTSTONE weak, clayey, grey, fresh, carbonaceous			-medium bedded to thinly bedded	9.1			9
	SANDSTONE, siltstone laminations					13.4		
	CLAYSTONE, very silty, grey					16.5		
10	SILTSTONE, weak to moderately strong, clayey, trace f. sand			-medium bedded				10

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE NO. 87-1

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV.
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 4, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	SILTSTONE (continued)							
	COAL, moderately strong, fresh			-thinly bedded -vertical fracture		18.1		
	SANDSTONE moderately strong, bentonitic, fine grained, grey, fresh			-thickly bedded	99 (41)	14.2		
11	CLAYSTONE			-thinly bedded		12.8		11
	SANDSTONE fine grained, siltstone interbeds			-thickly bedded				
					11.8	14.9		
12	End of coring at 11.8m			Pneumatic Piezometer Tip No. 7182				12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE NO. 87-2

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
N 5933005.74, E 32857.50
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV 638.20m
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 7, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	ASPHALT							
	SAND and GRAVEL silt layers			Slope Indicator Installation				
1								1
2								2
3								3
4	CLAYSTONE, grey, weathered START OF CORING AT 4.9m				4.9			4
5	SANDSTONE weak to moderately strong, bentonitic, silty, fine grained, grey, fresh, coal laminations, occasional claystone lamination			-medium to thickly bedded		16.2		5
					83 (83)	17.3		
				-vertical fracture		17.6		
6					6.1			6
						6.2		
7						18.1		7
	SILTSTONE/CLAYSTONE & SANDSTONE very weak, fresh			-medium bedded	87 (56)	19.1		
8	CLAYSTONE weak to moderately strong, grey, fresh, siltstone laminations			-thickly bedded -joint, rough, planar, 20° TCA		26.5		8
	SANDSTONE and CLAYSTONE weak, fresh				8.8			
9	COAL, black			-rubbly core		26.0		9
	CLAYSTONE weak, silty, grey, fresh, occasional siltstone and sandstone laminations			-thinly to thickly bedded		23.3	LL=102% PL= 24% PI= 78%	
10								10

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE NO. 87-2

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV.
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 7, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	CLAYSTONE (continued)					15.4		
	-sandstone interbed			-medium bedded				
	COAL				69 (23)	25.0		11
11	NO RECOVERY				11.85			
12	CLAYSTONE, weak, silty, fresh					22.8		12
	BENTONITE					40.0		
	COAL							
	CLAYSTONE/SILTSTONE & SANDSTONE interbedded,			-thinly to medium bedded	92 (56)	17.5		
13	weak, silty, grey, fresh, carbonaceous					17.4		13
						13.6		
	COAL, moderately weak, fresh -siltstone interbed			-medium bedded	13.65			
						19.7		
14	SILTSTONE/SANDSTONE & CLAYSTONE interbedded, weak, bentonitic, sandy, brown and grey, fresh, occasional coal stringer			-joint, closed, planar, 80° TCA		16.8		14
				-joint, closed, planar, 75° TCA	110 (82)	16.5		
15				-medium to thickly bedded, horizontal		14.4		15
					15.3			
	End of coring at 15.3m							
16								16
17								17
18								18
19								19
20								20

SCALE 1:50

FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE NO. 87-3

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
N 5933026.85, E 32807.37
RIG TYPE Mayhew 1500
BIT
CASING DIA.
CORE BARREL Christensen
CORE DIA. 75 mm Nom.
GROUND ELEV. 637.17m
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 6, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
0	ASPHALT							0
	GRAVEL (FILL) rubble			Pneumatic Piezometer Installation				
1								1
2								2
3								3
4								4
	CLAYSTONE/SILTSTONE and CLAY grey							
5	START OF CORING AT 5.0m				5.0			5
	SANDSTONE weak, bentonitic, silty, fine to medium grained, grey, fresh, occasional coal stringer			-thickly bedded	74 (63)	19.3		
				-joint 20° TCA		17.9		
6					5.95			6
				-joint 70° TCA				
	interlaminated SILTSTONE/CLAY-STONE and SANDSTONE, weak to very weak			-thinly bedded		12.0		
7						20.3		7
	NO RECOVERY				30 (16)			
8								8
9					9.0			9
	COAL moderately weak, fresh			-medium bedded		28.2		
	interbedded SILTSTONE & CLAYSTONE weak, silty, clayey, grey, fresh					17.6		
10						17.7		10

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE NO. 87-3

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV.
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 6, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	SILTSTONE and CLAYSTONE (cont.)			-medium bedded to thinly bedded		20.5		
11	SILTSTONE clayey, carbonaceous, grey-brn. completely weathered to fresh			-thickly bedded	89 (33)			11
	COAL			-thinly bedded		18.9		
	SILTSTONE and CLAYSTONE			-thinly bedded				
12	NO RECOVERY				12.05			12
	SILTSTONE weak, clayey, grey, fresh			-medium bedded		16.6		
	SANDSTONE, claystone laminations					15.3		
13	interbedded SILTSTONE & CLAYSTONE weak, clayey, silty, grey, fresh, carbonaceous			-thinly to medium bedded		15.2		13
	COAL				90 (66)			
	SILTSTONE weak, clayey, grey, fresh			W.L. Apr. 9/87				
14	SANDSTONE moderately weak, bentonitic			-medium bedded		15.5		14
	CLAYSTONE, very weak			-thinly bedded				
	SANDSTONE, weak, bentonitic			-medium bedded		12.5		
15	CLAYSTONE very weak, silty			-thinly bedded	15.1			15
	End of coring at 15.1m			Pneumatic Piezometer Tip No. 9780				
16								16
17								17
18								18
19								19
20								20

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE NO. 87-4

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
N 5933074.22, E 32693.79
RIG TYPE Mayhew 1500
BIT
CASING DIA.
CORE BARREL Christensen
CORE DIA. 75 mm Nom.
GROUND ELEV. 637.84m
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 2, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	SAND brown, gravelly			Slope Indicator Installation				
1								1
							Sample 1 (Tube)	
2								2
	SAND brown, gravelly layers							
3							Sample 2 (Tube)	3
4								4
	SILTSTONE grey, clayey							
5	START OF CORING AT 5.2m				5.2			5
	NO RECOVERY							
6					20 (20)			6
7								7
	IRONSTONE					3.3		
	SANDSTONE weak, fine grained, bentonitic, fresh, grey, Siltstone laminations, calcareous			-thinly bedded to medium bedded	7.9	19.0		
8								8
	SILTSTONE weak, bentonitic, fresh, grey, claystone laminations			-numerous multidirectional closed planar joints		7.5		
9				-medium bedded -horizontal bedding	88 (60)	19.5		9
						18.3		
					9.9			
10	CLAYSTONE, weak.....							10

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE NO. 87-4

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV.
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 2, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	CLAYSTONE (continued) weak, silty, grey to brown, fresh bentonitic, ironstone interbeds			-very thinly bedded to medium bedded		15.9	LL=99% PL=32% PI=67%	
						33.3		
						18.1		
	COAL			-vertical fracture 0° TCA		47.1		
11	weak, black, fresh, bentonitic laminations			-very thinly bedded to medium bedded		37.3 28.3		11
	CLAYSTONE, weak, silty, brown, fresh			-medium bedded	82			
	SILTSTONE, weak, clayey, gr. fresh			-thinly bedded	(40)	14.6		
	SANDSTONE, weak, fine grained, bentonitic, grey, fresh							
12						10.5		12
	interlaminated SILTSTONE/CLAYSTONE and SANDSTONE moderately weak, grey, fresh			-thinly to medium bedded				
					12.9			
13	CLAYSTONE, weak, silty, grey, fresh, carbonaceous					16.7		13
	BENTONITE			-joint 85° planar, rough				
	COAL moderately weak, black, fresh			-joint 80° planar, rough		29.2		
				-vertical fracture				
14	SILTSTONE weak, brown, fresh, carbonaceous, occasional coal lens			-medium bedded		14.4		14
				-medium bedded -joint 45°	103 (71)			
	interlaminated SILTSTONE/SANDSTONE and CLAYSTONE, weak, grey			-thinly bedded		14.0		
15	COAL							15
	SILTSTONE, moderately weak, grey, fresh, sandstone and claystone interbeds, trace of fine grained sand			-very thinly bedded		21.0		
						13.4		
					15.9			
16	SANDSTONE, weak, fine grained, grey, fresh					15.4		16
	CLAYSTONE, weak, grey, fresh			-rough, planar joints		14.4		
	SANDSTONE, moderately weak			-medium bedded				
17								17
	CLAYSTONE weak, silty, grey, fresh, occasional coal laminations			-numerous multidirectional joints, closed, planar		17.0		
				-thinly to thickly bedded	102 (49)			
18						17.4		18
				Slope Indicator Installation				
					18.9	17.0		
19								19
	End of coring at 19.1m							
20								20

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE NO. 87-5

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
(SI)N 5933082.29, E 32654.21 (PP) N 5933083.86, E 32651.59

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING

RIG TYPE Mayhew 1500
BIT
CASING DIA.
CORE BARREL Christensen
CORE DIA. 75 mm Nom.
GROUND ELEV for S.I. =633.70m
for P.P. =633.81m
WATER LEVEL

DATE March 3, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUITIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	CLAY grey-brown, very silty, trace of fine sand, coal fines			Slope Indicator Installation Pneumatic Piezometer Installation				
1						30.7	Sample 1	1
	-thin peat layer				63			
	CLAYSTONE and CLAY grey-brown, some coal					17.3		
2	GRAVEL grey-brown, clayey, pebbles to 40mm, asphalt rubble							2
						26.8	Sample 2	
	CLAYSTONE weak, silty, grey to grey-brown, moderately weathered				57			
3						22.1		3
	START OF CORING AT 4.0m				4.0			
4	CLAYSTONE, weak, silty, brown, fresh, coal lenses			-thinly bedded		25.1 18.2		4
				▼W.L. Apr. 9/87				
5	NO RECOVERY				8 (6)			5
6	SANDSTONE, weak, silty, bentonitic, grey, fresh			-thinly bedded	6.4			6
	CLAYSTONE weak, silty, fresh, carbonaceous			-medium bedded		18.1		
7				-numerous multidirectional joints		19.4		7
	COAL BENTONITE COAL					40.6	LL=361 PL= 39 PI=322	
	CLAYSTONE weak to moderately weak, silty, fresh, carbonaceous, occasional coal stringer			-thinly bedded -thickly bedded	81 (37)	14.7		
8								8
	NO RECOVERY				9.1			
9	SILTSTONE COAL			-numerous multidirectional joints		12.4 18.8		9
	interbedded SILTSTONE/CLAYSTONE and SANDSTONE weak, grey fresh			-very thinly bedded to medium bedded		16.8		
10								10

SCALE 1:50 FILE No. 17-454-20

THURBER CONSULTANTS LTD.,
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE NO. 87-5

LOG OF TEST HOLE CORING

LOCATION See Drawing No. 17-454-20-1
RIG TYPE Mayhew 1500
BIT
CORE BARREL Christensen
GROUND ELEV.
CASING DIA.
CORE DIA. 75 mm Nom.
WATER LEVEL

CLIENT DELEUW CATHER WESTERN LTD.
PROJECT RIVER VALLEY ROAD UPGRADING
DATE March 3, 1987
DRILLING CO. Garritty & Baker
INSPECTOR J. Hogan

DEPTH (METRES)	ROCK DESCRIPTION type, strength, grain, size, weathering, colour	ROCK TYPE	INSTR. DETAILS	DISCONTINUTIES DESCRIPTION joints, bedding, seams, faults, spacing, attitude, smoothness	Recovery (RQD) (%)	Wn (%)	TEST RESULTS	DEPTH (METRES)
	SANDSTONE, weak, silty, bentonitic, grey							
	SILTSTONE, moderately weak, clayey, tr. fine gr. sand, gr. fresh			-medium bedded		12.7		
	SANDSTONE, strong, silty, grey, fresh					6.6		
11	CLAYSTONE weak, silty, grey, fresh			Slope Indicator Installation	11.8			11
12	End of coring at 11.8m							12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20

SCALE 1:50 FILE No. 17-454-20

501 27058

CITY OF EDMONTON
MATERIALS TESTING DIV.

TEST HOLE LOG & LABORATORY TEST DATA

PROJECT: Slope Indicator #5
Fortway Road - 109 Street

DWN. D.W.F. | CKD. | JOB NO. 4387 | DATE 83-01-17 | HOLE NO. 2 | PLATE NO. 3

Moist. Cont. ○ Liq. Lmt. □ Plas. Lmt. △

MOISTURE CONTENT (%) STANDARD PENETRATION (N) 10 20 30 40 50 60 70 80

DEPTH m	ELEV. m	CLASSIFICATION (GROUND SURFACE ELEV.)	SOIL SYMBOL	OTHER TESTS	SAMPLE COND.	TYPE	DEPTH m	SCALE ft.
		Clay Brown Damp -Silty -Cl -Stiff -Rust stains -Traces of clay shale -Frost 1.1m		Qu=kPa PP=kPa		M	1	2 4 6
2							2	
		Bedrock Grey Moist -Clay shale -CH -Hard -Carbonaceous to 5.3m -Fractured -Rust stained fractures -Sandstone lenses -Coal lense 8.7m to 9.0m		Qu=* PP=+479		U	3	8 10
3		(N)		N=15		DS		12
4				Qu=194.1 PP=+479		U	4	14
				N=39		DS		16
5							5	18
				Qu=181.0 PP=+479		U		
6				N=21		DS	6	20 22
7				Qu=* PP=+479		U	7	24
				N=22		DS		26
8							8	28
				N = 55 for 15 cm		DS		
9				*Sample broke up			9	30
								32
10							10	
				N=34		DS		

End of Hole
10.4m

PLATE NO. 3

THE CITY OF Edmonton **TRANSPORTATION DEPARTMENT** **MEMORANDUM**

January 28, 2011 CAD: 931+36+16

TO: Engineering Services Library

FROM: Christina Tatarniuk, P.Eng., Research Engineer
Engineering Services, Transportation Operations

SUBJECT: **Slope Inclinometer Installation**
Fortway Drive near 109 Street
East of the High Level Bridge

INTRODUCTION

A slope inclinometer (SI) was installed by Engineering Services at the above-noted monitoring site on September 16, 2010. The location of the slope inclinometer, denoted SI 10-01, is shown on Figure 1 in Appendix A. SI 10-01 was installed on Fortway Drive, approximately 50m east of the High Level Bridge. This inclinometer was installed to replace SI-110, which was no longer operational. SI 10-01 was installed in the roadway to facilitate monitoring of ground movements below this section of Fortway Drive.

The surveyed coordinates of SI 10-01 were N 5933359.00 and E 32551.27, with a corresponding ground elevation of 642.628 m; the survey data sheet is included in Appendix A and shows the surveyed coordinate information for both SI 10-01 and the original SI-110.

BACKGROUND

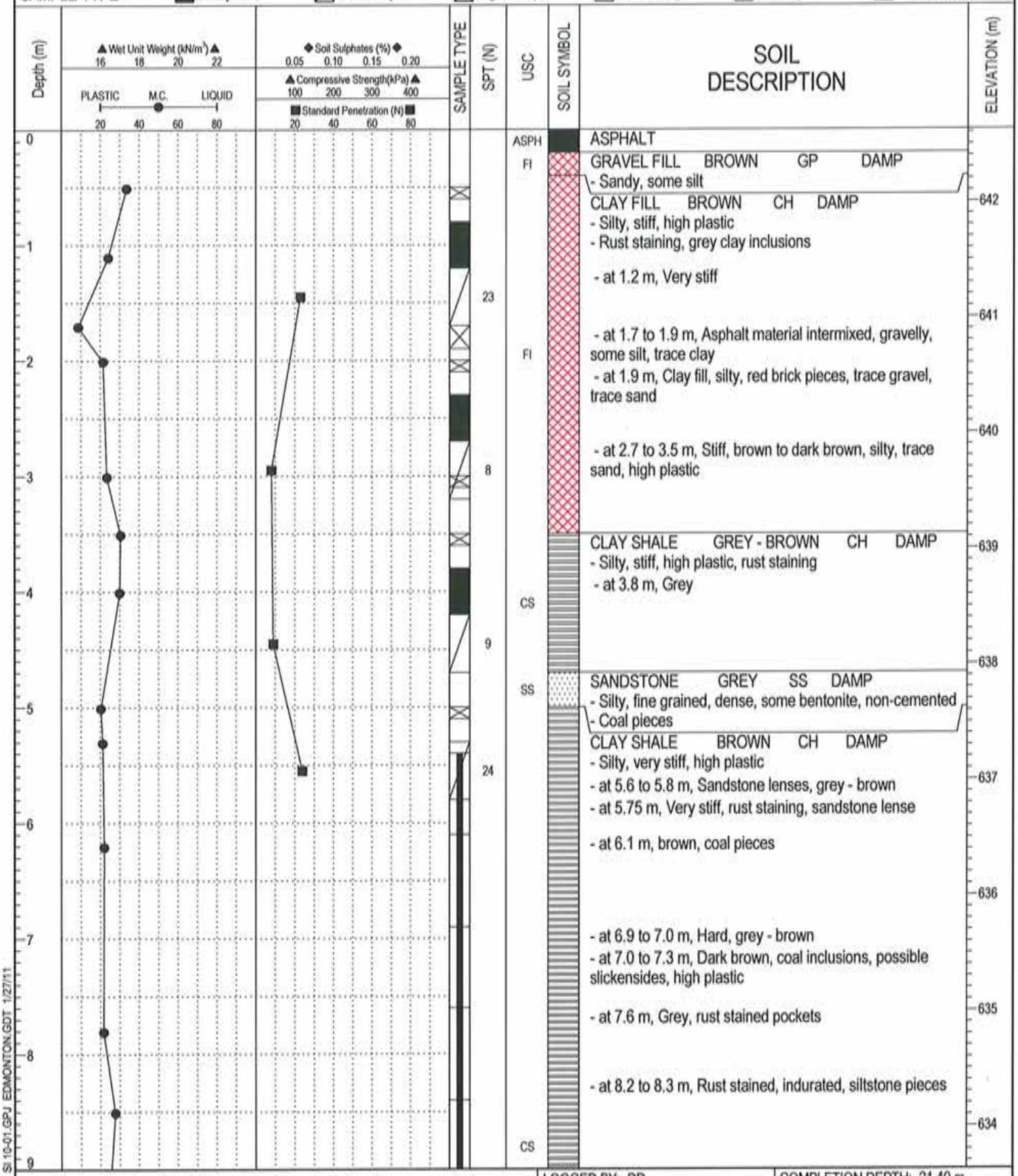
Fortway Drive is a low-volume road which connects River Valley Road to the Legislative Grounds to the north and 107 Street to the east. Fortway Drive traverses along the slopes and an upper terrace level of the North Saskatchewan River valley, upslope of River Valley Road. Records of borehole logs from the Engineering Services Library indicate that slope inclinometers were installed in the area between 1978 and 1985. A slope stability evaluation report for the site was prepared by Thurber Consultants Ltd., dated August 1986.

Engineering Services currently monitors 4 slope inclinometers at the Fortway Drive Site in addition to SI 10-01. These inclinometers were denoted SI-111, SI-113, SI-115, and SI-118. The locations of these remaining operational instruments at the site are also shown on Figure 1 in Appendix A.

Fortway Road SI 10-01 Site Plan (2011).dgn 01/26/2011 11:23:30 AM

Fortway Drive SI 10-01 Installation	Fortway Drive, East of the High Level Bridge	BOREHOLE NO: **10-01**
City of Edmonton, Engineering Services	UTM ZONE: - N5933359 E32551.27	PROJECT NO: 50001472-0010
START DATE: 9/15/2010	931+36+16	ELEVATION: 642.628 m

SAMPLE TYPE ■ Shelby Tube ⧄ Drive Sample ☒ Auger Sample ▭ No Recovery ▥ A-Casing ▮ Cored Sample



ASPHALT

GRAVEL FILL BROWN GP DAMP
- Sandy, some silt

CLAY FILL BROWN CH DAMP
- Silty, stiff, high plastic
- Rust staining, grey clay inclusions
- at 1.2 m, Very stiff
- at 1.7 to 1.9 m, Asphalt material intermixed, gravelly, some silt, trace clay
- at 1.9 m, Clay fill, silty, red brick pieces, trace gravel, trace sand
- at 2.7 to 3.5 m, Stiff, brown to dark brown, silty, trace sand, high plastic

CLAY SHALE GREY - BROWN CH DAMP
- Silty, stiff, high plastic, rust staining
- at 3.8 m, Grey

SANDSTONE GREY SS DAMP
- Silty, fine grained, dense, some bentonite, non-cemented
- Coal pieces

CLAY SHALE BROWN CH DAMP
- Silty, very stiff, high plastic
- at 5.6 to 5.8 m, Sandstone lenses, grey - brown
- at 5.75 m, Very stiff, rust staining, sandstone lense
- at 6.1 m, brown, coal pieces
- at 6.9 to 7.0 m, Hard, grey - brown
- at 7.0 to 7.3 m, Dark brown, coal inclusions, possible slickensides, high plastic
- at 7.6 m, Grey, rust stained pockets
- at 8.2 to 8.3 m, Rust stained, indurated, siltstone pieces

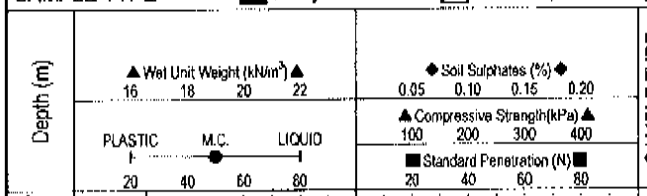
GEOTECH SI 10-01.GPJ EDMONTON.GDT 1/27/11

THE CITY OF Edmonton — Transportation Department, Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 21.40 m
REVIEWED BY: KMT	COMPLETION DATE: 2010/09/16

Fortway Drive SI 10-01 Installation	Fortway Drive, East of the High Level Bridge	BOREHOLE NO: **10-01**
City of Edmonton, Engineering Services	UTM ZONE: - N5933359 E32551.27	PROJECT NO: 50001472-0010
START DATE: 9/15/2010	931+36+16	ELEVATION: 642.628 m

SAMPLE TYPE ■ Shelby Tube ▨ Drive Sample ▩ Auger Sample ▭ No Recovery ▯ A-Casing ◧ Cored Sample



SOIL DESCRIPTION

Depth (m)	USC	ELEVATION (m)	SOIL DESCRIPTION
9			CLAY SHALE GREY CH DAMP - at 9.16 m, Grey, rust stained pockets
		633	
10			- at 9.85 m, Rust stained silty lenses, sandstone laminations
		632	
11			- at 11.16 m, Silty sandstone lenses - at 11.36 m, Sandstone intermixed - at 11.46 to 12.21 m, Sandstone interbedded, fine grained
		631	
12			- at 12.21 to 12.61 m, silty, high plastic
		630	
13	COAL		COAL BLACK COAL DAMP - Fractured, no signs of seepage
		629	
14	CS		CLAY SHALE DARK BROWN CI - CH DAMP - Silty, very stiff, medium to high plastic - Carbonaceous, coal flakes, coal inclusions - at 13.71 m, Brown shale, high plastic, hard, silty
		628	
15	CH CS COAL		- 14.5 to 14.6 m, Grey - brown shale, silty, high plastic - at 14.6 tro 15.0 m, Brown clay shale, coal inclusions, silty, high plastic BENTONITE GREY - WHITE CH DAMP - Silty, high plastic
		627	CLAY SHALE DARK BROWN CH DAMP - Silty, high plastic, coal intermixed, carbonaceous
16	CS		COAL BLACK COAL DAMP - Fractured, no sigs of seepage
	SI	626	CLAY SHALE BROWN CH DAMP - Silty, hard, high plastic - Coal pieces
17	CS		SILT STONE GREY SI DAMP - Well cemented, rock like
			CLAY SHALE GREY CH DAMP - Silty, hard, high plastic
	COAL	625	COAL BLACK COAL DAMP - Fractured, no signs of seepage
18	CS		CLAY SHALE BROWN CH DAMP

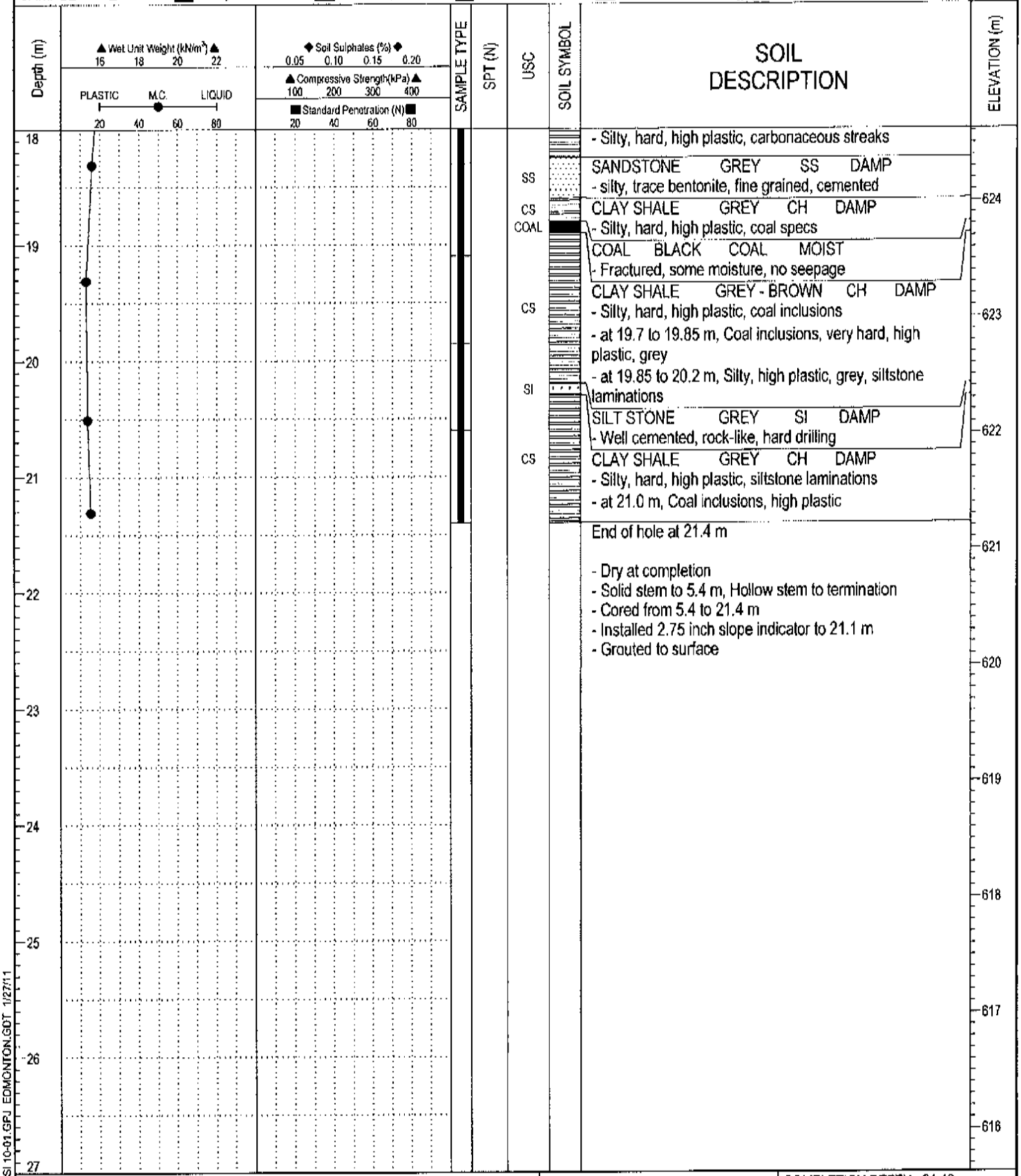
GEOTECH SI 10-01.GPJ EDMONTON.GDT 1/27/11

THE CITY OF Edmonton — Transportation Department, Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 21.40 m
REVIEWED BY: KMT	COMPLETION DATE: 2010/09/16

Fortway Drive SI 10-01 Installation	Fortway Drive, East of the High Level Bridge	BOREHOLE NO: **10-01**
City of Edmonton, Engineering Services	UTM ZONE: - N5933359 E32551.27	PROJECT NO: 50001472-0010
START DATE: 9/15/2010	931+36+16	ELEVATION: 642.628 m

SAMPLE TYPE ■ Shelby Tube ⧄ Drive Sample ☒ Auger Sample ▭ No Recovery ▯ A-Casing ▮ Cored Sample



GEOTECH SI 10-01.GPJ EDMONTON.GDT 1/27/11

THE CITY OF Edmonton

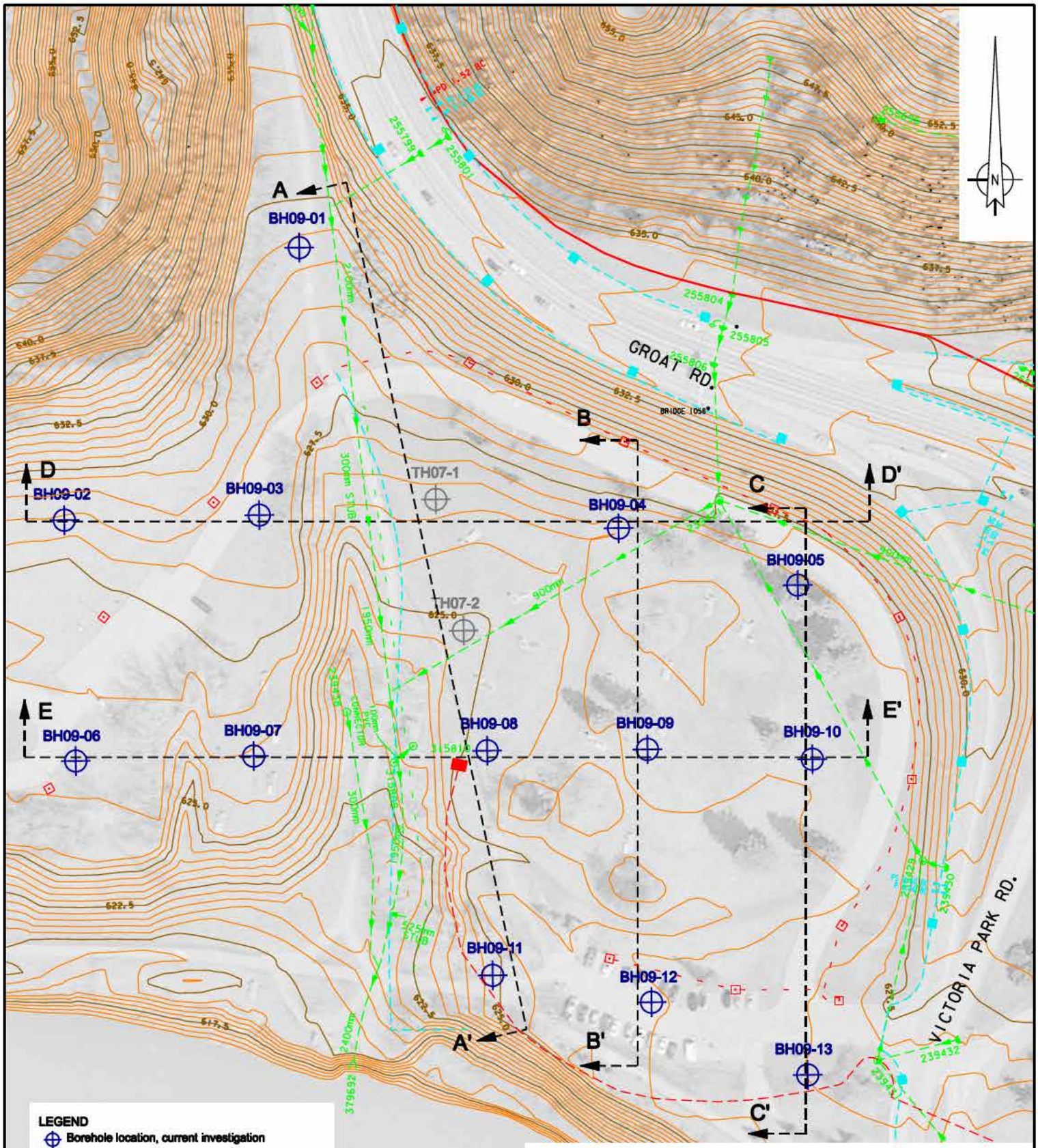
Transportation Department
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 21.40 m
REVIEWED BY: KMT	COMPLETION DATE: 2010/09/16
	Page 3 of 3

PROPOSED GROAT SURFACE WETLAND
GEOTECHNICAL INVESTIGATION

Government House Park
Southwest of Groat Road at Victoria Park Road

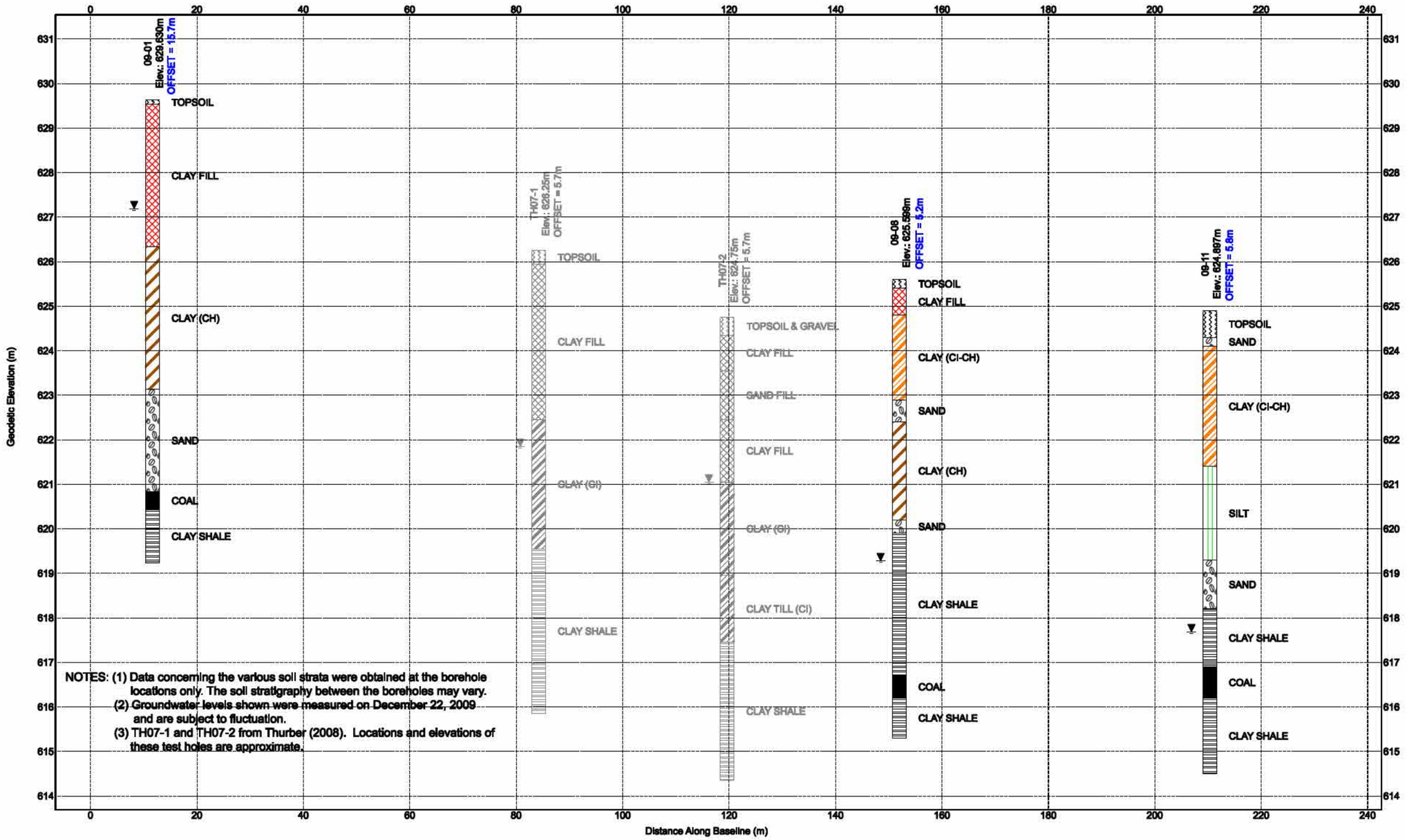
February 2010



THE CITY OF Edmonton ENGINEERING SERVICES TRANSPORTATION

PROJECT
GROAT SURFACE WETLAND PROJECT
GEOTECHNICAL BOREHOLE LOCATIONS

DRAWN BY **KMT**		
CHECKED **PRL**	APPROVED **DML**	DATE **FEBRUARY 2010**
FILE	SCALE **AS SHOWN**	DRAWING **PLATE 2**



LEGEND:

TOPSOIL | SILT (LOW PLASTIC) | CLAY (MEDIUM PLASTIC) | COAL | GRAVEL (POORLY GRADED) | CLAY SHALE (BEDROCK)

GROUND WATER | FILL | CLAY (HIGH PLASTIC) | CLAY (LOW PLASTIC) | SAND | GRAVEL (WELL GRADED)

LOOKING WEST

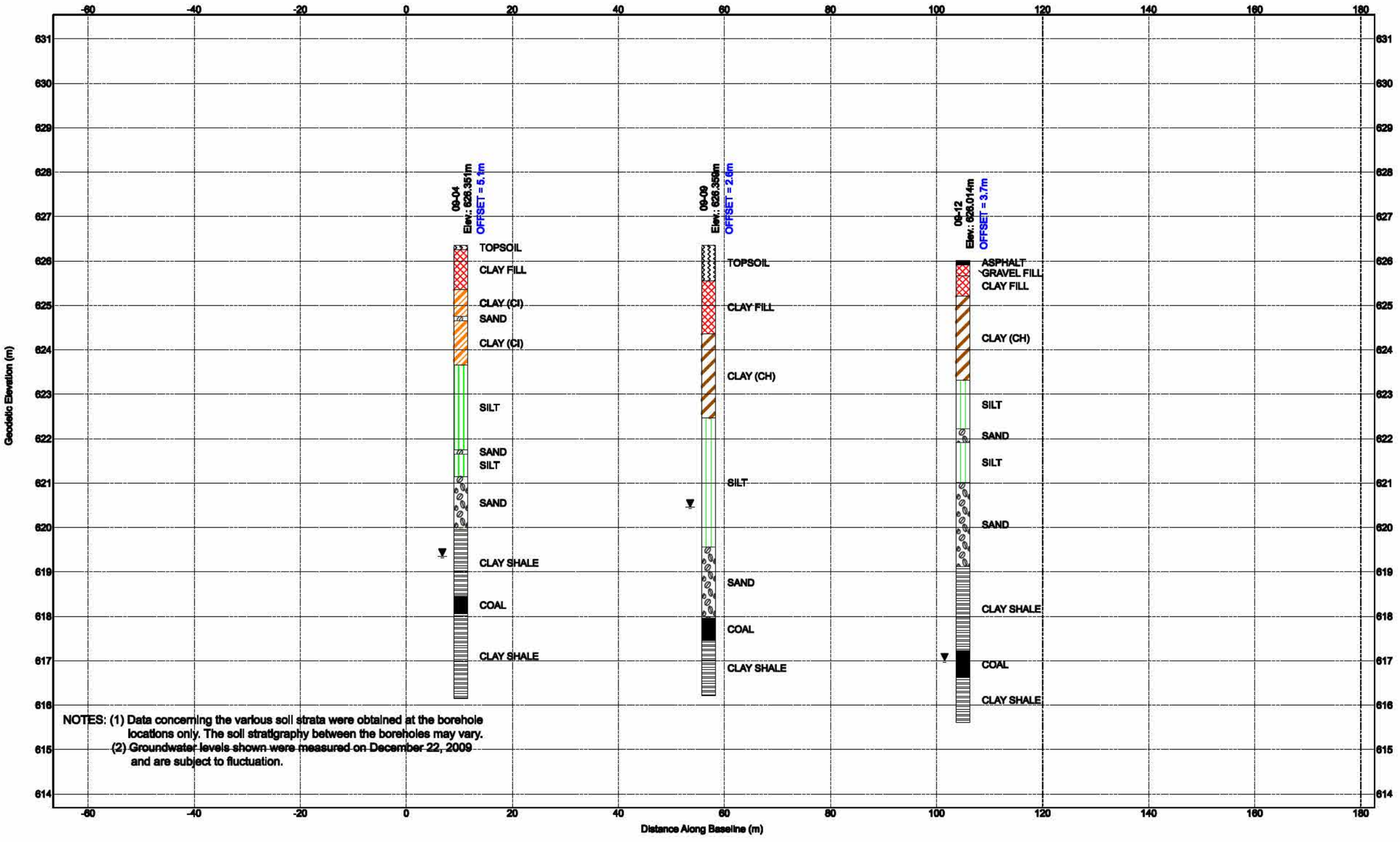
Drawing	PLATE 4	Drawn By	KMT
Checked	PRL	Date	FEBRUARY 2010
		Scale	AS SHOWN

THE CITY OF Edmonton
Transportation Department
Engineering Services Section

PROPOSED GROAT WETLAND

GEOTECHNICAL INVESTIGATION

PLATE 4: CROSS SECTION A-A'



LEGEND:

TOPSOIL | SILT | CLAY (MEDIUM PLASTIC) | COAL | GRAVEL (POORLY GRADED) | CLAY SHALE (BEDROCK)

GROUND WATER | FILL | CLAY (HIGH PLASTIC) | CLAY (LOW PLASTIC) | SAND | GRAVEL (WELL GRADED)

LOOKING WEST

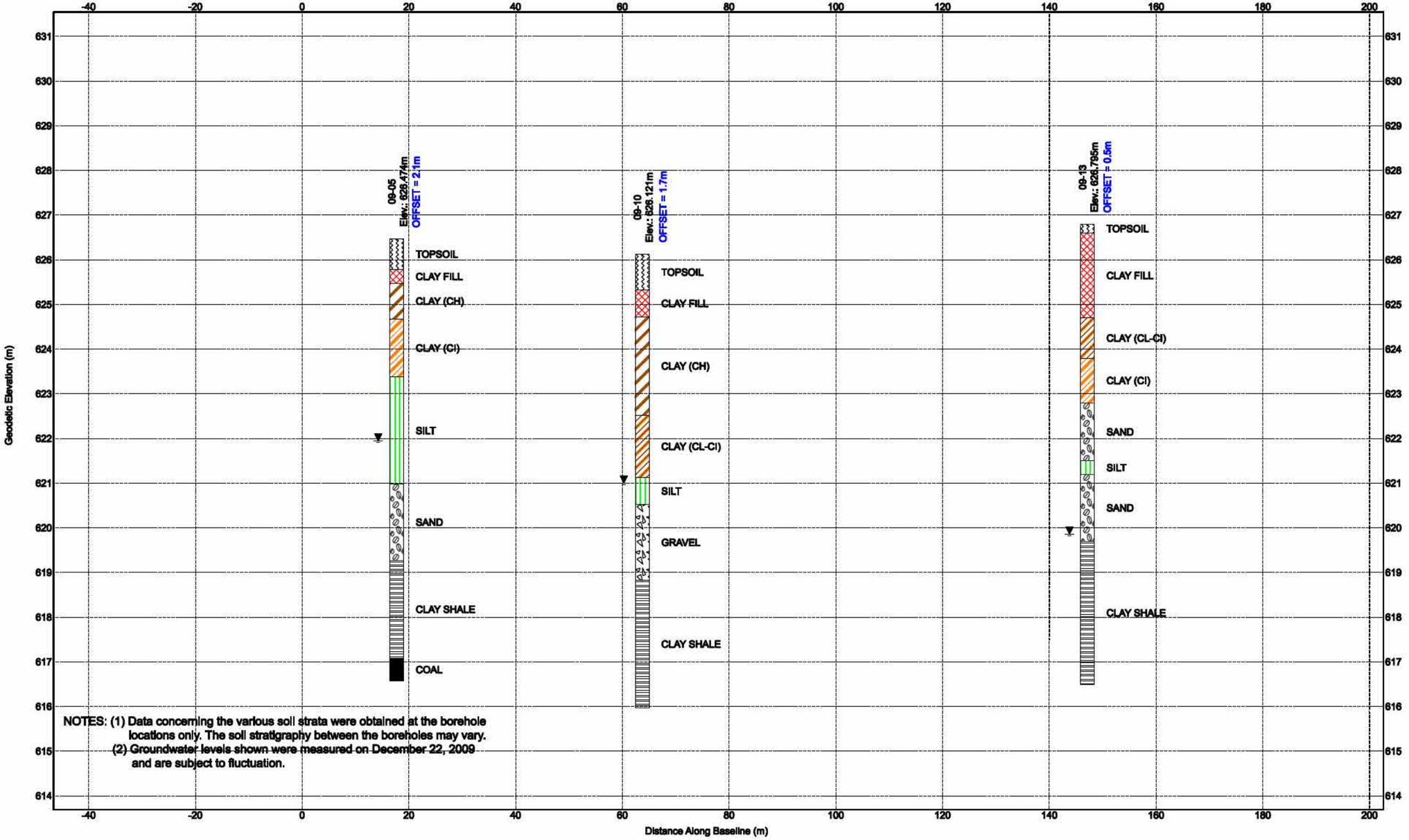
Drawing	PLATE 5	Drawn By	KMT
Checked	PRL	Date	FEBRUARY 2010
		Scale	AS SHOWN

THE CITY OF Edmonton
Transportation Department
Engineering Services Section

PROPOSED GROAT WETLAND

GEOTECHNICAL INVESTIGATION

PLATE 5: CROSS SECTION B-B'



NOTES: (1) Data concerning the various soil strata were obtained at the borehole locations only. The soil stratigraphy between the boreholes may vary.
(2) Groundwater levels shown were measured on December 22, 2009 and are subject to fluctuation.

LEGEND:

TOPSOIL | SILT | CLAY (MEDIUM PLASTIC) | COAL | GRAVEL (POORLY GRADED) | CLAY SHALE (BEDROCK)

GROUND WATER | FILL | CLAY (HIGH PLASTIC) | CLAY (LOW PLASTIC) | SAND | GRAVEL (WELL GRADED)

LOOKING WEST

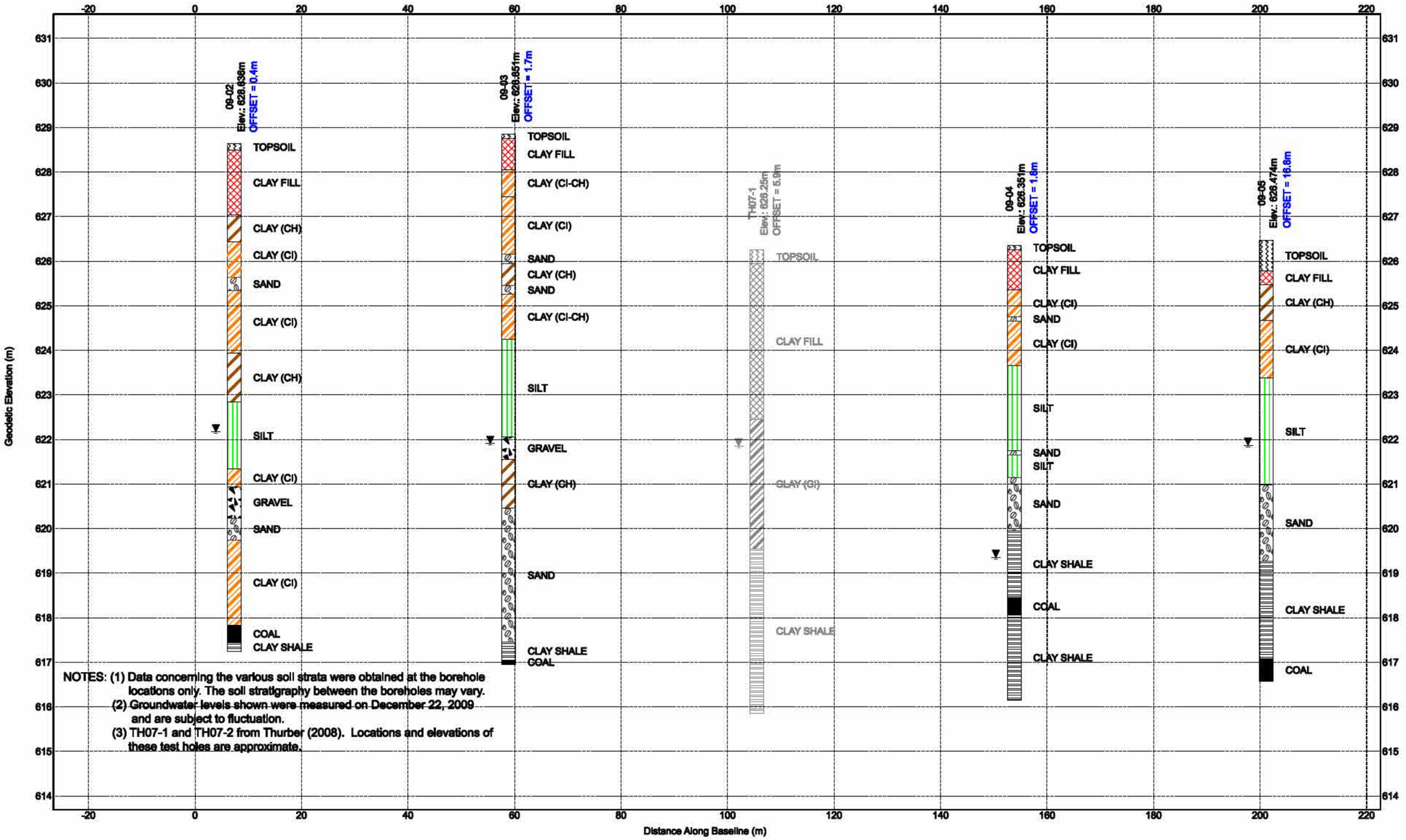
Drawing	PLATE 6	Drawn By	KMT
Checked	PRL	Date	FEBRUARY 2010
		Scale	AS SHOWN

THE CITY OF Edmonton
Transportation Department
Engineering Services Section

PROPOSED GROAT WETLAND

GEOTECHNICAL INVESTIGATION

PLATE 6: CROSS SECTION C-C'



NOTES: (1) Data concerning the various soil strata were obtained at the borehole locations only. The soil stratigraphy between the boreholes may vary.
(2) Groundwater levels shown were measured on December 22, 2009 and are subject to fluctuation.
(3) TH07-1 and TH07-2 from Thurber (2008). Locations and elevations of these test holes are approximate.

LEGEND:

TOPSOIL | SILT (LOW PLASTIC) | CLAY (MEDIUM PLASTIC) | COAL | GRAVEL (POORLY GRADED) | CLAY SHALE (BEDROCK)

GROUND WATER | FILL | CLAY (HIGH PLASTIC) | CLAY (LOW PLASTIC) | SAND | GRAVEL (WELL GRADED)

LOOKING NORTH

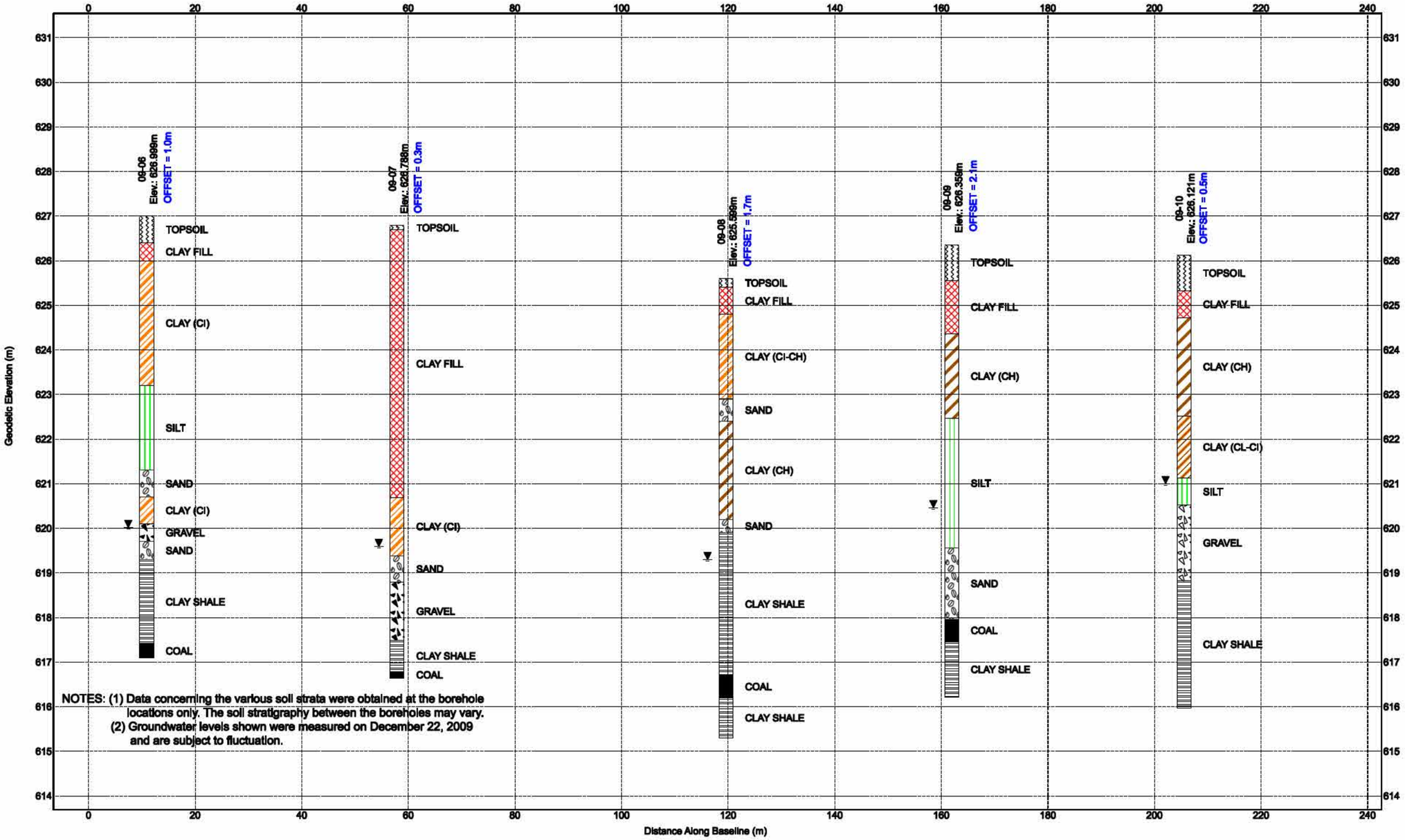
Drawing	PLATE 7	Drawn By	KMT
Checked	PRL	Date	FEBRUARY 2010
		Scale	AS SHOWN

THE CITY OF EDMONTON
Transportation Department
Engineering Services Section

PROPOSED GROAT WETLAND

GEOTECHNICAL INVESTIGATION

PLATE 7: CROSS SECTION D-D'



NOTES: (1) Data concerning the various soil strata were obtained at the borehole locations only. The soil stratigraphy between the boreholes may vary.
(2) Groundwater levels shown were measured on December 22, 2009 and are subject to fluctuation.

LEGEND:

TOPSOIL | SILT (LOW PLASTIC) | CLAY (MEDIUM PLASTIC) | COAL | GRAVEL (POORLY GRADED) | CLAY SHALE (BEDROCK)

GROUND WATER | FILL | CLAY (HIGH PLASTIC) | CLAY (LOW PLASTIC) | SAND | GRAVEL (WELL GRADED)

LOOKING NORTH

Drawing	PLATE 8	Drawn By	KMT
Checked	PRL	Date	FEBRUARY 2010
		Scale	AS SHOWN

THE CITY OF Edmonton
Transportation Department
Engineering Services Section

PROPOSED GROAT WETLAND

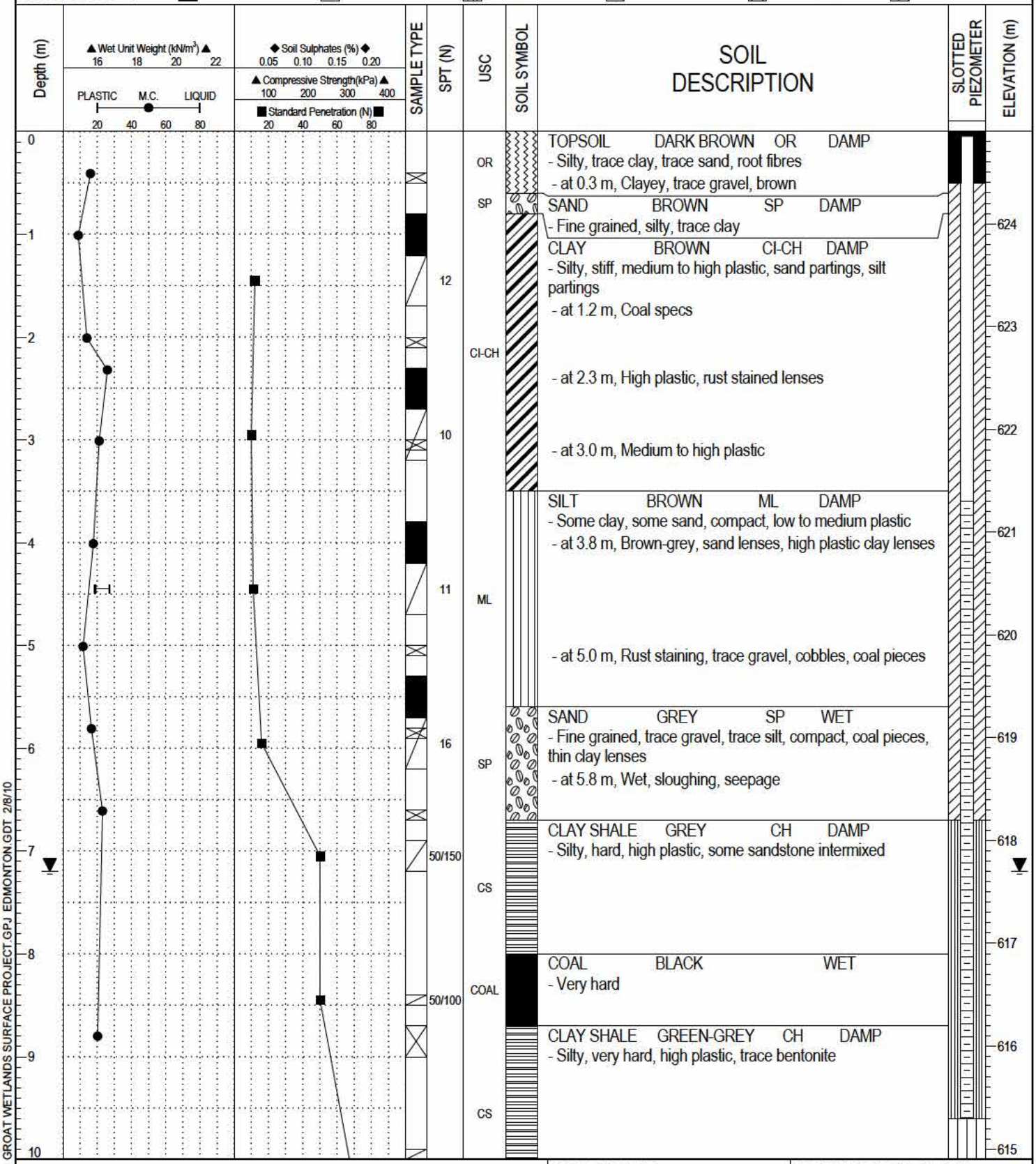
GEOTECHNICAL INVESTIGATION

PLATE 8: CROSS SECTION E-E'

GROAT SURFACE WETLAND PROJECT	West of Groat Road North Side of Sask. River	BOREHOLE NO: **09-11**
DRAINAGE SERVICES	UTM ZONE: - N5934107.39 E30444.67	PROJECT NO: 60007944 - 0010
START DATE: 2009/09/30	934 + 32 + 02 / 934 + 32 + 03	ELEVATION: 624.897 m

SAMPLE TYPE: Shelby Tube | Drive Sample | Auger Sample | No Recovery | A Casing | Cored Sample

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



STANDP P GROAT WETLANDS SURFACE PROJECT.GPJ EDMONTON.GDT 2/8/10

THE CITY OF Edmonton

Transportation
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 10.40 m
REVIEWED BY: KMT	COMPLETION DATE:2009/09/30

GROAT SURFACE WETLAND PROJECT	West of Groat Road North Side of Sask. River	BOREHOLE NO: **09-11**
DRAINAGE SERVICES	UTM ZONE: - N5934107.39 E30444.67	PROJECT NO: 60007944 - 0010
START DATE: 2009/09/30	934 + 32 + 02 / 934 + 32 + 03	ELEVATION: 624.897 m

SAMPLE TYPE: Shelby Tube | Drive Sample | Auger Sample | No Recovery | A Casing | Cored Sample

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	Wet Unit Weight (kN/m³) 16 18 20 22 / PLASTIC M.C. LIQUID 20 40 60 80	Soil Sulphates (%) 0.05 0.10 0.15 0.20 / Compressive Strength(kPa) 100 200 300 400 / Standard Penetration (N) 20 40 60 80	SAMPLE TYPE	SPT (N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SLOTTED PIEZOMETER	ELEVATION (m)
10				69			CLAY SHALE GREEN-GREY CH DAMP		
							End of Borehole at 10.4 m - Water level at 6.1 m, slough at 6.7 m on completion - Water level at 7.2 m on December 22, 2009 - Installed 25 mm PVC standpipe to 9.6 m - Backfilled with drill cuttings, bentonite surface seal		614
11									
12									613
13									612
14									611
15									610
16									609
17									608
18									607
19									606
20									605

STANDP P GROAT WETLANDS SURFACE PROJECT.GPJ EDMONTON.GDT 2/8/10

THE CITY OF Edmonton

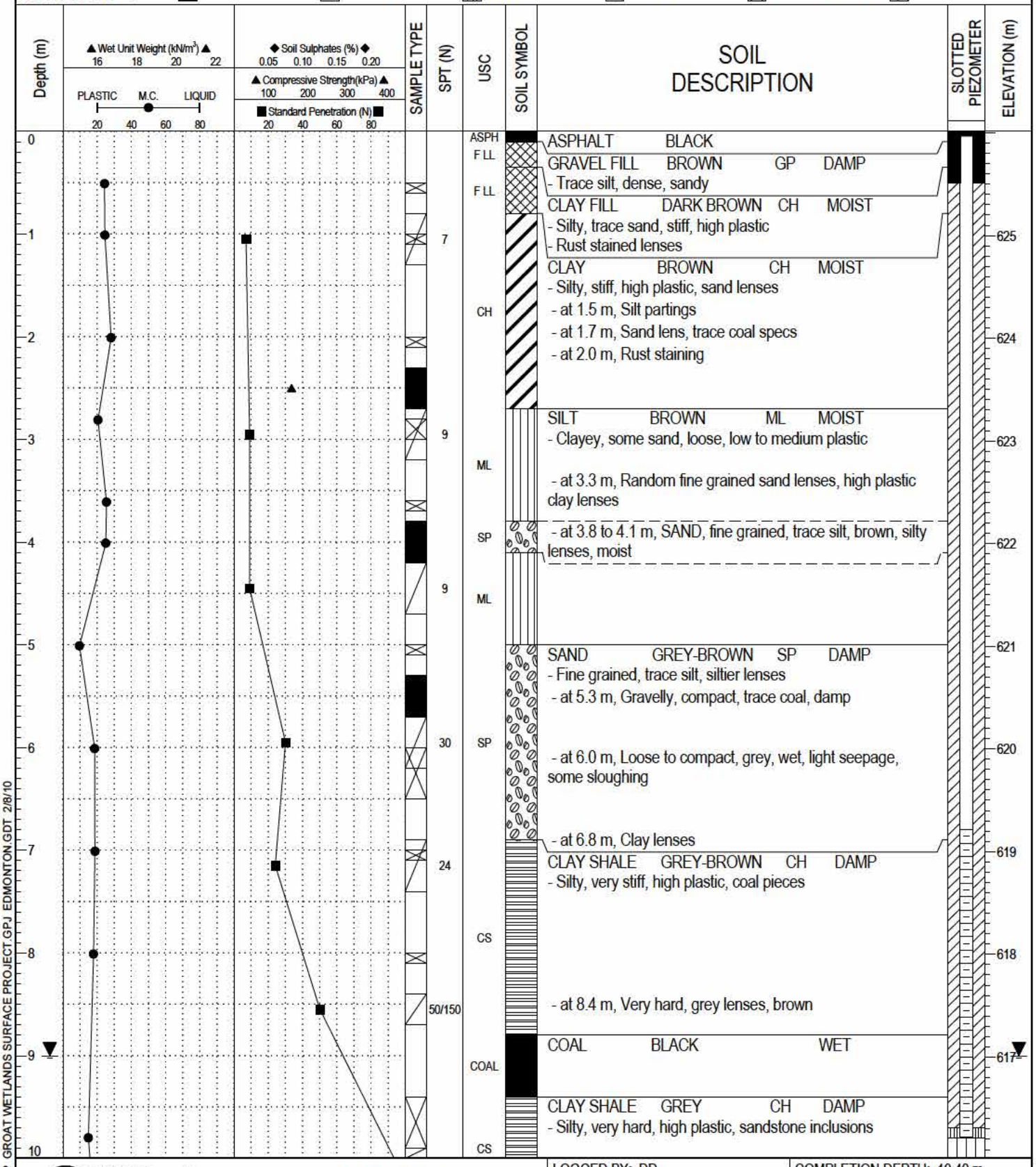
Transportation
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 10.40 m
REVIEWED BY: KMT	COMPLETION DATE:2009/09/30
	Page 2 of 2

GROAT SURFACE WETLAND PROJECT	West of Groat Road North Side of Sask. River	BOREHOLE NO: **09-12**
DRAINAGE SERVICES	UTM ZONE: - N5934100.29 E30486.64	PROJECT NO: 60007944 - 0010
START DATE: 2009/09/30	934 + 32 + 02 / 934 + 32 + 03	ELEVATION: 626.014 m

SAMPLE TYPE: Shelby Tube | Drive Sample | Auger Sample | No Recovery | A Casing | Cored Sample

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



THE CITY OF Edmonton

Transportation
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 10.40 m
REVIEWED BY: KMT	COMPLETION DATE:2009/09/30
	Page 1 of 2

STANDP P GROAT WETLANDS SURFACE PROJECT.GPJ EDMONTON.GDT 2/8/10

GROAT SURFACE WETLAND PROJECT	West of Groat Road North Side of Sask. River	BOREHOLE NO: **09-12**
DRAINAGE SERVICES	UTM ZONE: - N5934100.29 E30486.64	PROJECT NO: 60007944 - 0010
START DATE: 2009/09/30	934 + 32 + 02 / 934 + 32 + 03	ELEVATION: 626.014 m

SAMPLE TYPE: Shelby Tube; Drive Sample; Auger Sample; No Recovery; A Casing; Cored Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

Wet Unit Weight (kN/m³) 16 18 20 22

PLASTIC M.C. LIQUID

20 40 60 80

Soil Sulphates (%) 0.05 0.10 0.15 0.20

Compressive Strength(kPa) 100 200 300 400

Standard Penetration (N) 20 40 60 80

Depth (m)	SAMPLE TYPE	SPT (N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SLOTTED PIEZOMETER	ELEVATION (m)
10		98			CLAY SHALE GREY CH DAMP		
					End of Borehole at 10.4 m - Water level at 6.9 m, slough at 9.7 m on completion - Water level at 9.0 m on October 5, 2009 - Installed 25 mm PVC standpipe to 9.8 m - Backfilled with drill cuttings, bentonite surface seal		
11							615
12							614
13							613
14							612
15							611
16							610
17							609
18							608
19							607
20							

STANDP P GROAT WETLANDS SURFACE PROJECT.GPJ EDMONTON.GDT 2/8/10

THE CITY OF Edmonton

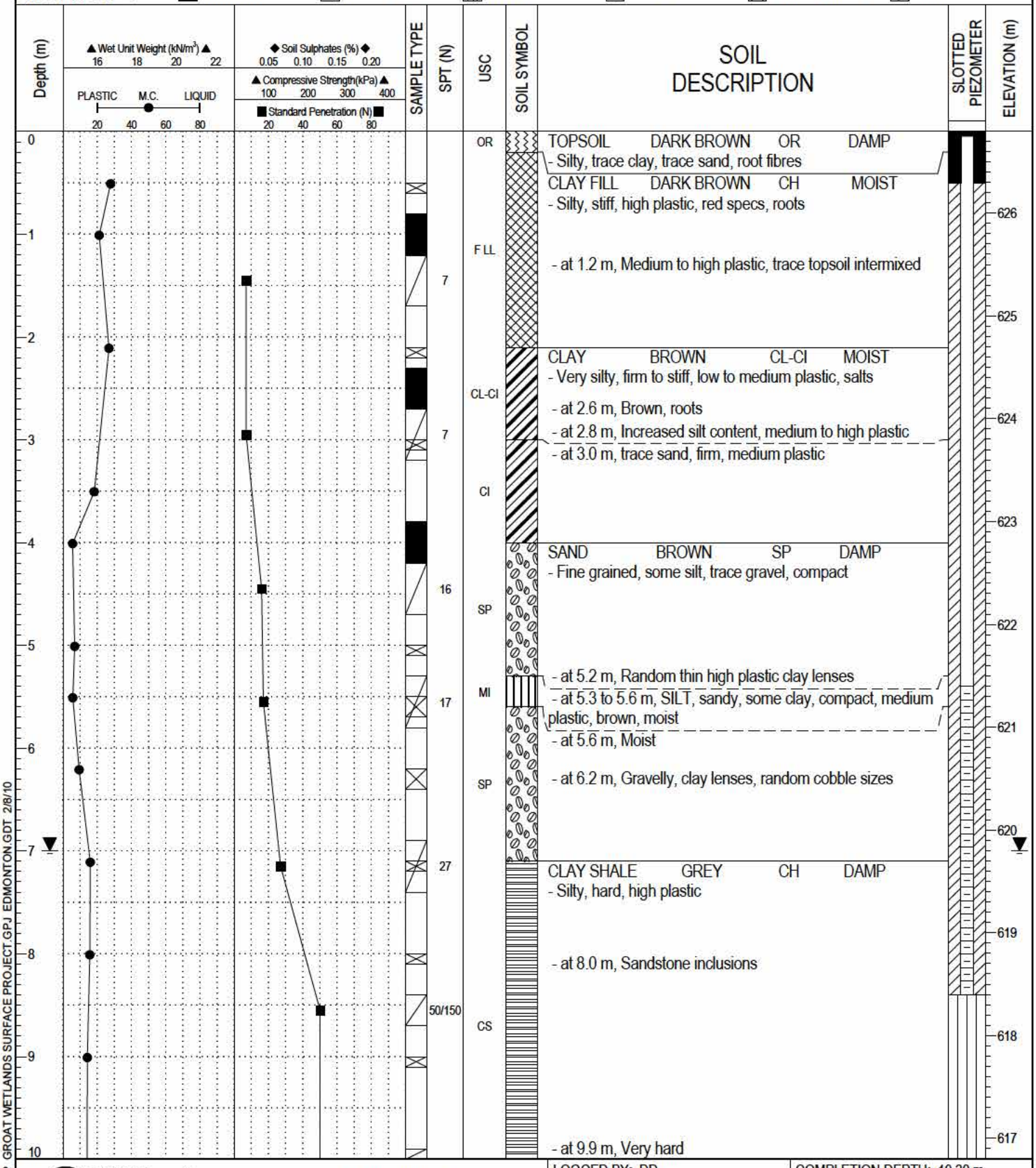
Transportation
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 10.40 m
REVIEWED BY: KMT	COMPLETION DATE:2009/09/30

GROAT SURFACE WETLAND PROJECT	West of Groat Road North Side of Sask. River	BOREHOLE NO: **09-13**
DRAINAGE SERVICES	UTM ZONE: - N5934081.08 E30527.91	PROJECT NO: 60007944 - 0010
START DATE: 2009/09/30	934 + 32 + 02 / 934 + 32 + 03	ELEVATION: 626.795 m

SAMPLE TYPE: Shelby Tube | Drive Sample | Auger Sample | No Recovery | A Casing | Cored Sample

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND



STANDP P GROAT WETLANDS SURFACE PROJECT.GPJ EDMONTON.GDT 2/8/10

THE CITY OF Edmonton

Transportation
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 10.30 m
REVIEWED BY: KMT	COMPLETION DATE:2009/09/30

GROAT SURFACE WETLAND PROJECT	West of Groat Road North Side of Sask. River	BOREHOLE NO: **09-13**
DRAINAGE SERVICES	UTM ZONE: - N5934081.08 E30527.91	PROJECT NO: 60007944 - 0010
START DATE: 2009/09/30	934 + 32 + 02 / 934 + 32 + 03	ELEVATION: 626.795 m

SAMPLE TYPE: Shelby Tube; Drive Sample; Auger Sample; No Recovery; A Casing; Cored Sample

BACKFILL TYPE: BENTONITE; PEA GRAVEL; SLOUGH; GROUT; DRILL CUTTINGS; SAND

Wet Unit Weight (kN/m³): 16 18 20 22

PLASTIC M.C. LIQUID

20 40 60 80

Soil Sulphates (%): 0.05 0.10 0.15 0.20

Compressive Strength(kPa): 100 200 300 400

Standard Penetration (N): 20 40 60 80

Depth (m)	SAMPLE TYPE	SPT (N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SLOTTED PIEZOMETER	ELEVATION (m)
10		50/125			CLAY SHALE GREY CH DAMP		
					End of Borehole at 10.3 m - Borehole dry, slough at 8.4 m on completion - Water level at 7.0 m on December 22, 2009 - Installed 25 mm PVC standpipe to 8.4 m - Backfilled with drill cuttings, bentonite surface seal		
11							616
12							615
13							614
14							613
15							612
16							611
17							610
18							609
19							608
20							607

STANDP P GROAT WETLANDS SURFACE PROJECT.GPJ EDMONTON.GDT 2/8/10

THE CITY OF Edmonton

Transportation
Engineeering Services Section

LOGGED BY: DD	COMPLETION DEPTH: 10.30 m
REVIEWED BY: KMT	COMPLETION DATE:2009/09/30

Groat Road Bridges Rehabilitation Project: Roadworks at Groat Road Interchange Environmental Impact Assessment

Draft Report

Prepared for:

City of Edmonton Transportation Planning & Design and Transportation Infrastructure Delivery
Edmonton, Alberta

Prepared by:

Spencer Environmental Management Services Ltd.
Edmonton, Alberta

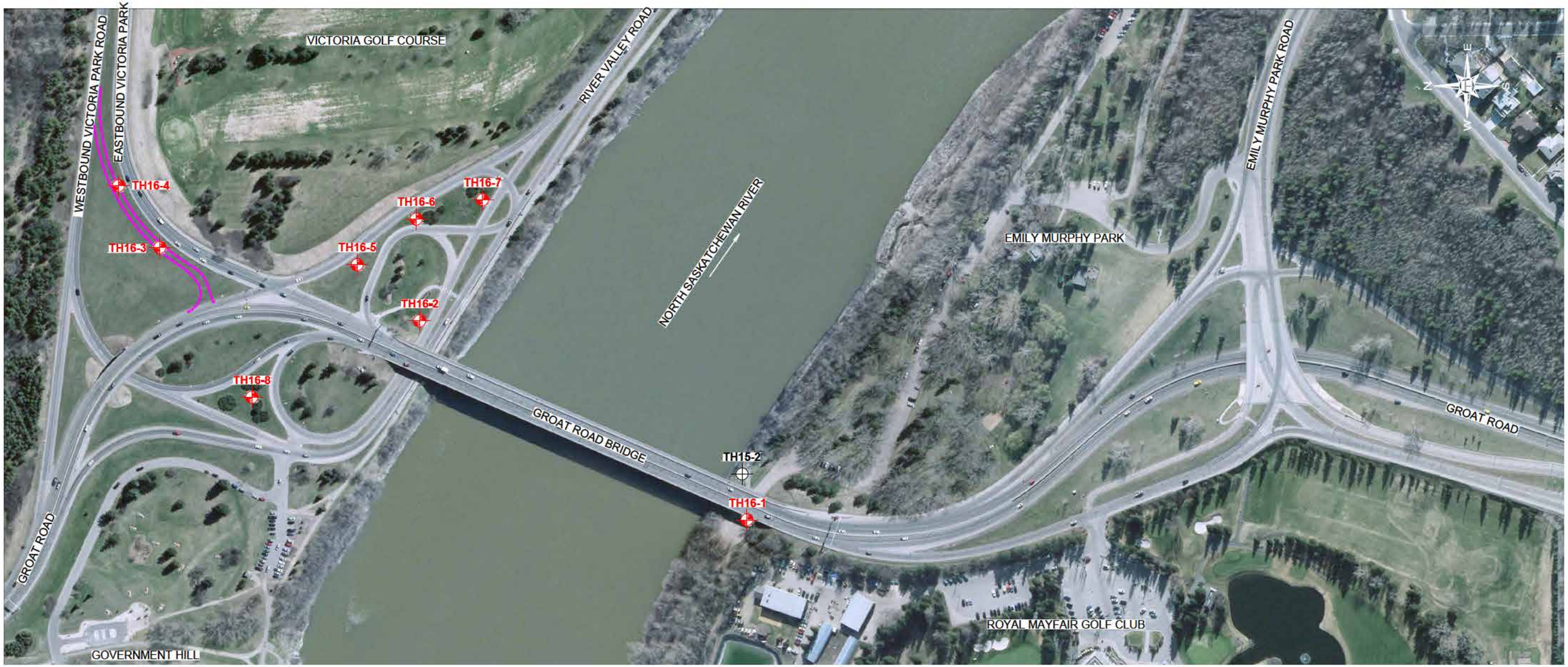
Under contract to:

DIALOG
Edmonton, Alberta

Project Number EP 667

March 2017

H:\10000\10298 Groat Road River Bridge Rehabilitation & Associated Road Work\Drafting\10298-1-2.dwg - 1 - Jul. 08, 2016



BASE PLAN PROVIDED BY CITY OF EDMONTON TRANSPORTATION DEPARTMENT

LEGEND

- APPROXIMATE TEST HOLE LOCATION (2016)
- APPROXIMATE TEST HOLE LOCATION (2015)
- PROPOSED WESTBOUND VICTORIA PARK ROAD TO NORTHBOUND GROAT ROAD RAMP

0 25 50 75 100 150 200 m

SCALE 1:3000

DIALOG

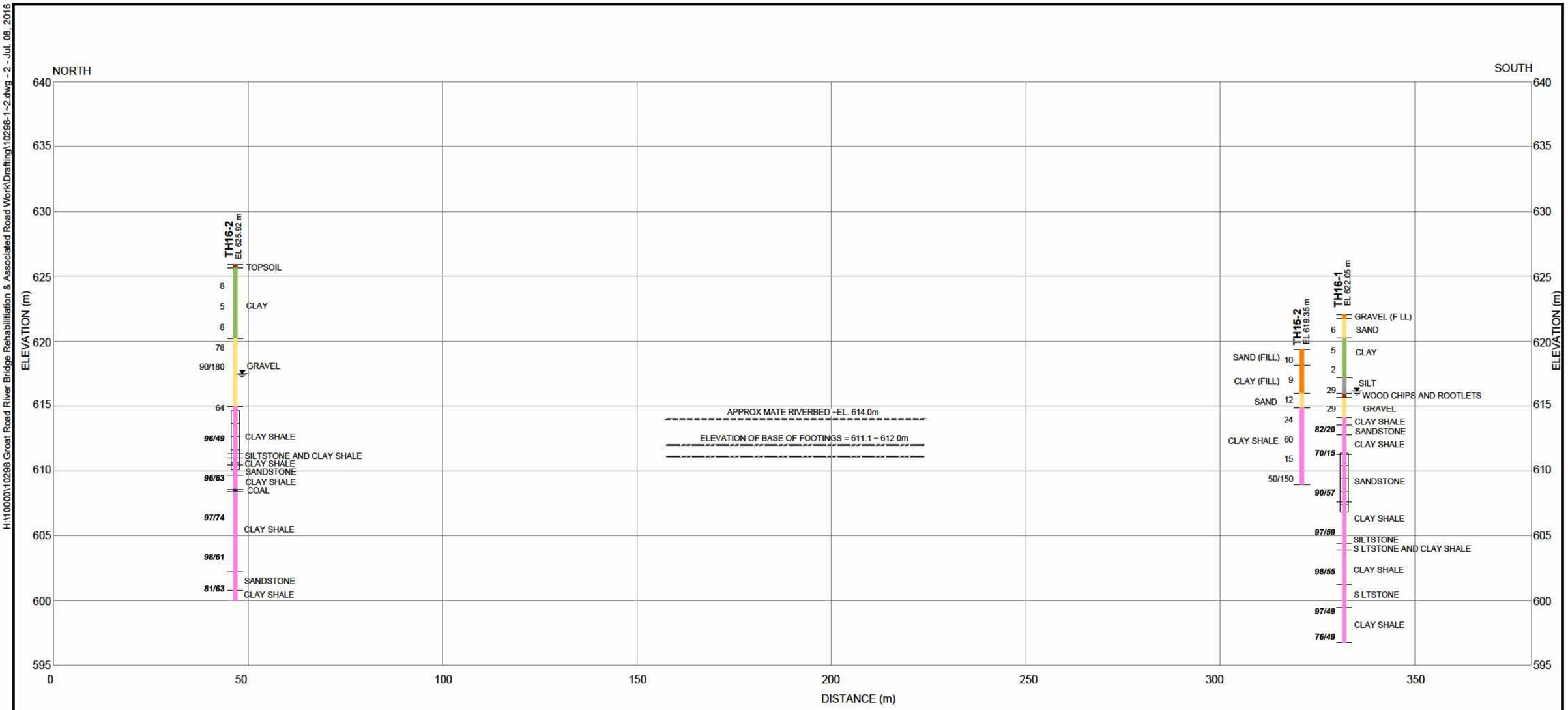
GROAT ROAD BRIDGE REHABILITATION

SITE PLAN SHOWING TEST HOLE LOCATIONS

DWG No. 10298-1

DRAWN BY	ML
DESIGNED BY	SEC
APPROVED BY	HER
SCALE	1:3000
DATE	JUNE 2016
FILE No.	10298

THURBER ENGINEERING LTD.



LEGEND

- 15 — SPT N VALUE
- 13/38 — RQD / RECOVERY %
- WATER LEVEL IN PIEZOMETER
- STANDPIPE PIEZOMETER SCREENED INTERVAL

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

DIALOG

GROAT ROAD BRIDGE REHABILITATION

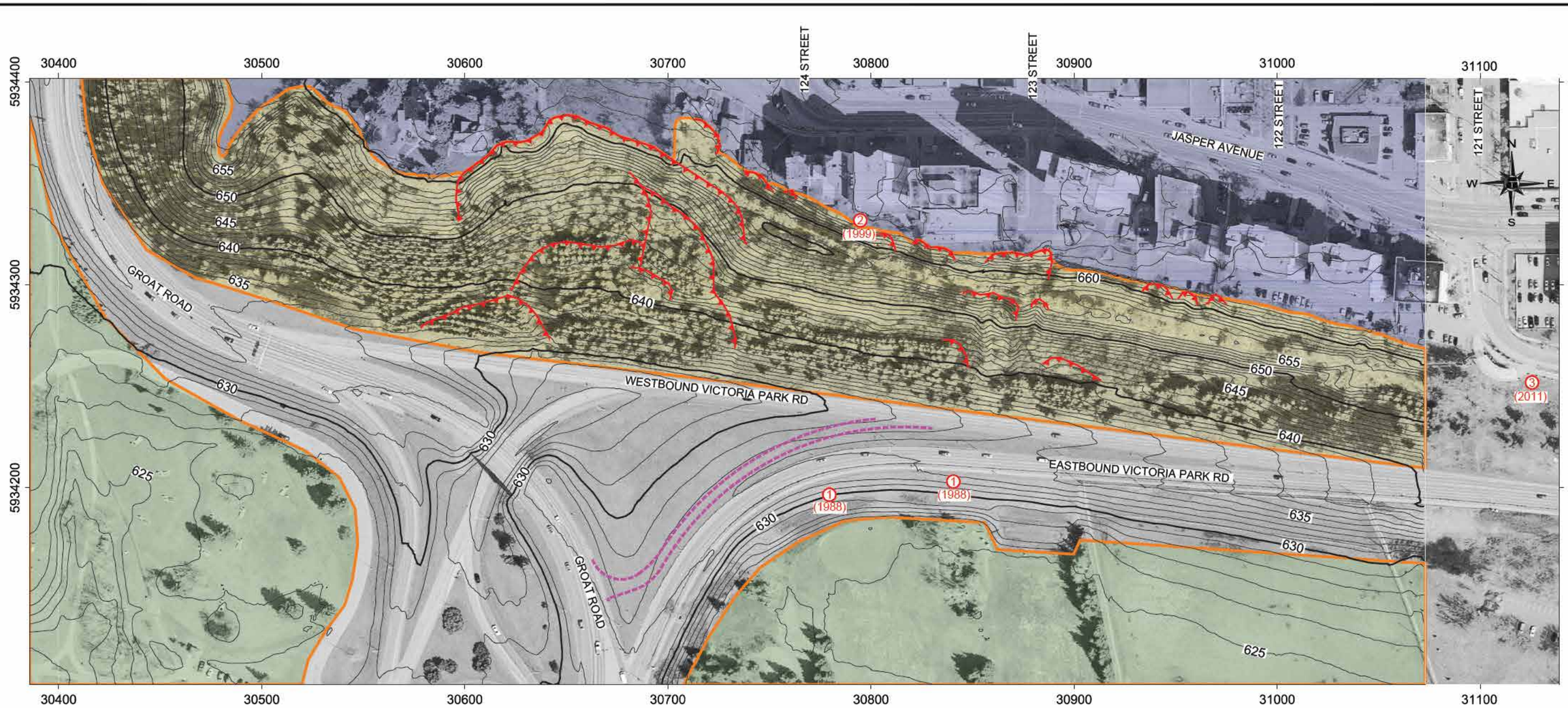
STRATIGRAPHIC CROSS - SECTION

DWG No. 10298-2

DRAWN BY	ML
DESIGNED BY	SEC
APPROVED BY	HER
SCALE	H 1:1000 V 1:300
DATE	JUNE 2016
FILE No.	10298

THURBER ENGINEERING LTD.

H:\10000\10298 Groat Road River Bridge Rehabilitia ion & Associated Road Work\Drafting\10298-3.dwg - 3 - Jul. 08, 2016



LEGEND

- ROADS, FILL
- ALLUVIUM DEPOSITS
- COLLUVIUM
- GLACIOLACUSTRINE DEPOSITS; SILT, CLAY, SAND
- SCARP
- 630 GROUND SURFACE (CONTOURS 1m)
- ① (1988) SLOPE INSTABILITY REPORTED IN 1988
- PROPOSED WESTBOUND VICTORIA PARK ROAD TO NORTHBOUND GROAT ROAD RAMP

Reference:
L. A. Bayrock. Surficial Geology Edmonton. NTS 83H A berta Research 1972.

0 20 40 60 80 100 120m
SCALE 1:2000

DIALOG

GROAT ROAD BRIDGE REHABILITATION

SURFICIAL GEOLOGY MAP

DWG NO. 10298-3

DRAWN BY	ML
DESIGNED BY	MJB
APPROVED BY	HER
SCALE	1:2000
DATE	JUNE 2016
FILE No.	10298

THURBER ENGINEERING LTD.

CLIENT: DIALOG	PROJECT: Groat Road River Bridge Rehabilitiation & Associated Road Work	BOREHOLE NO: **TH16-2**
DRILLING COMPANY: Garritty & Baker	DATE DRILLED: April 19, 2016	PROJECT NO: 10298
DRILL/METHOD: Wet Rotary / Coring	LOCATION: N5933991.67, E30656.47	ELEVATION: 625.92 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | SAND

DEPTH (m)	SAMPLE TYPE	RQD/REC	▲RECOVERY %▲ 20 40 60 80 ■RQD %■ 20 40 60 80 PLASTIC M.C. LIQUID 10 20 30 40	DISCONTINUITIES DESCRIPTION	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
0								TOPSOIL, black, organics and rootlets	
			67.7			CI		CLAY grey to brown, silty	
						CI			
1									625
								-stiff, occasional silt laminae	
				-CPEN = 120kPa SPT N = 8		CI			
2									624
						CI			
3								-grey, sandy	623
				-CPEN = 120kPa					
				-SO_4 = 0.0%				-firm, very silty	
				-CPEN = 72kPa SPT N = 5		CI			
4									622
								-stiff, occasional oxides, 200 mm thick silty clayey sand layer	
				-SPT N = 8		CI			
5									621

THURBER ENGINEERING LTD.

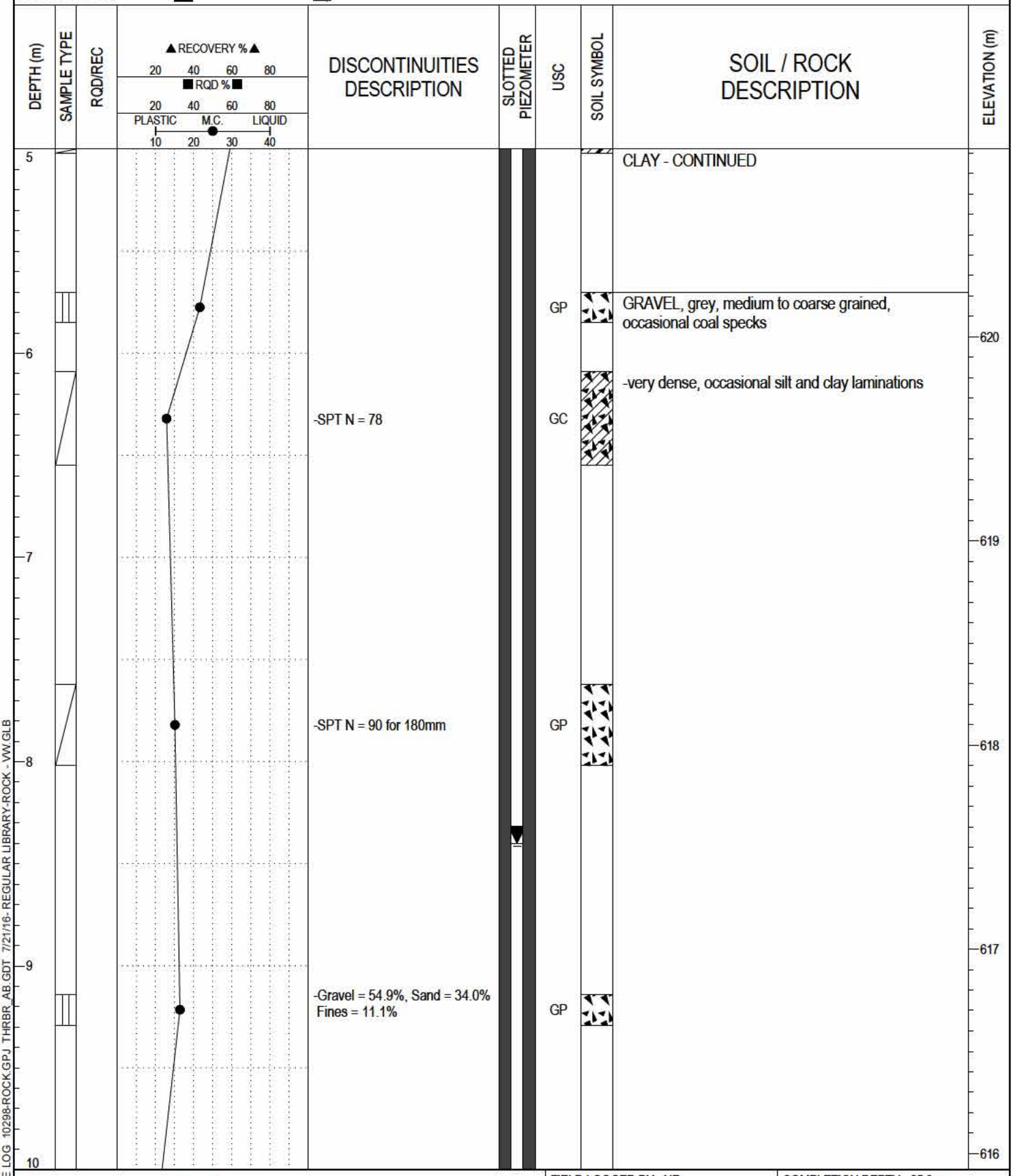
FIELD LOGGED BY: NR	COMPLETION DEPTH: 25.9 m
PREPARED BY: SEC	COMPLETION DATE: 4/19/16
REVIEWED BY: HER	Page 1 of 6

BOREHOLE LOG 10298-ROCK.GPJ THRBR_AB.GDT 7/21/16- REGULAR LIBRARY-ROCK - VW.GLB

CLIENT: DIALOG	PROJECT: Groat Road River Bridge Rehabilitiation & Associated Road Work	BOREHOLE NO: **TH16-2**
DRILLING COMPANY: Garritty & Baker	DATE DRILLED: April 19, 2016	PROJECT NO: 10298
DRILL/METHOD: Wet Rotary / Coring	LOCATION: N5933991.67, E30656.47	ELEVATION: 625.92 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | SAND



BOREHOLE LOG 10298-ROCK.GPJ THRBR_AB.GDT 7/21/16- REGULAR LIBRARY-ROCK - VW.GLB

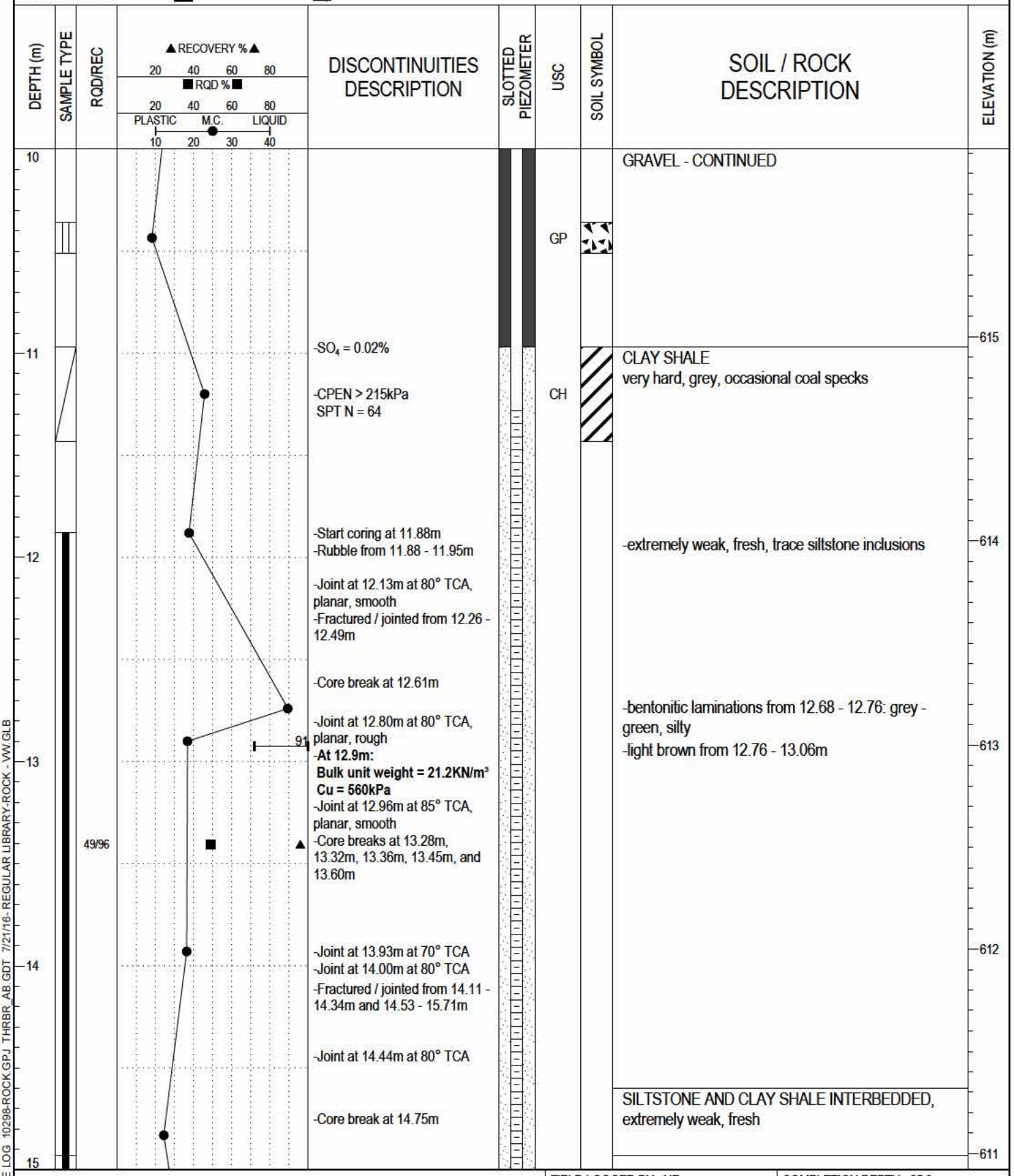
THURBER ENGINEERING LTD.

FIELD LOGGED BY: NR	COMPLETION DEPTH: 25.9 m
PREPARED BY: SEC	COMPLETION DATE: 4/19/16
REVIEWED BY: HER	Page 2 of 6

CLIENT: DIALOG	PROJECT: Groat Road River Bridge Rehabilitiation & Associated Road Work	BOREHOLE NO: **TH16-2**
DRILLING COMPANY: Garritty & Baker	DATE DRILLED: April 19, 2016	PROJECT NO: 10298
DRILL/METHOD: Wet Rotary / Coring	LOCATION: N5933991.67, E30656.47	ELEVATION: 625.92 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | SAND



BOREHOLE LOG 10298-ROCK.GPJ THRBR_AB.GDT 7/21/16- REGULAR LIBRARY-ROCK - VW.GLB

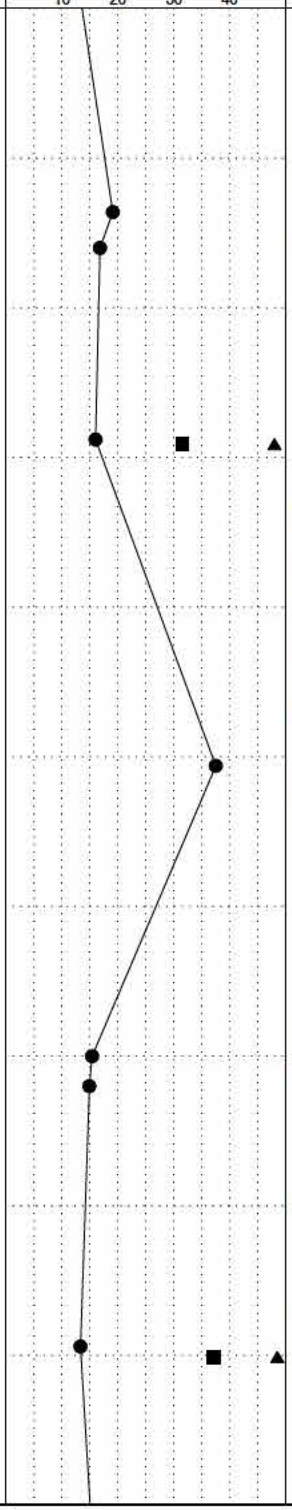
THURBER ENGINEERING LTD.

FIELD LOGGED BY: NR	COMPLETION DEPTH: 25.9 m
PREPARED BY: SEC	COMPLETION DATE: 4/19/16
REVIEWED BY: HER	Page 3 of 6

CLIENT: DIALOG	PROJECT: Groat Road River Bridge Rehabilitiation & Associated Road Work	BOREHOLE NO: **TH16-2**
DRILLING COMPANY: Garritty & Baker	DATE DRILLED: April 19, 2016	PROJECT NO: 10298
DRILL/METHOD: Wet Rotary / Coring	LOCATION: N5933991.67, E30656.47	ELEVATION: 625.92 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | SAND



DEPTH (m)	SAMPLE TYPE	RQD/REC	DISCONTINUITIES DESCRIPTION	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
15			-Joint at 15.10m at 60° TCA				CLAY SHALE, extremely weak, fresh, brown, trace siltstone / sandstone inclusions and siltstone clasts	
			-Core breaks at 15.41m, 15.68m, 15.70m, 15.93m, and 16.44m				SANDSTONE extremely weak, fresh, fine grained, silty, bentonitic, trace clay shale laminations and thin coal laminations	
			-**At 15.8m:** **Bulk unit weight = 21.4KN/m³** **Cu = 414kPa**					
16								610
		63/96					CLAY SHALE extremely weak, fresh, brown	
			-Joint at 16.58m at 80° TCA, planar, smooth -Joint at 16.78m at 70° TCA, curved, rough -Rubble from 16.92 - 16.98m					
17			-Joint at 17.06m at 70° TCA, curved, smooth -Joint at 17.17m at 80° TCA, planar, smooth -Core break at 17.29m -Joint at 17.35m at 70° TCA, curved, smooth -Rubble from 17.35 - 17.53m -Core break at 17.59m -Fractured from 17.70 - 17.85m					609
							COAL extremely weak, fresh	
							CLAY SHALE, very weak, fresh, highly carbonaceous, some coal -trace bentonite lenses	
18								608
							-brown, trace coal inclusions and siltstone clasts	
			-Joints at 18.29m, 18.38m, 18.50m, and 18.72m at 80° TCA					
			-**At 18.6m:** **Bulk unit weight = 21.5KN/m³** **Cu = 1661kPa**					
							Siltstone, very weak, fresh, cemented	607
19			-Joint at 18.91m at 70° TCA, irregular, rough -Joint at 18.98m at 80° TCA, curved, smooth -Joint at 19.23m at 80° TCA, planar, smooth					
		74/97	-Core breaks at 19.47m, 19.75m, 19.89m, and 20.22m				-grey, trace siltstone clasts and coal inclusions from 19.47 - 20.50m	
20								606

BOREHOLE LOG 10298-ROCK.GPJ THRBR_AB.GDT 7/21/16- REGULAR LIBRARY-ROCK - VW.GLB

THURBER ENGINEERING LTD.

FIELD LOGGED BY: NR	COMPLETION DEPTH: 25.9 m
PREPARED BY: SEC	COMPLETION DATE: 4/19/16
REVIEWED BY: HER	Page 4 of 6

CLIENT: DIALOG	PROJECT: Groat Road River Bridge Rehabilitiation & Associated Road Work	BOREHOLE NO: **TH16-2**
DRILLING COMPANY: Garritty & Baker	DATE DRILLED: April 19, 2016	PROJECT NO: 10298
DRILL/METHOD: Wet Rotary / Coring	LOCATION: N5933991.67, E30656.47	ELEVATION: 625.92 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | SAND

DEPTH (m)	SAMPLE TYPE	RQD/REC	▲RECOVERY %▲ 20 40 60 80 ■RQD %■ 20 40 60 80 PLASTIC M.C. LIQUID 10 20 30 40	DISCONTINUITIES DESCRIPTION	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
20								CLAY SHALE - CONTINUED	
				-Joint at 20.30m at 60° TCA, curved, rough, slickensided -Joint at 20.38m at 60° TCA, curved, smooth -Joint at 20.47m at 50° TCA, curved, smooth -Core break at 20.60m -Joint at 20.84m at 80° TCA, curved, smooth -Joints at 20.93m and 21.38m at 70° TCA, stepped, smooth					
21								Siltstone, medium strong, fresh, cemented -trace siltstone and coal inclusions	605
				-Fractured / jointed from 21.78 - 21.98m -Joint at 21.84m at 50° TCA, curved, smooth -Joint at 21.93m at 40° TCA, curved, smooth -Joints from 21.98 - 22.15m at 10° TCA, irregular, rough -Joint at 22.16m at 80° TCA, planar, rough -Joints from 22.16 - 22.31m at 15° TCA, closed -Joint at 22.33m at 60° TCA, curved, smooth -Joints from 22.37 - 22.52m at 25° TCA, curved, smooth -Core break at 22.60m -Joint at 22.64m at 60° TCA, undulating, smooth -Joint at 23.20m at 80° TCA, planar, smooth -Core break at 23.25m -Joint at 23.52m at 80° TCA, curved, rough				-carbonaceous -highly carbonaceous from 21.98 - 22.15m	604
22		61/98							
23								Sandstone very weak, fresh, fine grained, bentonitic, trace coal inclusions and clay shale / siltstone laminations	603
24				-Joint at 23.89m at 80° TCA -Core break at 24.27m				SANDSTONE very weak, fresh, fine grained, bentonitic, trace thin coal laminations -trace siltstone inclusions and clay shale laminations -calcareous from 24.27 - 24.43m	602
25				-Joint at 24.63m at 85° TCA, planar, smooth -Joint at 24.84m at 70° TCA, curved, rough					601

BOREHOLE LOG 10298-ROCK.GPJ THRBR_AB.GDT 7/21/16- REGULAR LIBRARY-ROCK - VW.GLB

THURBER ENGINEERING LTD.

FIELD LOGGED BY: NR	COMPLETION DEPTH: 25.9 m
PREPARED BY: SEC	COMPLETION DATE: 4/19/16
REVIEWED BY: HER	

CLIENT: DIALOG	PROJECT: Groat Road River Bridge Rehabilitiation & Associated Road Work	BOREHOLE NO: **TH16-2**
DRILLING COMPANY: Garritty & Baker	DATE DRILLED: April 19, 2016	PROJECT NO: 10298
DRILL/METHOD: Wet Rotary / Coring	LOCATION: N5933991.67, E30656.47	ELEVATION: 625.92 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | SAND

DEPTH (m)	SAMPLE TYPE	RQD/REC	▲RECOVERY %▲ 20 40 60 80 / ■RQD %■ 20 40 60 80 / PLASTIC M.C. LIQUID 10 20 30 40	DISCONTINUITIES DESCRIPTION	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
25		63/81		-Joints from 24.99 - 25.12m at 5° TCA, closed -Fractured / jointed from 25.12 - 25.22m -Joint at 25.56m at 40° TCA, curved, smooth				-medium strong, cemented, calcareous from 24.99 - 25.12m CLAY SHALE, very weak, fresh, brown - grey -cemented siltstone clasts	
26								END OF TEST HOLE AT 25.9m UPON COMPLETION: Standpipe piezometer installed WATER LEVEL BELOW GROUND SURFACE: -May 3, 2016 = 7.9m -May 18, 2016 = 8.4m	600
27									599
28									598
29									597
30									596

THURBER ENGINEERING LTD.

FIELD LOGGED BY: NR	COMPLETION DEPTH: 25.9 m
PREPARED BY: SEC	COMPLETION DATE: 4/19/16
REVIEWED BY: HER	Page 6 of 6

BOREHOLE LOG 10298-ROCK.GPJ THRBR_AB.GDT 7/21/16- REGULAR LIBRARY-ROCK - VW.GLB

THURBER ENGINEERING LTD.

WALTERDALE BRIDGE REPLACEMENT
EDMONTON, ALBERTA
GEOTECHNICAL INVESTIGATION

Report

to

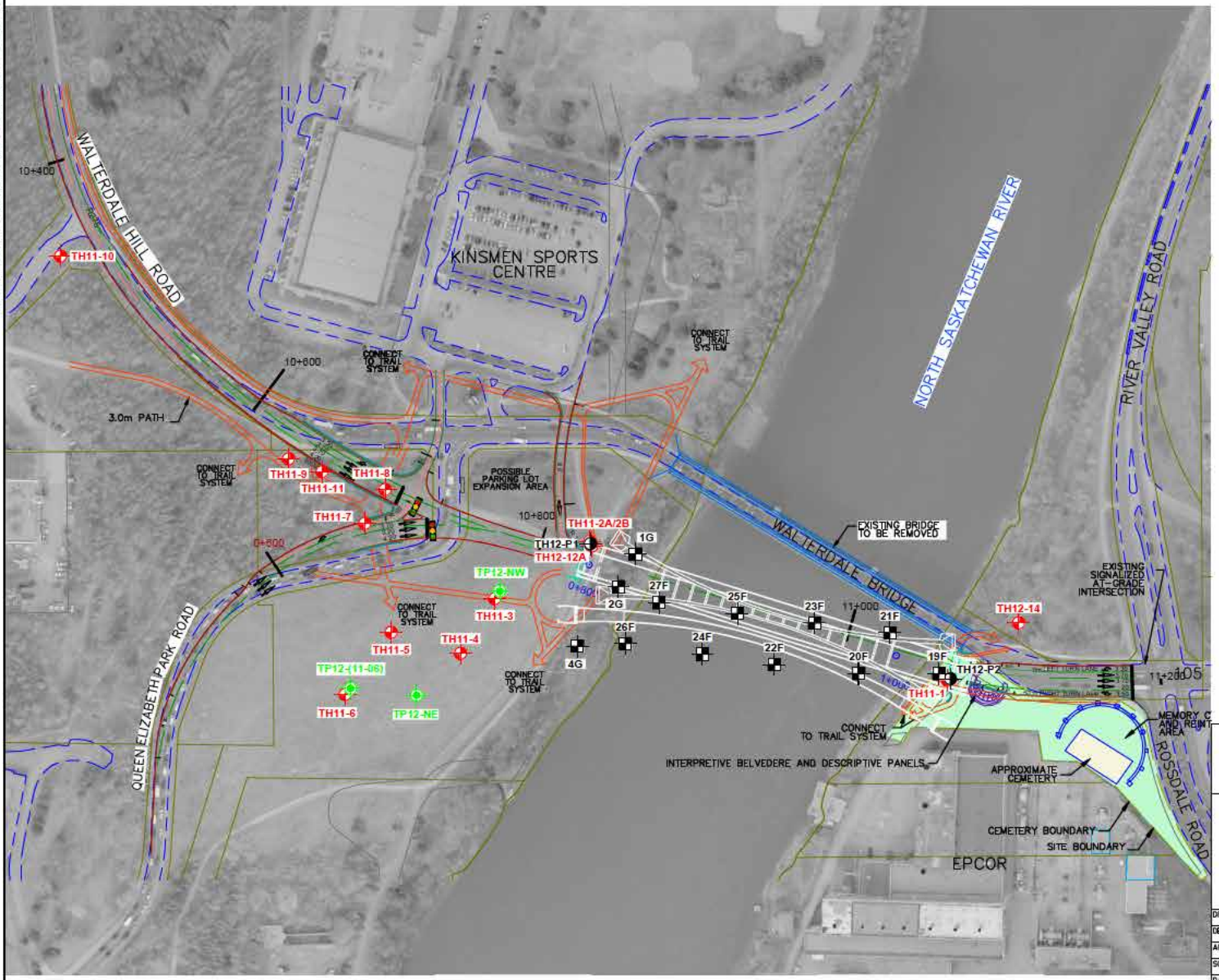
ISL Engineering and Land Services

Xiaobo Wang, Ph.D., P.Eng.
Senior Project Engineer

Hassan El-Ramly, P.Eng., Ph.D.
Review Principal

Date: January 31, 2013
File: 19-598-370

200, 9636 - 51 Avenue, Edmonton, AB T6E 6A5 T: 780 438 1460 F: 780 437 7125
thurber.ca



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LEGEND

- RECENT GEOTECHNICAL TEST HOLE LOCATION (THURBER, 2011/2012)
- PREVIOUS GEOTECHNICAL TEST HOLE LOCATION - APPROXIMATE (R. M. HARDY & ASSOCIATES, 1965)
- GEOTECHNICAL TEST PIT LOCATION (THURBER 2012)
- PRESSUREMETER TEST LOCATION

NOTE:
BASE PLAN PROVIDED BY AL-TERRA ENGINEERING LTD. IN AUGUST 2011

0 25 50 75 100 125 150m
SCALE 1:2500

ISL Engineering and Land Services

WALTERDALE BRIDGE REPLACEMENT
DETAILED DESIGN & CONSTRUCTION

SITE PLAN SHOWING GEOTECHNICAL TEST HOLE LOCATIONS

19-598-370-1

DRAWN BY	ML
DESIGNED BY	RFM
APPROVED BY	HER
SCALE	1:2500
DATE	JULY 2012
FILE No.	19-598-370

THURBER ENGINEERING LTD.

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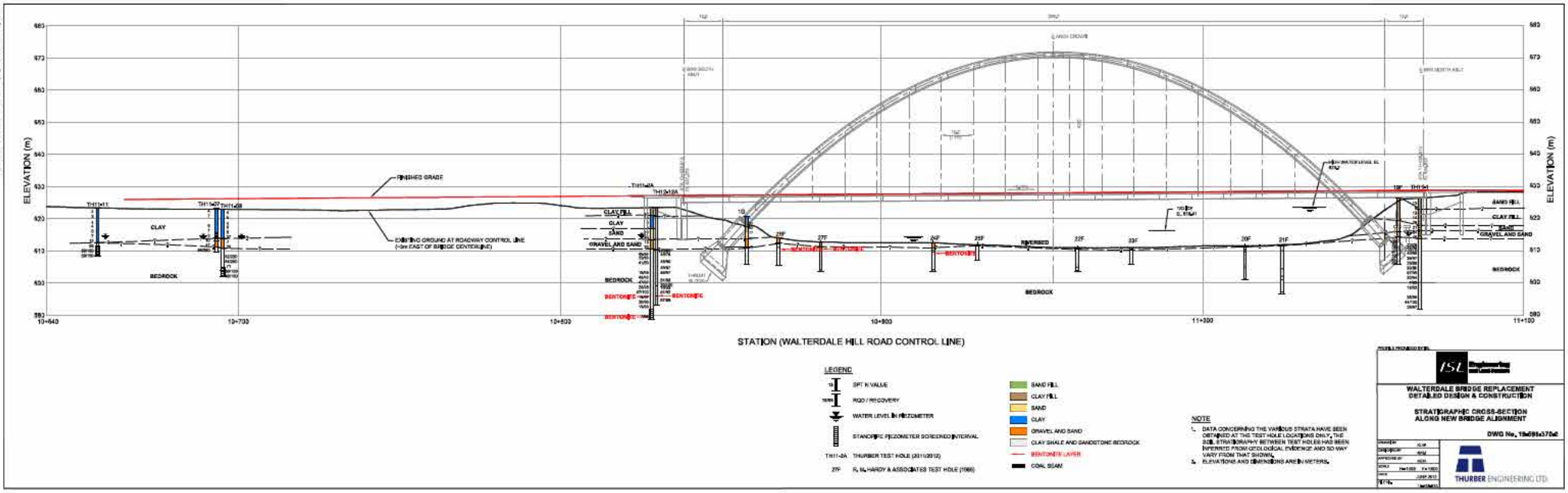


LEGEND

- SPT N VALUE
- RQD / RECOVERY
- WATER LEVEL IN PIEZOMETER
- STANDPIPE PIEZOMETER SCREENED INTERVAL
- TH11-2A THURBER TEST HOLE (2011/2012)
- 27F R. M. HARDY & ASSOCIATES TEST HOLE (1968)
- SAND FILL
- CLAY FILL
- SAND
- CLAY
- GRAVEL AND SAND
- CLAY SHALE AND SANDSTONE BEDROCK
- BENTONITE LAYER
- COAL SEAM

NOTE

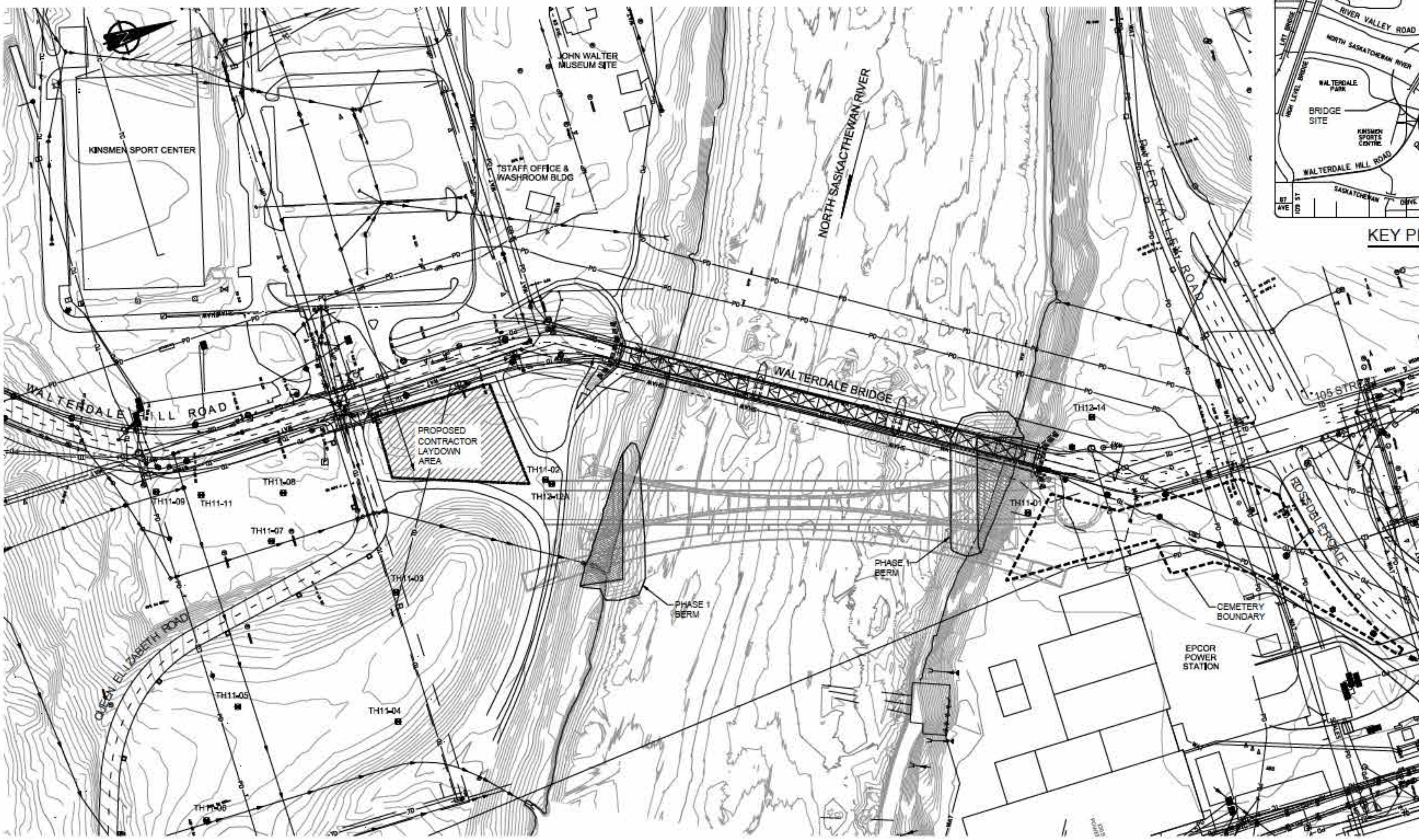
1. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.
2. ELEVATIONS AND DIMENSIONS ARE IN METERS.

WALTERDALE BRIDGE REPLACEMENT
DETAILED DESIGN & CONSTRUCTION

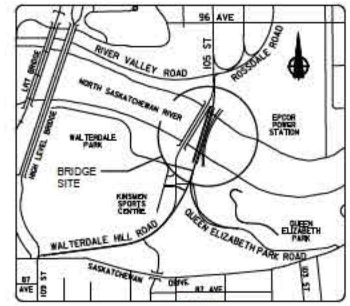
STRATIGRAPHIC CROSS-SECTION
ALONG NEW BRIDGE ALIGNMENT

DWG No. 19e89e378e2

THURBER ENGINEERING LTD.



EXISTING SITE PLAN
1:1000



KEY PLAN
1:10000

NO.	REVISIONS	BY	DATE	APP'D
1	90% PROGRESS – ISSUED FOR CLIENT REVIEW	JC	12 11 16	

PROGRAM NO.
CONTRACT NO.

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER

DESIGNER

APPROVED FOR CONSTRUCTION

CHECKER

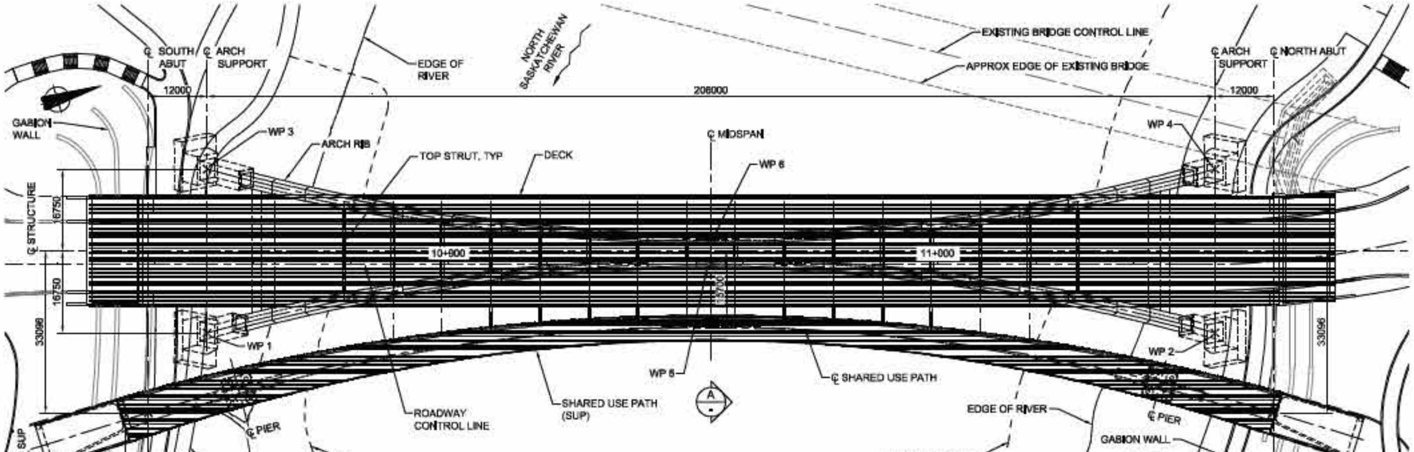
ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
AL-Terra

DRAWN: WT SMITH 11 OCT 2012
DESIGNED: J CHAPMAN
SCALE: AS SHOWN

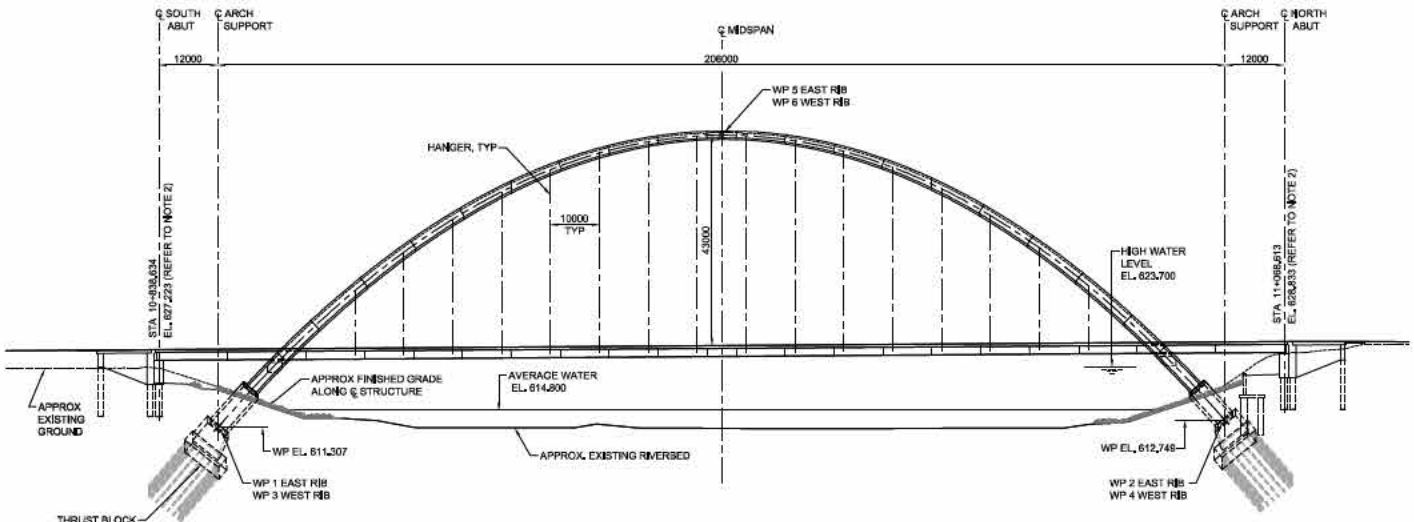
The City of Edmonton
TRANSPORTATION SERVICES DEPARTMENT
ROADS DESIGN AND CONSTRUCTION BRANCH

WALTERDALE BRIDGE
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
EXISTING SITE PLAN

WALT 131 S005

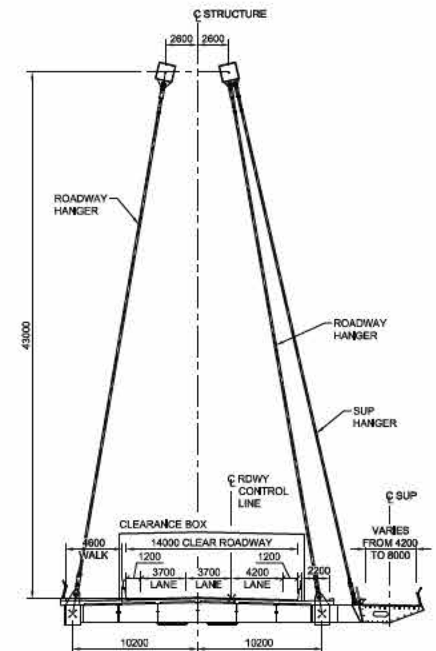


PLAN
1:500



NOTE:
SHARED USE PATH NOT SHOWN FOR CLARITY.
REFER TO DRAWING S007 FOR SUP GENERAL ARRANGEMENT.

ELEVATION
LOOKING WEST 1:500



SECTION
1:200

NOTES:

1. FOR GENERAL NOTES REFER TO DRAWING S002.
2. ELEVATIONS AND STATIONS AT ABUTMENTS ARE GIVEN AT ROADWAY CONTROL LINE. FOR ROADWAY ALIGNMENT AND PROFILE REFER TO DRAWING S009.

NO.	REVISIONS	BY	DATE	APPD
7				
6				
5				
4				
3				
2				
1	ISSUED FOR TENDER	AG	2013_01_29	

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

NO.	ISSUE	BY	DATE
3	TO QA/QC		
2	AS BUILT		
1	[illegible]		

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER
APEGA PERMIT NUMBER

APEGA PERMIT TO PRACTICE
APPROVED FOR CONSTRUCTION

CHECKER

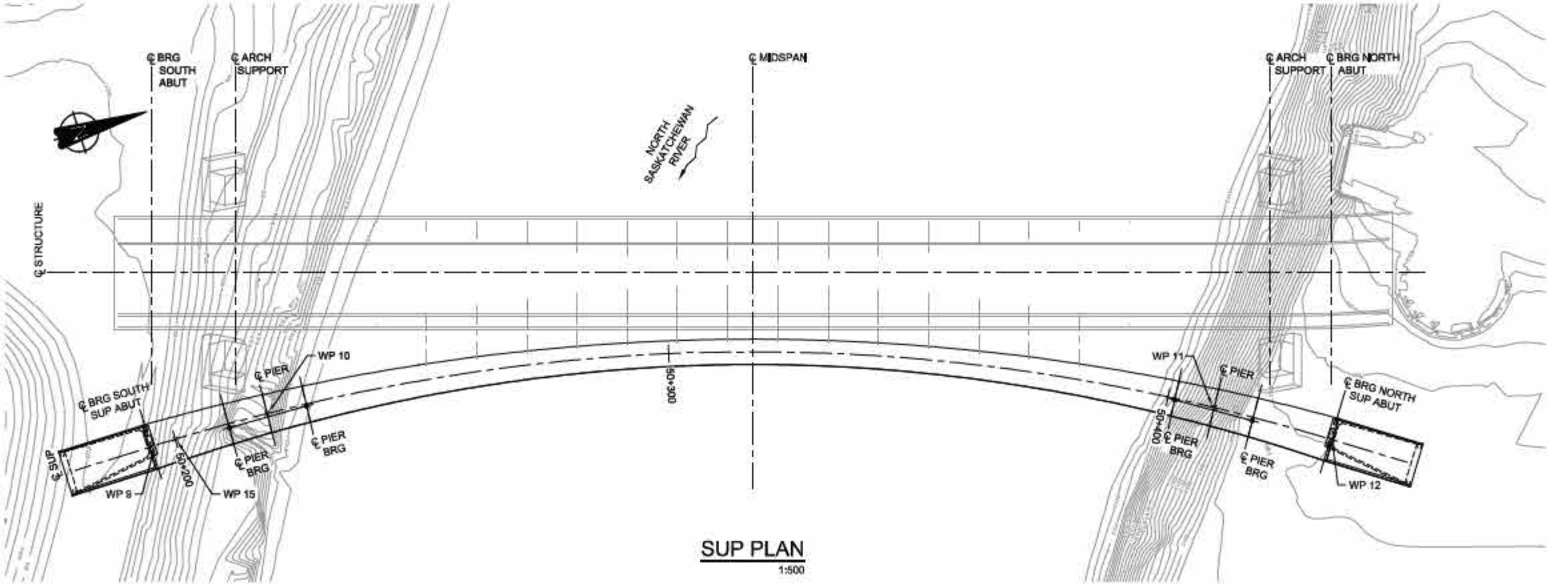
ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD.
a COWI company
Al-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE
SURVEY
JOB No. 1331
SCALE AS NOTED
DRAWN JE 2013-01-14
DESIGNED AG 2013-01-14
CHECKED DATE

The City of Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

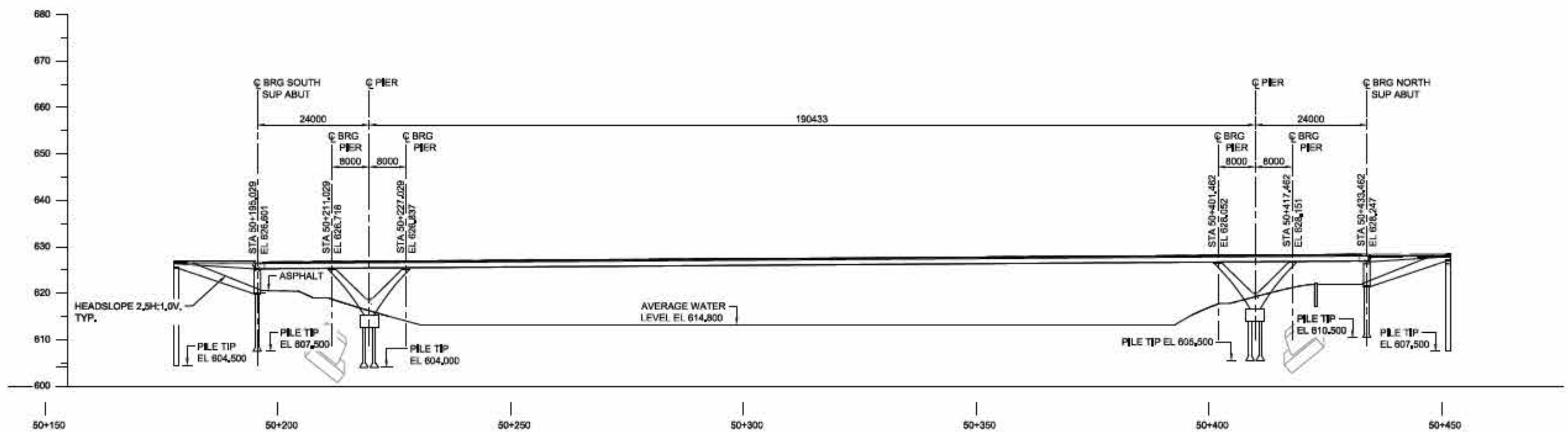
PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
GENERAL ARRANGEMENT

DRAWING
WALT 131 S006



SUP PLAN

1:500



SUP ELEVATION

LOOKING WEST ALONG ℄ SUP 1:500

NO.	REVISIONS	BY	DATE	APP'D
7				
6				
5				
4				
3				
2				
1	ISSUED FOR TENDER	K.L.	2013.01.28	

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

NO.	ISSUE	BY	DATE
3	TO G.A.L.A.		
2	AS BUILT		
1	TENDER AWARD		

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER
PROFESSIONAL ENGINEER KRISTOPHER J. LIMA ALBERTA
APEGA PERMIT #P 10020

PERMIT TO PRACTICE
DIALOG ALBERTA ARCHITECTURE ENGINEERING INTERIOR DESIGN PLANNING INC.
Signature
Date 28 January 2013
PERMIT NUMBER: P 10020
The Association of Professional Engineers and Geoscientists of Alberta

APPROVED FOR CONSTRUCTION

CHECKER

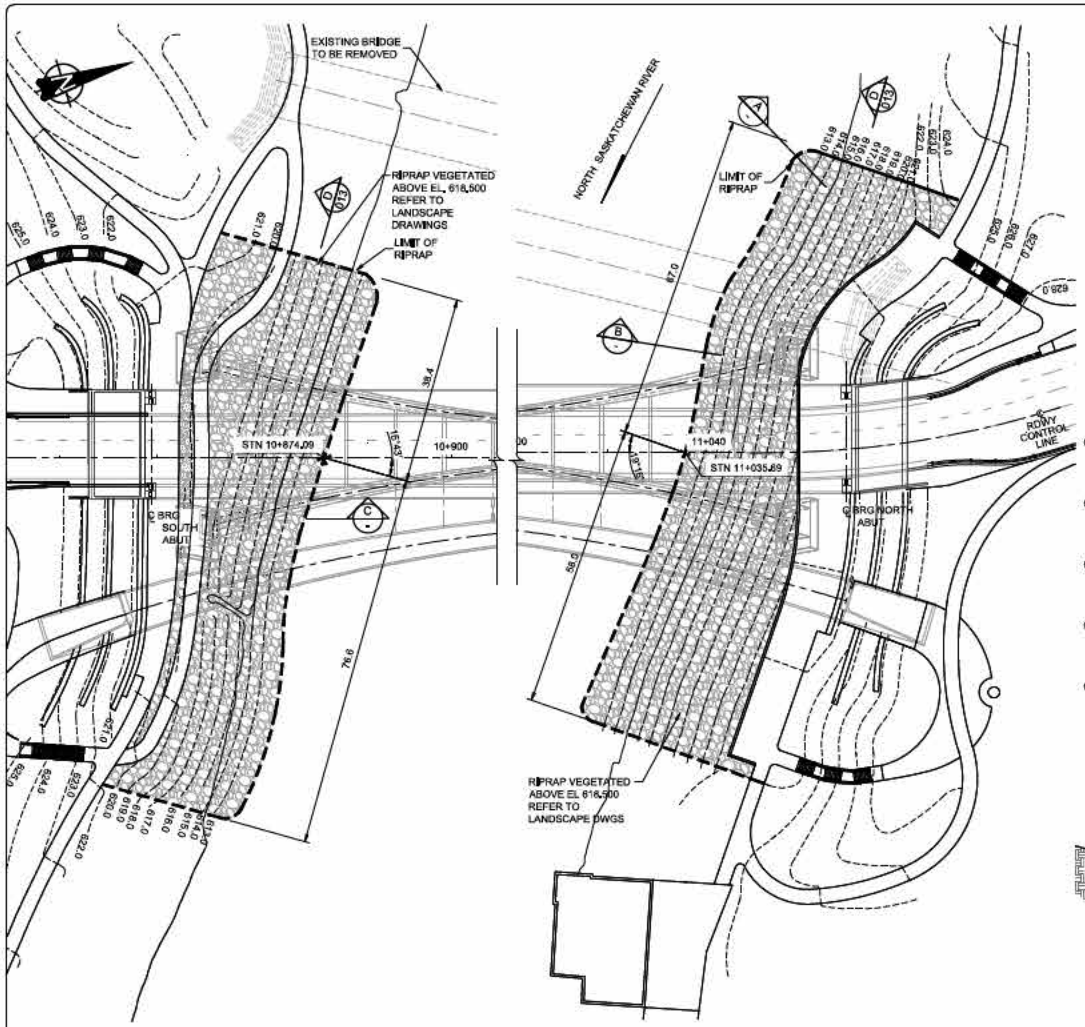
ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
Al-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE
SURVEY
JOB No. 0119050200
SCALE AS NOTED
DRAWN EW DATE 2013.01.28
DESIGNED K.L. DATE 2013.01.28
CHECKED DATE

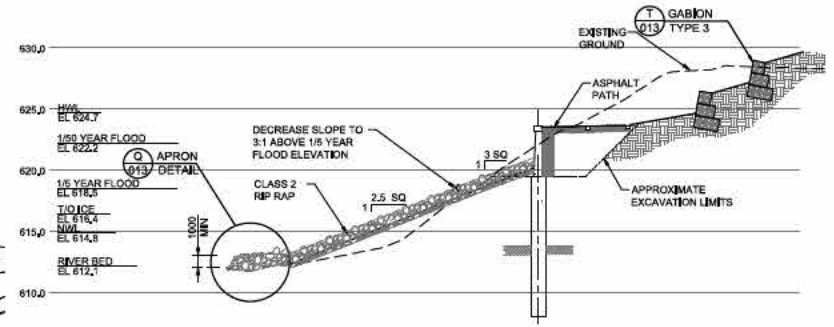
THE CITY OF Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
SUP GENERAL ARRANGEMENT

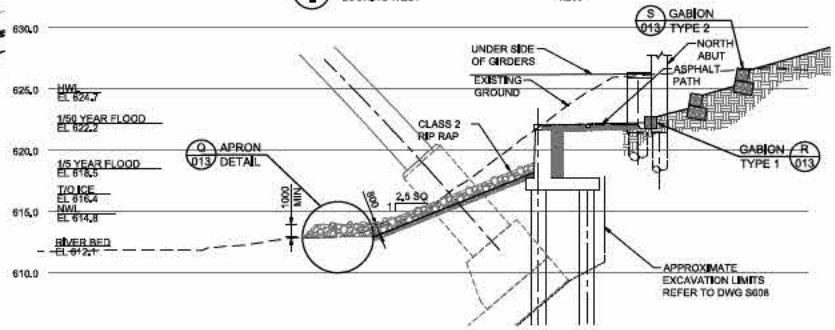
DRAWING
WALT 131 S007



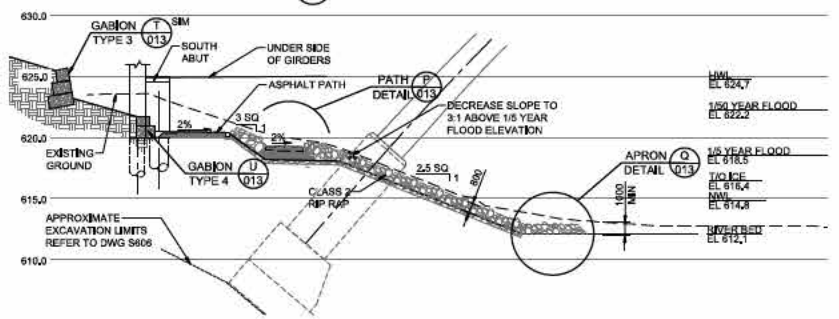
PLAN
1:500



A TYPICAL NORTH BANK
LOOKING WEST 1:200



B NORTH BANK AT ARCHES
LOOKING WEST 1:200



C TYPICAL SOUTH BANK
LOOKING WEST 1:200

NOTE:
1. FOR GENERAL NOTES REFER TO DWG S002 TO S004
2. REFER TO LANDSCAPE DWGS FOR PATH AND GABION WALL LAYOUT INFORMATION

NO.	REVISIONS	BY	DATE	APPD
7	ISSUED FOR TENDER	JC	2013/04/08	JC

NO.	ISSUED	BY	DATE
1	TO CLIENT		
2	AS BUILT		

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER
PROFESSIONAL ENGINEER ALBERTA
January 25, 2013

PERMIT TO PRACTICE
ISL Engineering and Land Services Ltd.
Signature
Date
PERMIT NUMBER: P 4741
The Association of Professional Engineers and Geoscientists of Alberta
APPROVED FOR CONSTRUCTION

CHECKER
PROFESSIONAL ENGINEER ALBERTA
January 25, 2013

ISL Engineering and Land Services
BUCKLAND & TAYLOR ltd
a COWI company
DIALOG
AL-Terra

DIRECTOR OF BRIDGE DESIGN AND CONSTRUCTION DATE
MANAGER OF BRIDGE DESIGN AND CONSTRUCTION DATE

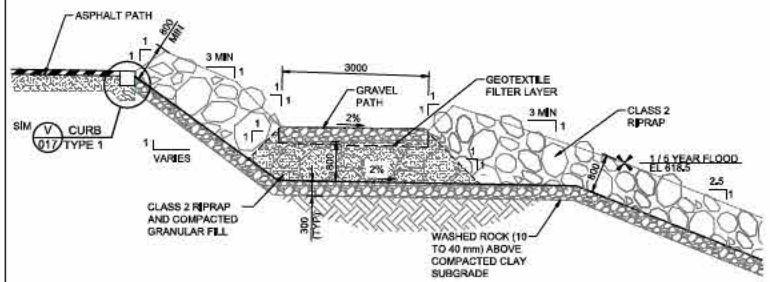
SURVEY
JOB NO. 12310
SCALE AS NOTED

DRAWN W.T. SMITH 2013/04/11
CHECKED J. CHAPMAN 2013/04/08
DESIGNED M.KHATAMI 2013/04/08

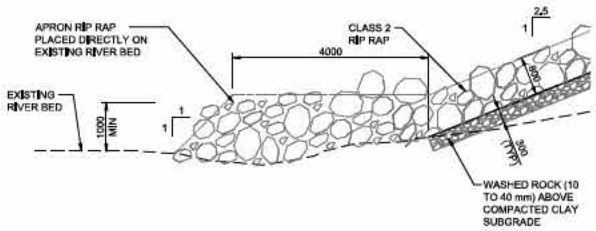
THE CITY OF Edmonton
TRANSPORTATION SERVICES
ROAD DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
SLOPE PROTECTION

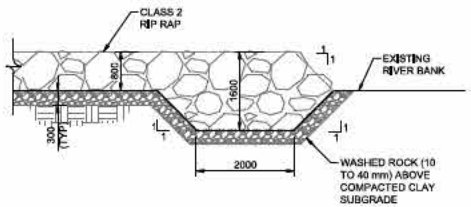
DRAWING
WALT 131 S012



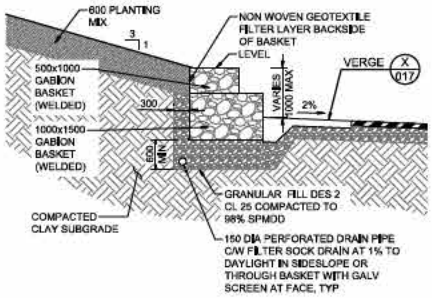
P 012 PATH DETAIL 1:50



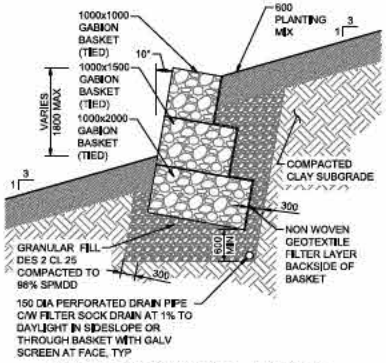
Q 012 APRON DETAIL 1:50



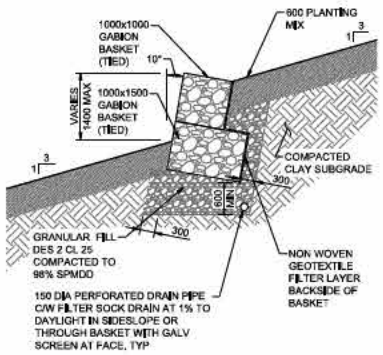
D 012 UPSTREAM EDGE 1:50



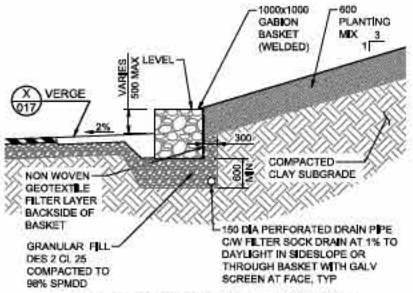
U 012 GABION WALL - TYPE 4 1:50



T 012 GABION WALL - TYPE 3 1:50



S 012 GABION WALL - TYPE 2 1:50



R 012 GABION WALL - TYPE 1 1:50

NOTE:
1. FOR GENERAL NOTES REFER TO DWG S002 TO S004
2. REFER TO LANDSCAPE DWGS FOR INFORMATION ON GABION BASKET ROCK FILL
3. REFER TO LANDSCAPE DWGS FOR PLANTING MIX AND REQUIREMENTS FOR ORGANIC MIX IN CLAY SUBGRADE

NO.	REVISIONS	BY	DATE	APPD
1	ISSUED FOR TENDER	JC	2013/01/28	JC

NO.	ISSUE	BY	DATE
1	TO WORK		
2	AS BUILT		

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
TRAFFIC SUPERVISOR DATE

DESIGNER
PROFESSIONAL ENGINEER ALBERTA
January 25, 2013

PERMIT TO PRACTICE
ISL Engineering and Land Services Ltd.
Signature
Date
PERMIT NUMBER: P 4741
The Association of Professional Engineers and Geoscientists of Alberta
APPROVED FOR CONSTRUCTION

CHECKER
PROFESSIONAL ENGINEER ALBERTA
January 25, 2013

ISL Engineering and Land Services
BUCKLAND & TAYLOR ltd. a COWI company
DIALOG
AL-Terra

DIRECTOR OF BRIDGE DESIGN AND CONSTRUCTION DATE
MANAGER OF BRIDGE DESIGN AND CONSTRUCTION DATE

SURVEY
JOB NO. 12310
SCALE AS NOTED

DRAWN W.T. SMITH 2013/Feb/11
DESIGNED J. CHAPMAN 2013/Feb/28
CHECKED M.KHATAMI 2013/Feb/28

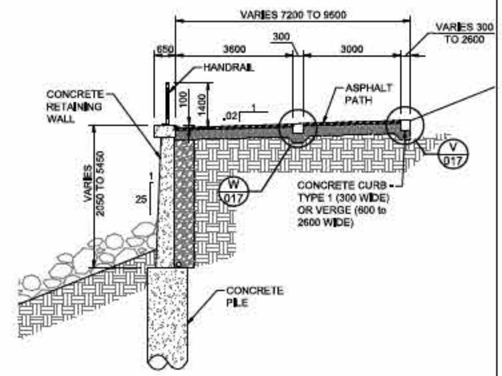
The City of Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
SLOPE PROTECTION DETAILS

DRAWING
WALT 131 S013

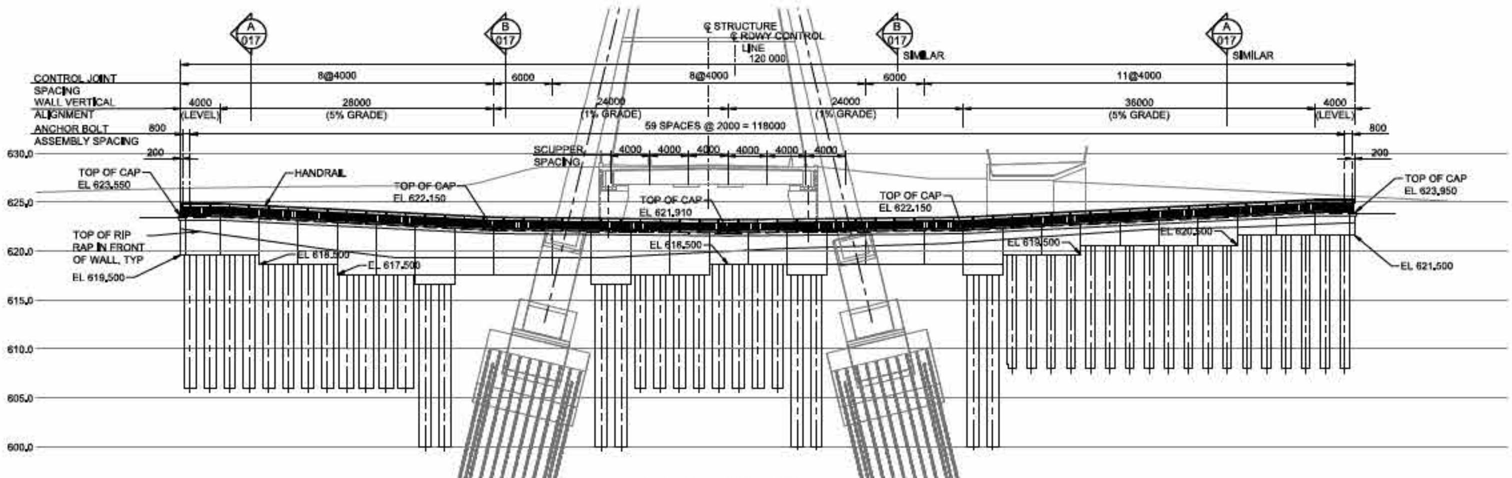
WALL PLAN

1:250



A SECTION

1:75



WALL ELEVATION

(DEVELOPED VIEW ALONG ℄ OF WALL) 1:250

NOTE:

1. FOR GENERAL NOTES REFER TO DWG S002 TO S004
2. CONTRACTOR TO BE TRAINED BY MANUKAL ON INSTALLATION OF ANCHORS

NO.	REVISIONS	BY	DATE	APPD
1	ISSUED FOR TENDER	JC	2013-01-28	JC

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN — CONTRACTOR — SURVEYOR — DATE — FILE NUMBER — CONSTRUCTION ENGINEER DATE — GENERAL SUPERVISOR DATE

DESIGNER — January 25, 2013

PERMIT TO PRACTICE
ISL Engineering and Land Services Ltd.
Signature
Date
PERMIT NUMBER: P 4741
The Association of Professional Engineers and Geoscientists of Alberta

APPROVED FOR CONSTRUCTION

CHECKER — PROFESSIONAL ENGINEER — MASOUD KHATAMI — January 25, 2013

ISL Engineering and Land Services — DIALOG — BUCKLAND & TAYLOR LTD. a COWI company — AL-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION — DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION — DATE

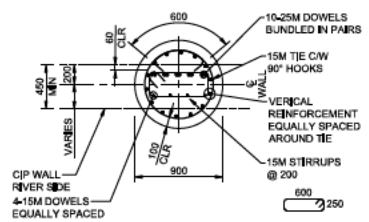
SURVEY		DRAWN WT SMITH	2012-10-11
JOB NO.	13310	DESIGNED J CHAPMAN	2013-01-28
SCALE	AS NOTED	CHECKED M KHATAMI	2013-01-28

Edmonton — TRANSPORTATION SERVICES — ROADS DESIGN AND CONSTRUCTION BRANCH

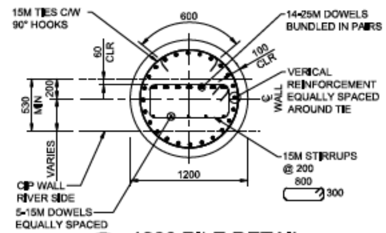
WALTERDALE BRIDGE REPLACEMENT

OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
PROMENADE RETAINING WALL LAYOUT

DRAWING **WALT 131 S014**

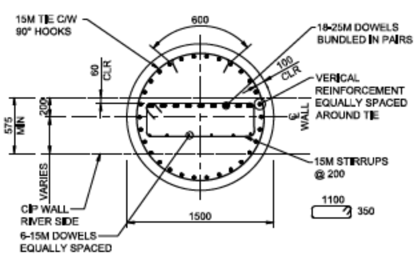


A 900 PILE SECTION
1:25

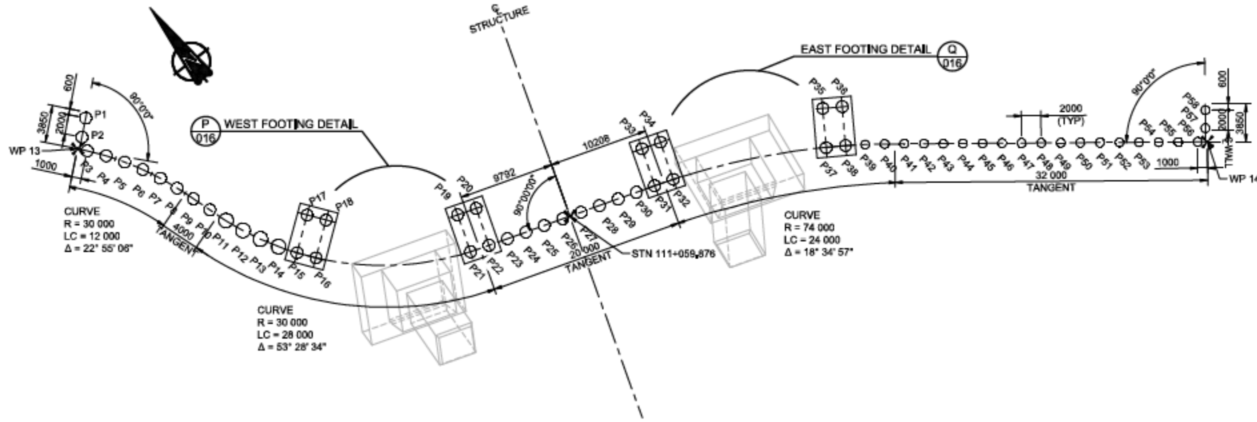


A 1200 PILE DETAIL
1:25

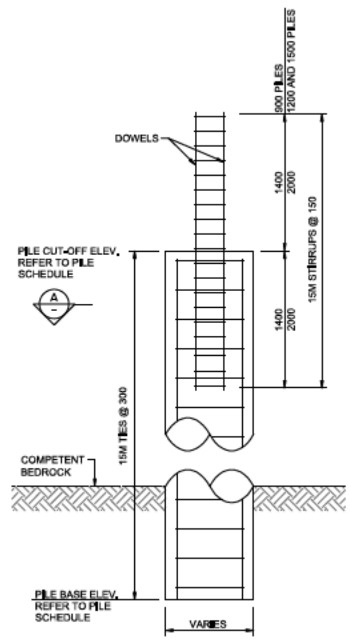
NOTE: REFER TO B/S017 FOR DOWEL REQUIREMENTS FOR PILES P15 TO P22 AND P31 TO P38



A 1500 PILE DETAIL
1:25



PILE PLAN
1:250



PILE DETAIL
1:25

RETAINING WALL PILE SCHEDULE									
MARK	SHAFT DIA. (mm)	BASE ELEVATION (m)	CUT-OFF ELEVATION (m)	SHAFT VERT. REINF.	MARK	SHAFT DIA. (mm)	BASE ELEVATION (m)	CUT-OFF ELEVATION (m)	SHAFT VERT. REINF.
P1	1200	606.000	619.500	24 – 30M	P30	1200	606.000	618.500	24 – 30M
P2	1200	606.000	619.500	24 – 30M	P31	1200	600.000	617.400	24 – 30M
P3	1200	606.000	619.500	24 – 30M	P32	1200	600.000	617.400	24 – 30M
P4	1200	606.000	619.500	24 – 30M	P33	1200	600.000	617.400	24 – 30M
P5	1200	606.000	619.500	24 – 30M	P34	1200	600.000	617.400	24 – 30M
P6	1200	606.000	619.500	24 – 30M	P35	1200	600.000	617.400	24 – 30M
P7	1200	606.000	618.500	24 – 30M	P36	1200	600.000	617.400	24 – 30M
P8	1200	606.000	618.500	24 – 30M	P37	1200	600.000	617.400	24 – 30M
P9	1200	606.000	618.500	24 – 30M	P38	1200	600.000	617.400	24 – 30M
P10	1200	606.000	618.500	24 – 30M	P39	900	608.000	619.500	14 – 30M
P11	1500	606.000	617.500	30 – 30M	P40	900	608.000	619.500	14 – 30M
P12	1500	606.000	617.500	30 – 30M	P41	900	608.000	619.500	14 – 30M
P13	1500	606.000	617.500	30 – 30M	P42	900	608.000	619.500	14 – 30M
P14	1500	606.000	617.500	30 – 30M	P43	900	608.000	620.500	14 – 30M
P15	1200	600.000	616.400	24 – 30M	P44	900	608.000	620.500	14 – 30M
P16	1200	600.000	616.400	24 – 30M	P45	900	608.000	620.500	14 – 30M
P17	1200	600.000	616.400	24 – 30M	P46	900	608.000	620.500	14 – 30M
P18	1200	600.000	616.400	24 – 30M	P47	900	608.000	620.500	14 – 30M
P19	1200	600.000	616.400	24 – 30M	P48	900	608.000	620.500	14 – 30M
P20	1200	600.000	616.400	24 – 30M	P49	900	608.000	620.500	14 – 30M
P21	1200	600.000	616.400	24 – 30M	P50	900	608.000	620.500	14 – 30M
P22	1200	600.000	616.400	24 – 30M	P51	900	608.000	621.500	14 – 30M
P23	1200	606.000	617.500	24 – 30M	P52	900	608.000	621.500	14 – 30M
P24	1200	606.000	617.500	24 – 30M	P53	900	608.000	621.500	14 – 30M
P25	1200	606.000	617.500	24 – 30M	P54	900	608.000	621.500	14 – 30M
P26	1200	606.000	617.500	24 – 30M	P55	900	608.000	621.500	14 – 30M
P27	1200	606.000	618.500	24 – 30M	P56	900	608.000	621.500	14 – 30M
P28	1200	606.000	618.500	24 – 30M	P57	900	608.000	621.500	14 – 30M
P29	1200	606.000	618.500	24 – 30M	P58	900	608.000	621.500	14 – 30M

NOTE:
1. FOR GENERAL NOTES REFER TO DWG S002 TO S004

NO.	REVISIONS	BY	DATE	APPD
1	ISSUED FOR TENDER	JC	2012-12-20	JC

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

PERMIT TO PRACTICE
ISL Engineering and Land Services Ltd.
PERMIT NUMBER: P 4741
The Association of Professional Engineers and Geoscientists of Alberta

APPROVED FOR CONSTRUCTION

January 25, 2013

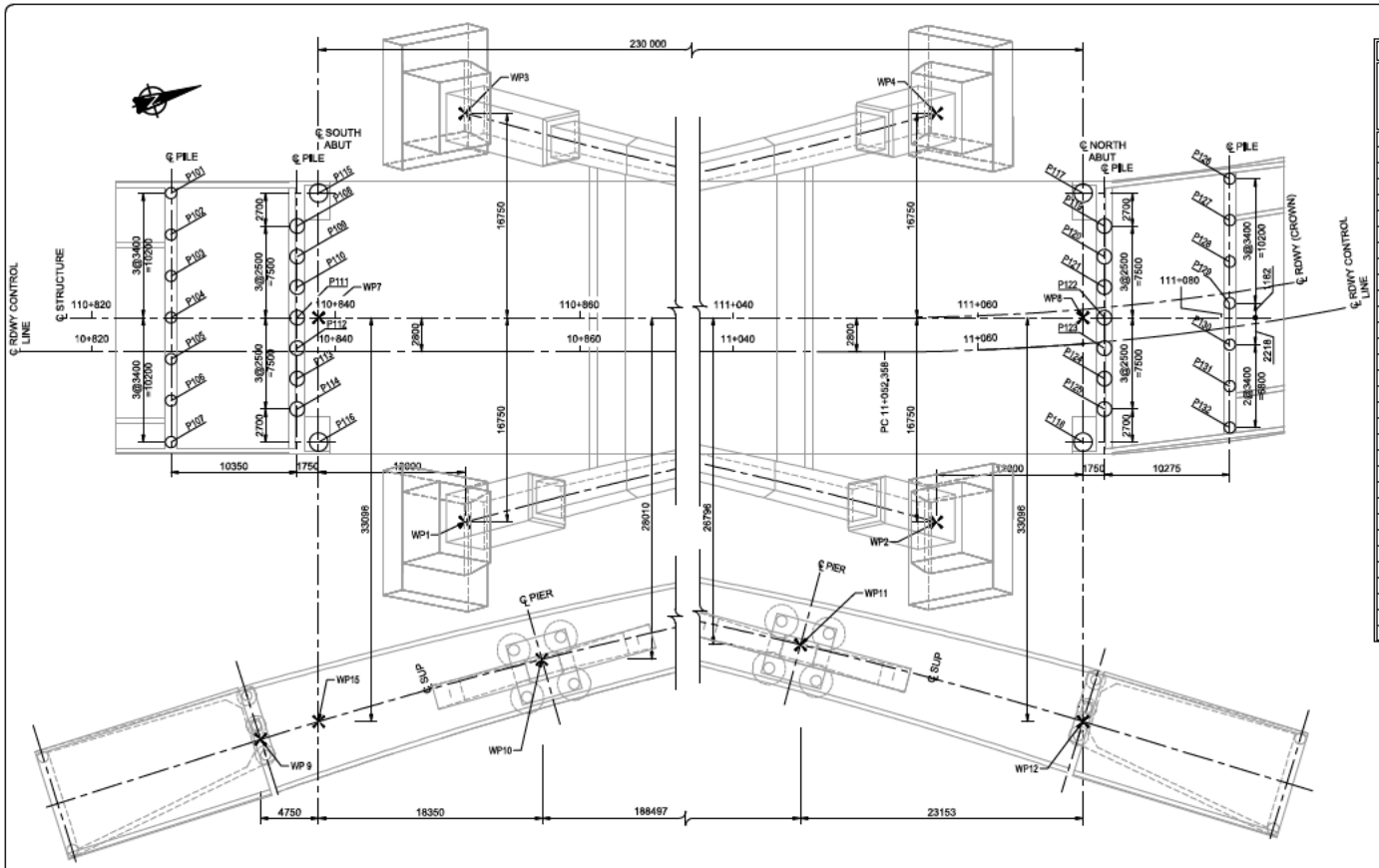
ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
AL-Terra

THE CITY OF Edmonton
TRANSPORTATION SERVICES

SCALE: AS NOTED
JOB NO. 13310

WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
PROMENADE RETAINING WALL - FOUNDATIONS

DRAWING: **WALT 131 S015**



ROAD BRIDGE PILE SCHEDULE

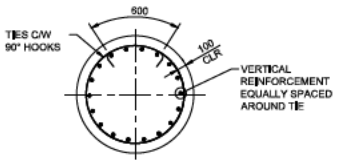
MARK	SHAFT DIA (mm)	BELL DIA (mm)	BASE ELEVATION (m)	CUT-OFF ELEVATION (m)	SHAFT VERT REINF	TIES
P101	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P102	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P103	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P104	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P105	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P106	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P107	900	-	605.500	624.600	14 - 25M	15M TIES @ 300
P108	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P109	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P110	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P111	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P112	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P113	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P114	1200	-	602.500	620.000	18 - 30M	15M TIES @ 300
P115	1500	-	598.000	620.000	26 - 30M	15M TIES @ 300
P116	1500	-	598.000	620.000	26 - 30M	15M TIES @ 300
P117	1500	-	602.500	621.500	26 - 30M	15M TIES @ 300
P118	1500	-	602.500	621.500	26 - 30M	15M TIES @ 300
P119	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P120	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P121	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P122	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P123	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P124	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P125	1200	-	605.500	621.500	18 - 30M	15M TIES @ 300
P126	900	-	608.500	626.350	14 - 25M	15M TIES @ 300
P127	900	-	608.500	626.350	14 - 25M	15M TIES @ 300
P128	900	-	608.500	626.350	14 - 25M	15M TIES @ 300
P129	900	-	608.500	626.350	14 - 25M	15M TIES @ 300
P130	900	-	608.500	626.350	14 - 25M	15M TIES @ 300
P131	900	-	608.500	626.350	14 - 25M	15M TIES @ 300
P132	900	-	608.500	626.350	14 - 25M	15M TIES @ 300

WORK POINTS

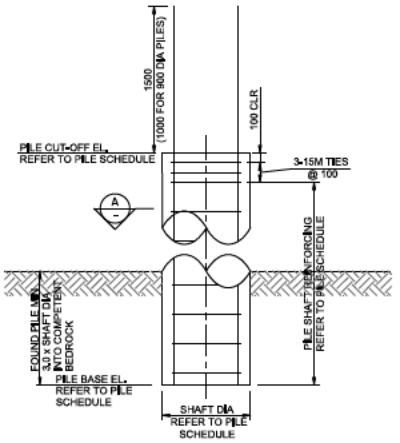
MARK	STATION ON ℄ STRUCTURE	OFFSET	NORTHING	EASTING
WP1	110 + 850.632	16 750	5932843.527	33027.740
WP2	111 + 056.594	16 750	5933040.260	33088.704
WP3	110 + 850.632	16 750	5932853.441	32995.747
WP4	111 + 056.594	16 750	5933050.174	33056.711
WP5	110 +953.603	200	5932946.081	33044.708
WP6	110 + 953.803	5400	5932947.621	33038.742
WP7	110 + 838.634	0	5932837.024	33008.192
WP8	111 + 068.591	0	5933056.677	33076.259
WP9	110 + 833.885	34 562	5932822.259	33039.794
WP10	110 + 856.961	28 000	5932846.245	33040.349
WP11	111 + 045.461	26 796	5933026.634	33094.997
WP12	111 + 068.592	33 096	5933046.881	33107.868
WP13	111 + 083.399	45 039	5933084.142	33037.655
WP14	111 + 039.993	63 917	5933015.214	33130.297
WP15	110 + 838.634	33 096	5932827.230	33039.799

FOUNDATION PLAN
1:200

NOTES:
1. FOR GENERAL NOTES REFER TO DWG S002 TO S004
2. OFFSETS ARE HORIZONTAL DIMENSIONS PERPENDICULAR TO ℄STRUCTURE AND ARE REFERENCED TO GROUND.
3. NORTHINGS AND EASTINGS ARE REFERENCED TO GRID AND SCALED ABOUT THE ORIGIN (0,0)
4. WP5 AND WP6 ARE LOCATED AT TOP OF STEEL ARCHES (NOT SHOWN ON THIS DRAWING)
5. WP13 AND WP14 ARE LOCATED AT THE ENDS OF PROMENADE RETAINING WALL (NOT SHOWN ON THIS DRAWING)
6. REFER TO THE UTILITIES DWGS FOR EXISTING UTILITIES IN THE VICINITY OF THE NEW BRIDGE CONSTRUCTION



A TYPICAL PILE SECTION
1:25



STRAIGHT SHAFT PILE DETAIL
1:25

NO.	REVISIONS	BY	DATE	APPD
7				
6				
5				
4				
3				
2				
1	ISSUED FOR TENDER	JC	2013-01-28	JC

NO.	ISSUE	BY	DATE
3	TO WWW		
2	AS-BUILT		
1	TENDER AWARD		

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER
PROFESSIONAL ENGINEER ALBERTA
January 25, 2013

PERMIT TO PRACTICE
ISL Engineering and Land Services Ltd.
Signature
Date
PERMIT NUMBER: P 4741
The Association of Professional Engineers and Geoscientists of Alberta
APPROVED FOR CONSTRUCTION

CHECKER
PROFESSIONAL ENGINEER ALBERTA
January 25, 2013

ISL Engineering and Land Services
BUCKLAND & TAYLOR ltd. a COWI company
DIALOG
AL-Terra

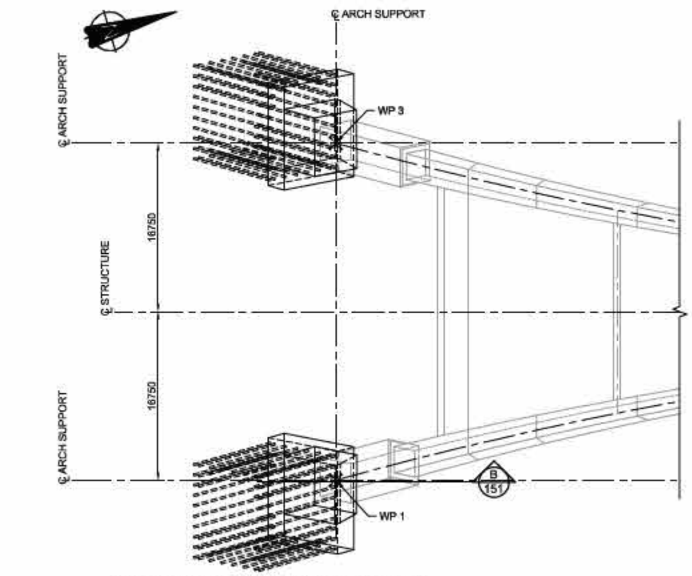
DIRECTOR OF ROAD DESIGN AND CONSTRUCTION DATE
MANAGER OF ROAD DESIGN AND CONSTRUCTION DATE
SURVEY
JOB NO. 13310
SCALE AS NOTED
DRAWN INT. SMITH DATE 2013-Feb-11
CHECKED J. CHAPMAN DATE 2013-Feb-25
DESIGNED M. KHATAMI DATE 2013-Feb-25

The City of Edmonton
TRANSPORTATION SERVICES
ROAD DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
FOUNDATION LAYOUT - ROAD BRIDGE

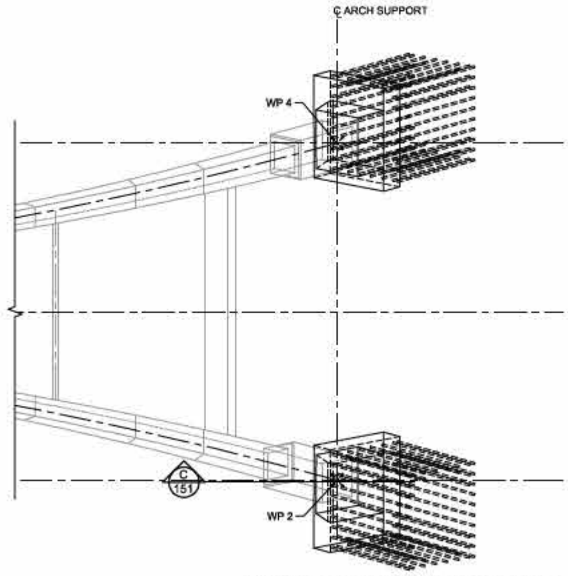
DRAWING
WALT 131 S101

Wayne Smith January 28, 2013 - J:\13300\13310\Engineering\Structural\Drawings\Working\WALT131S101.dgn



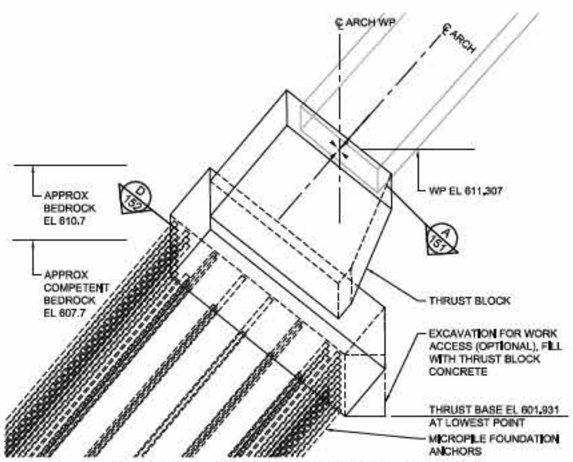
SOUTH THRUST BLOCKS PLAN

1:250



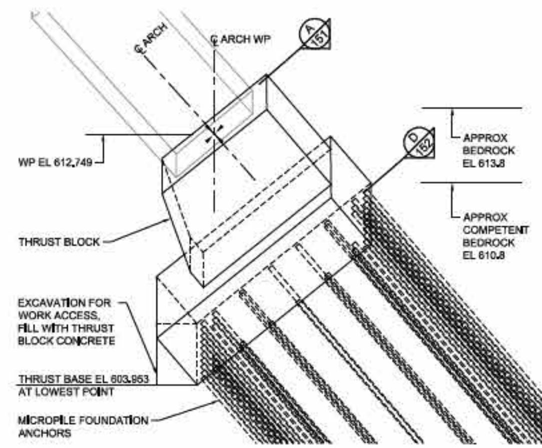
NORTH THRUST BLOCKS PLAN

1:250



SOUTH THRUST BLOCKS ELEVATION

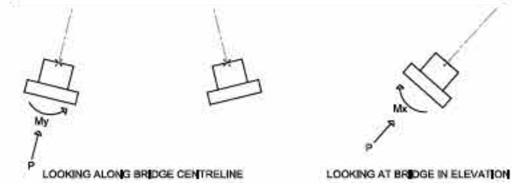
1:100



NORTH THRUST BLOCKS ELEVATION

1:100

THRUST BLOCK LOAD COMBINATIONS (FACTORED)			
CASE/LOAD	P [kN]	Mx [kNm]	My [kNm]
SERVICE DEAD LOAD - NE	32 100	400	3 100
SERVICE DEAD LOAD - SW	29 400	-26 200	-14 200
SERVICE (SLS 1) - SW Mx MAX	34 100	-121 500	-38 900
SERVICE (SLS 1) - NE Mx MAX	36 000	85 900	-17 100
SERVICE (SLS 1) - SW My MAX	37 400	-113 700	-63 800
ULTIMATE (ULS 3) - SW Mx MAX	44 900	-191 500	-66 300
ULTIMATE (ULS 3) - SW My MAX	46 200	-117 900	-81 100
ULTIMATE (ULS 3) - NE Mx MAX	47 900	159 200	-35 600
ULTIMATE (ULS 4) - NE P MAX	50 200	47 100	-29 600



LOAD SIGN CONVENTION - ARROWS DENOTE POSITIVE LOAD AND BENDING DIRECTIONS

THRUST BLOCK CONSTRUCTION NOTES

1. REFER TO DRAWINGS S805 TO S808 FOR THRUST BLOCK EXCAVATION CONCEPTUAL DESIGN.
2. AS EXCAVATIONS PROCEEDS, PLACE SHOTCRETE MUD SLAB ON SLOPED SURFACE FOR THE ARCH SUPPORT LEG.
3. PLACE SHOTCRETE WALL TO SUPPORT THE NEAR VERTICAL FACE OF THE THRUST BLOCK EXCAVATION AS BEDROCK IS REMOVED. SUPPORT EXCAVATION WITH GROUND ANCHORS WHERE REQUIRED.
4. EXERCISE EXTREME CARE DURING EXCAVATION TO MINIMIZE DISTURBANCE OF BEDROCK AT THE THRUST BLOCK BASE. EXCAVATE ONLY UNDER SUPERVISION OF THE GEOTECHNICAL CONSULTANT; SUB-EXCAVATE ANY MATERIAL DEEMED TO BE UNACCEPTABLE BY THE GEOTECHNICAL CONSULTANT.
5. PLACE SHOTCRETE MUD SLAB IMMEDIATELY AFTER COMPLETING THRUST BLOCK BASE EXCAVATION TO PROTECT EXPOSED BEDROCK FROM DEGRADATION AS A RESULT OF EXPOSURE TO THE ELEMENTS AND CONSTRUCTION ACTIVITY. FILL ANY OVER-EXCAVATED AREAS WITH SHOTCRETE.
5. EXCAVATE NO MORE THAN 1.5m VERTICALLY BELOW ANY ROW OF MICROPILE FOUNDATION ANCHORS BEFORE INSTALLING THE ANCHORS AT THAT LEVEL. ANCHOR GROUT SHALL HAVE A COMPRESSIVE STRENGTH OF 25 MPa BEFORE FURTHER EXCAVATION RESUMES.
6. INSTALL MICROPILE FOUNDATION ANCHORS INCLUDING THREADED BAR, GROUT, CENTRALIZERS, ANCHOR PLATES, AND NUTS. MICROPILES SHALL BE PRESSURE POST-GROUTED. REFER TO MICROPILE FOUNDATION ANCHOR NOTES, LAYOUT, AND DETAILS ON SHEET S152.
7. PERFORM STATIC LOAD TESTING ON TWO ANCHORS (ONE ANCHOR AT THE NORTH BANK AND ONE AT THE SOUTH BANK) TO CONFIRM ANCHOR STRENGTH AND DESIGN ASSUMPTIONS.
8. PRIOR TO CASTING THRUST BLOCK CONCRETE, SUBMIT PROPOSED CONSTRUCTION JOINT LOCATIONS TO CONSULTANT FOR ACCEPTANCE.
9. AFTER CASTING CONCRETE, BACKFILL VOIDS TO THE TOP OF THE THRUST BLOCK WITH GRANULAR MATERIAL OR LOW TO MEDIUM PLASTIC CLAY FILL. COMPACT BACKFILL TO AT LEAST 98% OF STANDARD PROCTOR MAXIMUM DRY DENSITY. FILL SHALL BE FREE OF ORGANICS, ROCKS, ICE, SNOW, LARGE OR FROZEN LUMPS, AND OTHER UNSUITABLE MATERIAL.
10. CAST ARCH SUPPORT LEG ON SHOTCRETE MUD SLAB.
11. BACKFILL AROUND THE ARCH SUPPORT LEG TO THE FINAL HEADSLOPE GRADE WITH LOW TO MEDIUM PLASTIC CLAY FILL. COMPACT BACKFILL TO AT LEAST 98% OF STANDARD PROCTOR MAXIMUM DRY DENSITY. FILL SHALL BE FREE OF ORGANICS, ROCKS, ICE, SNOW, LARGE OR FROZEN LUMPS, AND OTHER UNSUITABLE MATERIAL.

NO.	REVISIONS	BY	DATE	APPD
1	ISSUED FOR TENDER	K.E.	2013.01.28	

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER
APEGA PERMIT #P 10020

PERMIT TO PRACTICE
DIALOG ALBERTA ARCHITECTURE ENGINEERING INTERIOR DESIGN PLANNING INC.
Signature
Date 28 January 2013
PERMIT NUMBER: P 10020
The Association of Professional Engineers and Geoscientists of Alberta

APPROVED FOR CONSTRUCTION

CHECKER

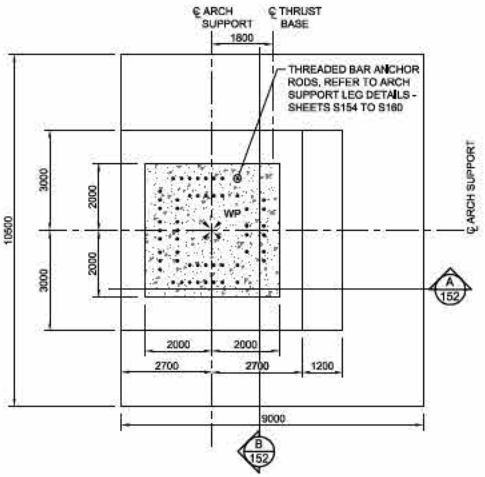
ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
Al-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE
SURVEY
JOB No. 0116060200
SCALE AS NOTED
DRAWN EW 2013.01.28
DESIGNED SB 2013.01.28
CHECKED

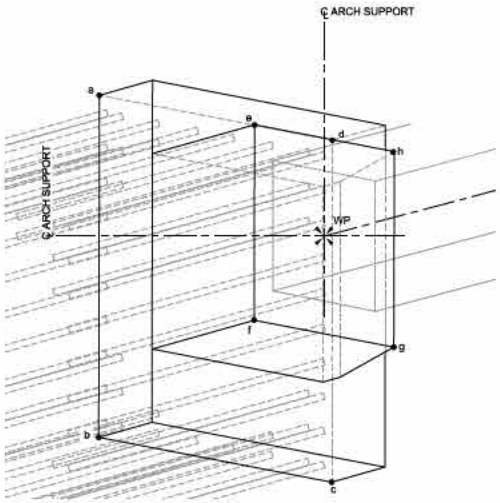
THE CITY OF Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
THRUST BLOCK LAYOUT

DRAWING
WALT 131 S150



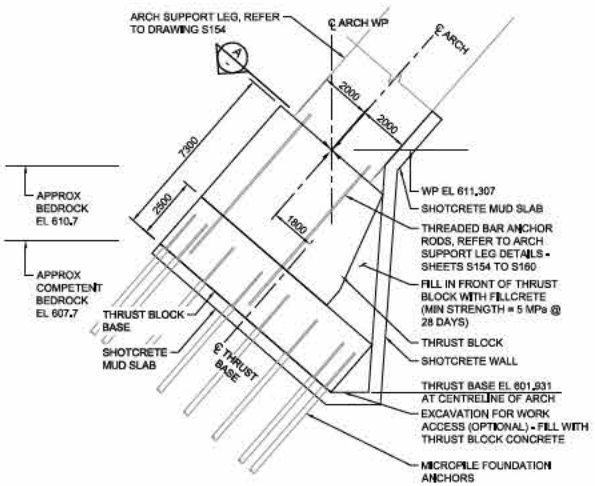
A SECTION
1:75



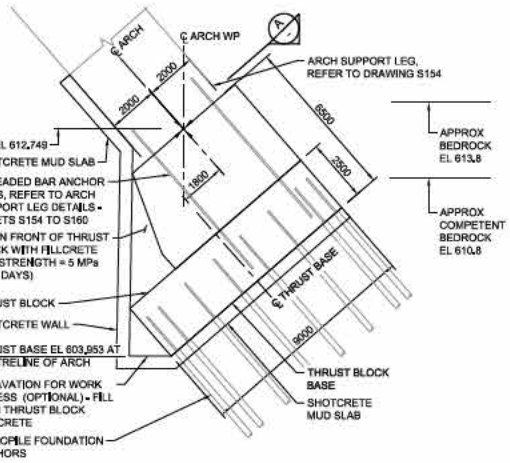
TYPICAL THRUST BLOCK BASE LAYOUT PLAN
1:75

CONCRETE THRUST BLOCKS - ELEVATIONS AND GLOBAL COORDINATES				
LEG	WORKPOINT	ELEVATION (m)	X (m)	Y (m)
SOUTHEAST	WP 1	611.307	0.000	-16.750
	a	608.710	-5.712	-12.549
	b	606.263	-5.729	-22.760
	c	600.709	0.225	-24.103
	d	603.156	0.242	-13.892
	e	613.672	-2.081	-13.430
	f	612.274	-2.091	-19.265
	g	608.942	2.081	-20.070
	h	610.340	2.091	-14.235
NORTHEAST	WP 2	612.749	206.000	-16.750
	a	608.345	212.240	-12.417
	b	610.792	212. 223	-22.828
	c	605.195	205.301	-23.958
	d	602.748	205.318	-13.747
	e	613.729	208.081	-13.434
	f	615.127	208.072	-19.268
	g	611.769	203.919	-20.066
	h	610.371	203.928	-14.232
SOUTHWEST	WP 3	611.307	0.000	16.750
	a	608.710	-5.712	12.549
	b	606.263	-5.729	22.759
	c	600.709	0.225	24.103
	d	603.156	0.242	13.892
	e	613.672	-2.081	13.430
	f	612.274	-2.091	19.265
	g	608.942	2.081	20.070
	h	610.340	2.091	14.235
NORTHWEST	WP 4	612.749	206.000	16.750
	a	608.345	212.240	12.417
	b	610.792	212.223	22.828
	c	605.195	205.301	23.958
	d	602.748	205.318	13.747
	e	613.729	208.081	13.434
	f	615.127	208.072	19.268
	g	611.769	203.919	20.066
	h	610.371	203.928	14.232

NOTE:
REFER TO SHEET S201 FOR GLOBAL COORDINATE SYSTEM.



B 150 SOUTH THRUST BLOCKS SECTION
VIEWED IN LOCAL PLANE OF ARCH RIB
1:100



C 150 NORTH THRUST BLOCKS SECTION
VIEWED IN LOCAL PLANE OF ARCH RIB
1:100

NO.	REVISIONS	BY	DATE	APP'D
1	ISSUED FOR TENDER	KJL	2013-01-28	

NO.	ISSUE	BY	DATE
1	TENDER AWARD		
2	AS-BUILT		
3	TO SUBA		

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
CONSTRUCTION SUPERVISOR DATE

DESIGNER
PROFESSIONAL ENGINEER KEAN L. BROWN ALBERTA
APEGA PERMIT NP 10020

PERMIT TO PRACTICE
DIALOG ALBERTA ARCHITECTURE ENGINEERING INTERIOR DESIGN PLANNING INC.
Signature
Date 16 January 2013
PERMIT NUMBER: P 10020
The Association of Professional Engineers and Geoscientists of Alberta

APPROVED FOR CONSTRUCTION

CHECKER

ISL Engineering and Land Services
BUCKLAND & TAYLOR ltd. a CIMI company
DIALOG
AECOM Al-Terra

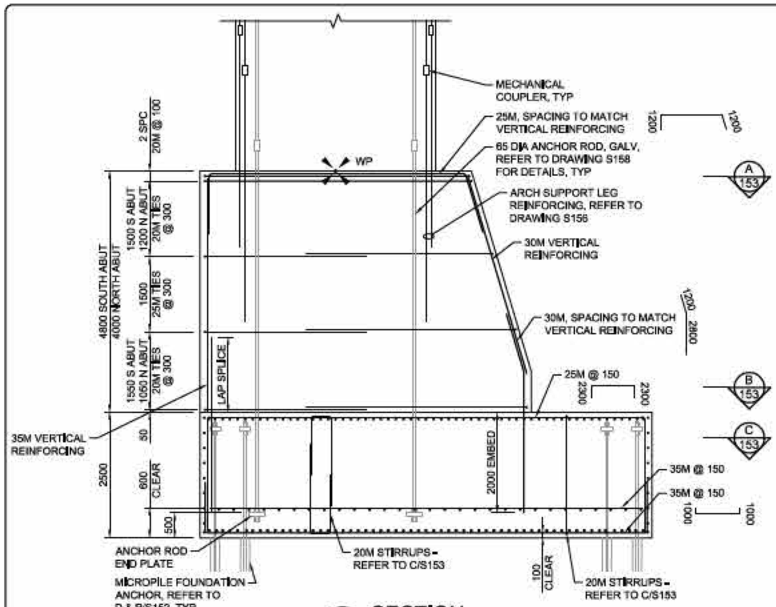
DIRECTOR OF ROADS DESIGN AND CONSTRUCTION — DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION — DATE

SURVEY
JOB No. 011900200E
SCALE AS NOTED
DRAWN RW 2013.01.28
DESIGNED SLB 2013.01.28
CHECKED — DATE

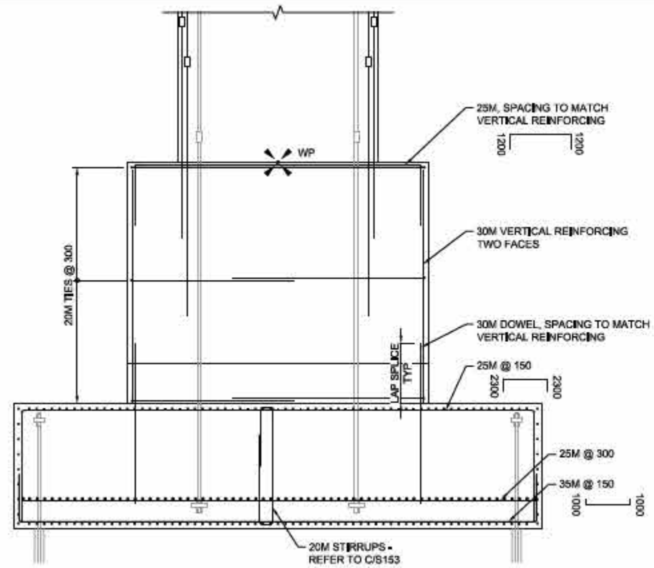
THE CITY OF Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
THRUST BLOCK DETAILS - SHEET 1

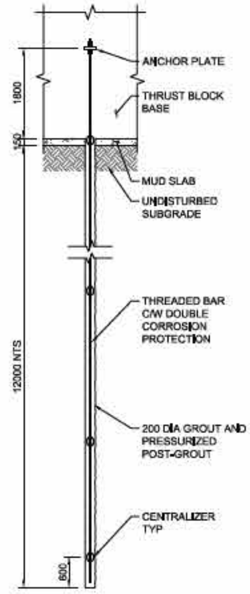
DRAWING
WALT 131 S151



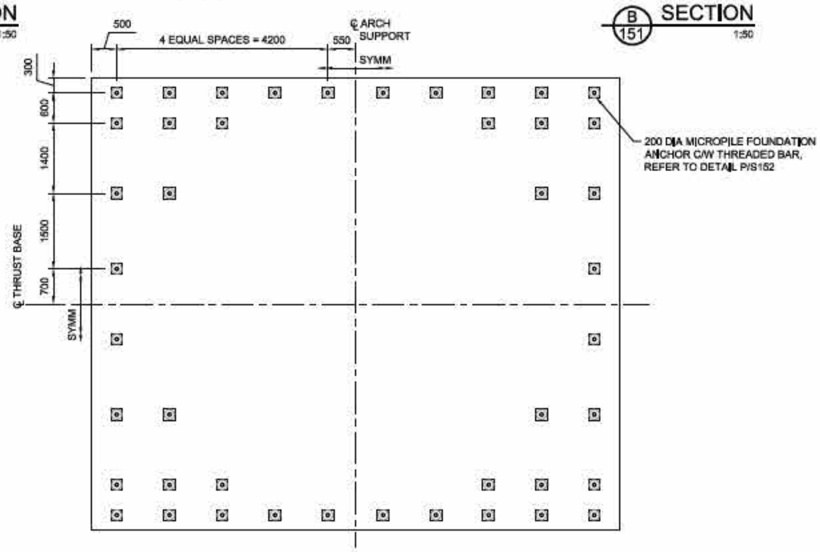
A
151
SECTION
1:50



B
151
SECTION
1:50



P
-
MICROPILE DETAIL
1:50



D
150
MICROPILE LAYOUT
1:50

MICROPILE FOUNDATION ANCHOR NOTES

1. DESIGN, INSTALL, AND LOAD TEST MICROPILE FOUNDATION ANCHORS.
2. MINIMUM DESIGN STRENGTH (FACTORED) Tr = 566 kN
   Cr = -754 kN

SKIN FRICTION RESISTANCE FACTOR = 0.3 FOR TENSION AND 0.4 FOR COMPRESSION.
ULTIMATE SKIN FRICTION RESISTANCE = 250 kPa FOR PRESSURE POST-GROUTED MICROPILE FOUNDATION ANCHORS.

NO.	REVISIONS	BY	DATE	APP'D
1	ISSUED FOR TENDER	KJL	2013.01.28	

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER
PROFESSIONAL ENGINEER ALBERTA — SEAN L. BROWN
APEGA PERMIT #P 10020

PERMIT TO PRACTICE
DIALOG ALBERTA ARCHITECTURE ENGINEERING INTERIOR DESIGN PLANNING INC.
Signature
Date 28 January 2013
PERMIT NUMBER: P 10020
The Association of Professional Engineers and Geoscientists of Alberta

APPROVED FOR CONSTRUCTION

CHECKER

ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
Al-Terra

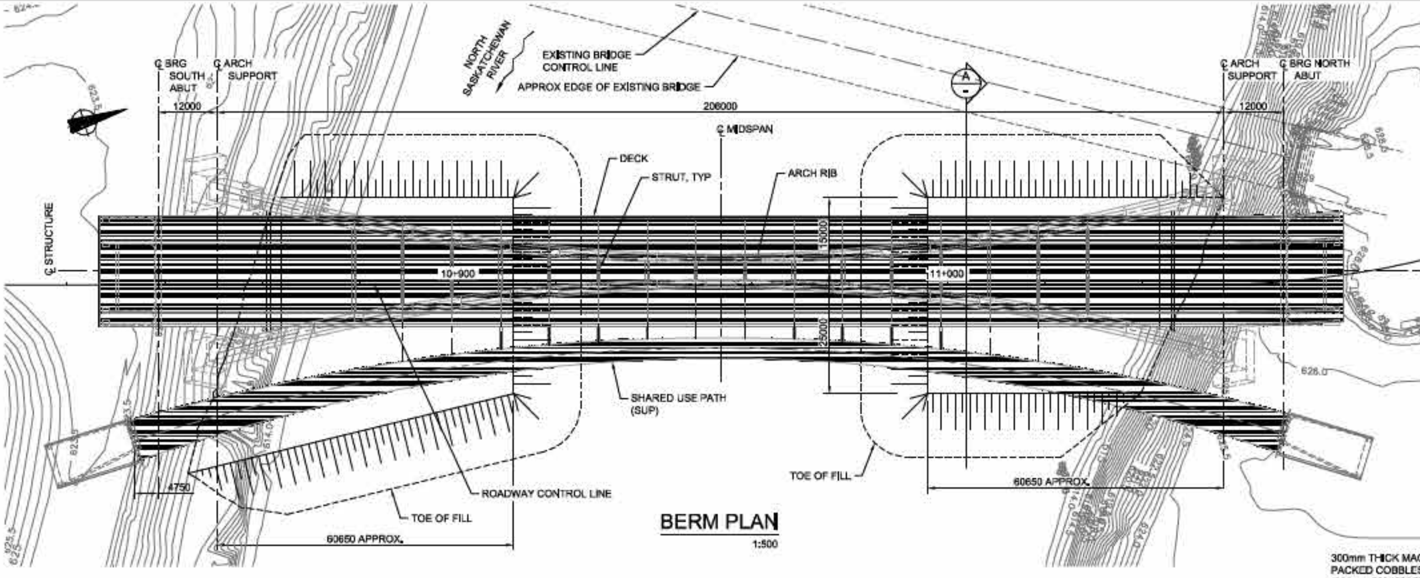
DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE

SURVEY	DRAWN EW	DATE 2013.01.28
JOB No. 01160E0200	DESIGNED SLB	DATE 2013.01.28
SCALE AS NOTED	CHECKED	DATE

The City of Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

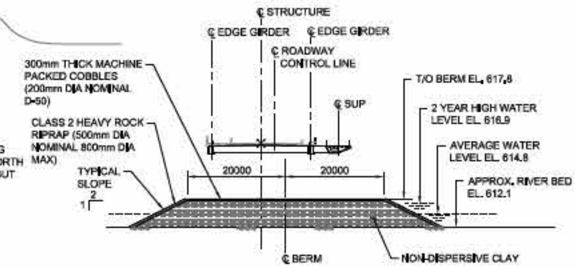
PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
THRUST BLOCK DETAILS - SHEET 2

DRAWING
WALT 131 S152



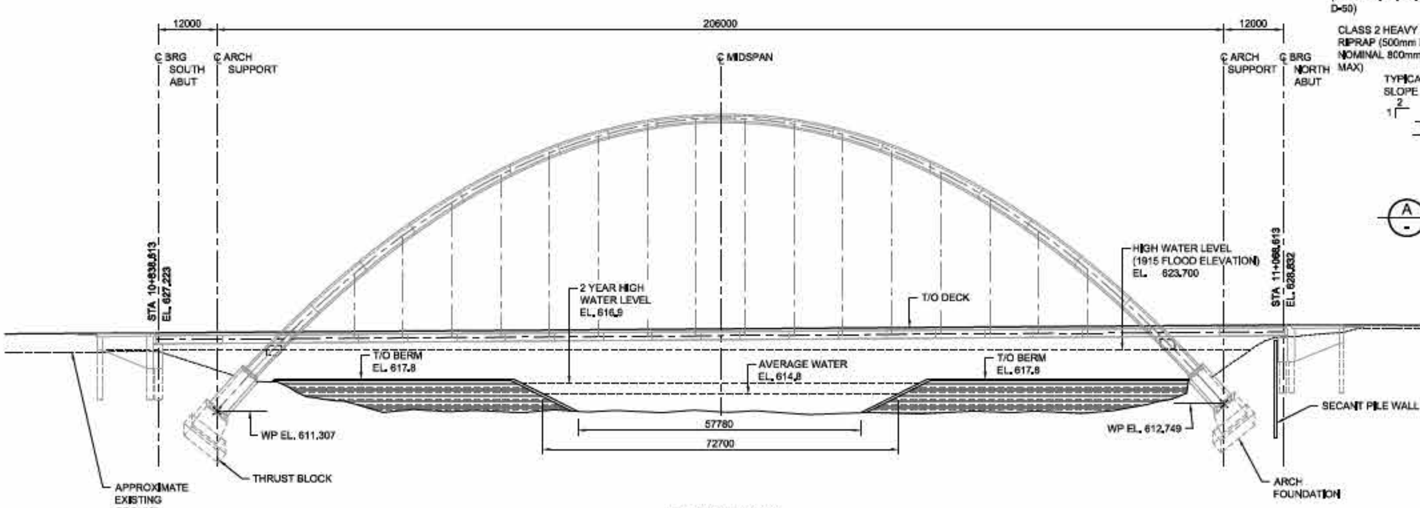
BERM PLAN

1:500



(A) TYPICAL AVERAGE CROSS SECTION

1:500



ELEVATION

LOOKING WEST 1:500

STAGE 1:

1. CONSTRUCT BERMS FOR FOUNDATION CONSTRUCTION.
2. EXCAVATE FOR THRUST BLOCK CONSTRUCTION. AT NORTH FOUNDATION INSTALL SECANT PILE WALLS WITH BRACING AND TIE BACK ANCHORS TO SUPPORT EXCAVATION. AT SOUTH FOUNDATION, INSTALL SHEET PILE WALLS AS REQUIRED TO FACILITATE DEWATERING.
3. CONSTRUCT NORTH AND SOUTH THRUST BLOCKS. FOR CONCEPTUAL THRUST BLOCK EXCAVATION REFER TO DRAWING S605.

NOTES:

1. FOR GENERAL NOTES REFER TO DRAWING S002.
2. THE CONSTRUCTION SEQUENCE SHOWN IS ASSUMED IN THE DESIGN OF THE BRIDGE AND IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY. THE CONTRACTOR IS FULLY RESPONSIBLE FOR PREPARING AND SUBMITTING A DETAILED ERECTION PROCEDURE, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED WITH APEGGA, AS PER THE SPECIFICATIONS.

   THE CONTRACTOR IS FULLY RESPONSIBLE FOR STRENGTH AND STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
3. APPLICATIONS HAVE BEEN MADE FOR ENVIRONMENTAL APPROVALS AND PERMITS FOR THIS CONSTRUCTION SEQUENCE. BIDDERS WILL BE KEPT APPRISED OF PERMIT PROGRESS.

NO.	REVISIONS	BY	DATE	APPD
7				
6				
5				
4				
3				
2				
1	ISSUED FOR TENDER	AG	2013.01.28	

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN — CONTRACTOR — SURVEYOR — DATE — FILE NUMBER — CONSTRUCTION ENGINEER DATE — GENERAL SUPERVISOR DATE

DESIGNER — CHECKER — APPROVED FOR CONSTRUCTION

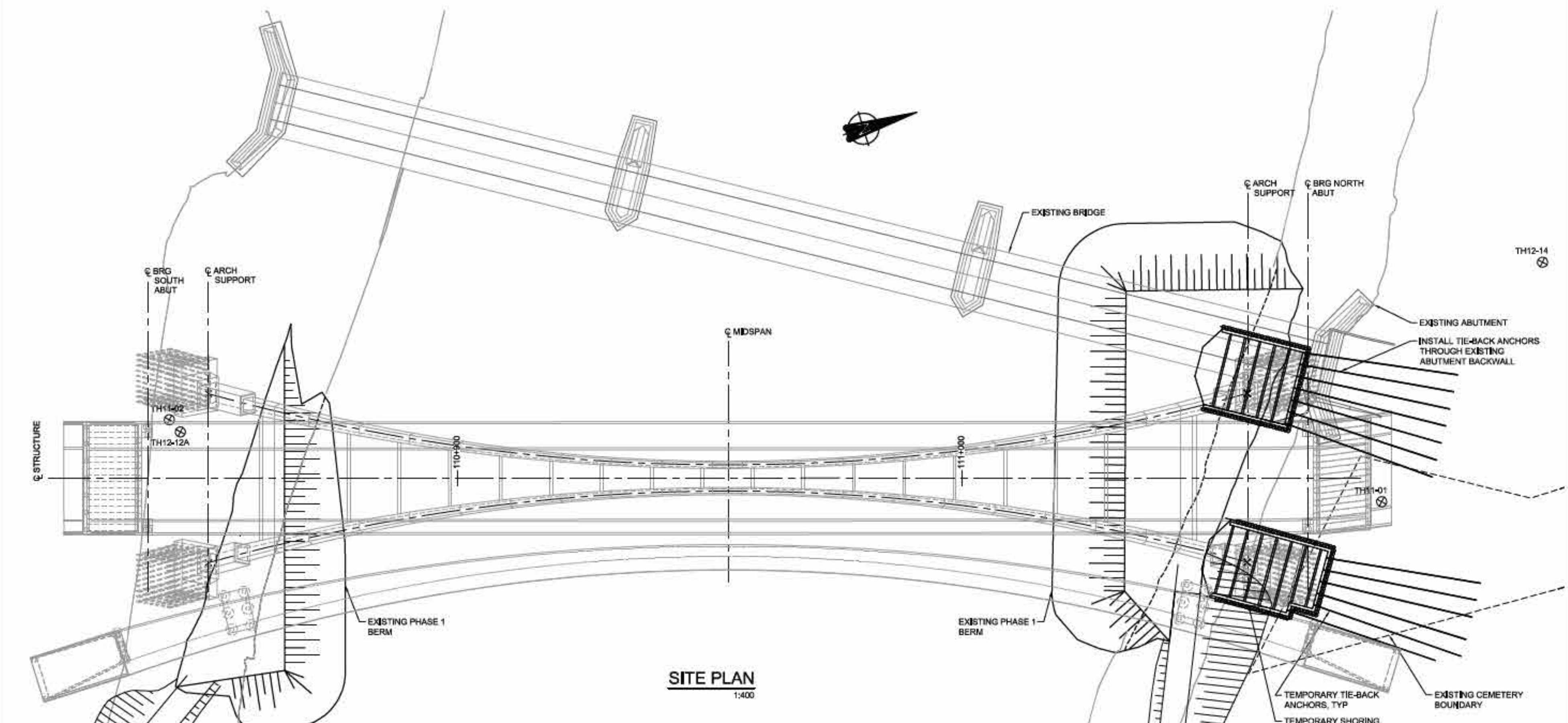
ISL Engineering and Land Services — DIALOG — BUCKLAND & TAYLOR LTD. a COWI company — Al-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE
SURVEY — ASS No. 1551 — SCALE AS NOTED
DRAWN TUNG 2013-01-14 — DESIGNED MKSG 2013-01-14 — CHECKED

THE CITY OF Edmonton — TRANSPORTATION SERVICES — ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT: **WALTERDALE BRIDGE REPLACEMENT**
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
ASSUMED CONSTRUCTION SEQUENCE - SHEET 1

DRAWING: **WALT 131 S601**



SITE PLAN

1:400

THRUST BLOCK EXCAVATION NOTES

1. ALL EXISTING BERM GEOMETRY SHOWN IS APPROXIMATE. CONTRACTOR SHALL DETERMINE ACTUAL BERM GEOMETRY PRIOR TO COMMENCING WORK.
2. EXCAVATION DIMENSIONS AND TECHNIQUES SHOWN ARE PROOF OF CONCEPT ONLY. CONTRACTOR SHALL PROVIDE A DETAILED THRUST BLOCK EXCAVATION DESIGN AND DRAWINGS, SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF ALBERTA.
3. THESE DRAWINGS ADDRESS THE STRUCTURAL REQUIREMENTS TO TEMPORARY SUPPORT THE EXCAVATION, BUT DO NOT CONSIDER THE REQUIREMENTS FOR DEWATERING. INSTALL SHEET PILE OR BENTONITE SLURRY WALLS WERE REQUIRED TO FACILITATE DEWATERING.
4. LOCATE TEMPORARY WALL PILES SO THAT THEY DO NOT CONFLICT WITH PROMENADE WALL PILES, THRUST BLOCK MICROPILES, OR ABUTMENTS.
5. MAXIMUM PERMISSIBLE WALL DEFORMATION = 40 mm (HORIZONTAL AND VERTICAL). MAXIMUM PERMISSIBLE DEFORMATION OF EXISTING BRIDGE ABUTMENT = 40 mm (HORIZ AND VERT).

NO.	REVISIONS	BY	DATE	APP'D
7				
6				
5				
4				
3				
2				
1	ISSUED FOR TENDER	K.L.	2013.01.28	

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

NO.	ISSUE	BY	DATE
3	TO G.A.S.		
2	AS BUILT		
1	TENDER AWARD		

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER

APPROVED FOR CONSTRUCTION

CHECKER

ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
Al-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE

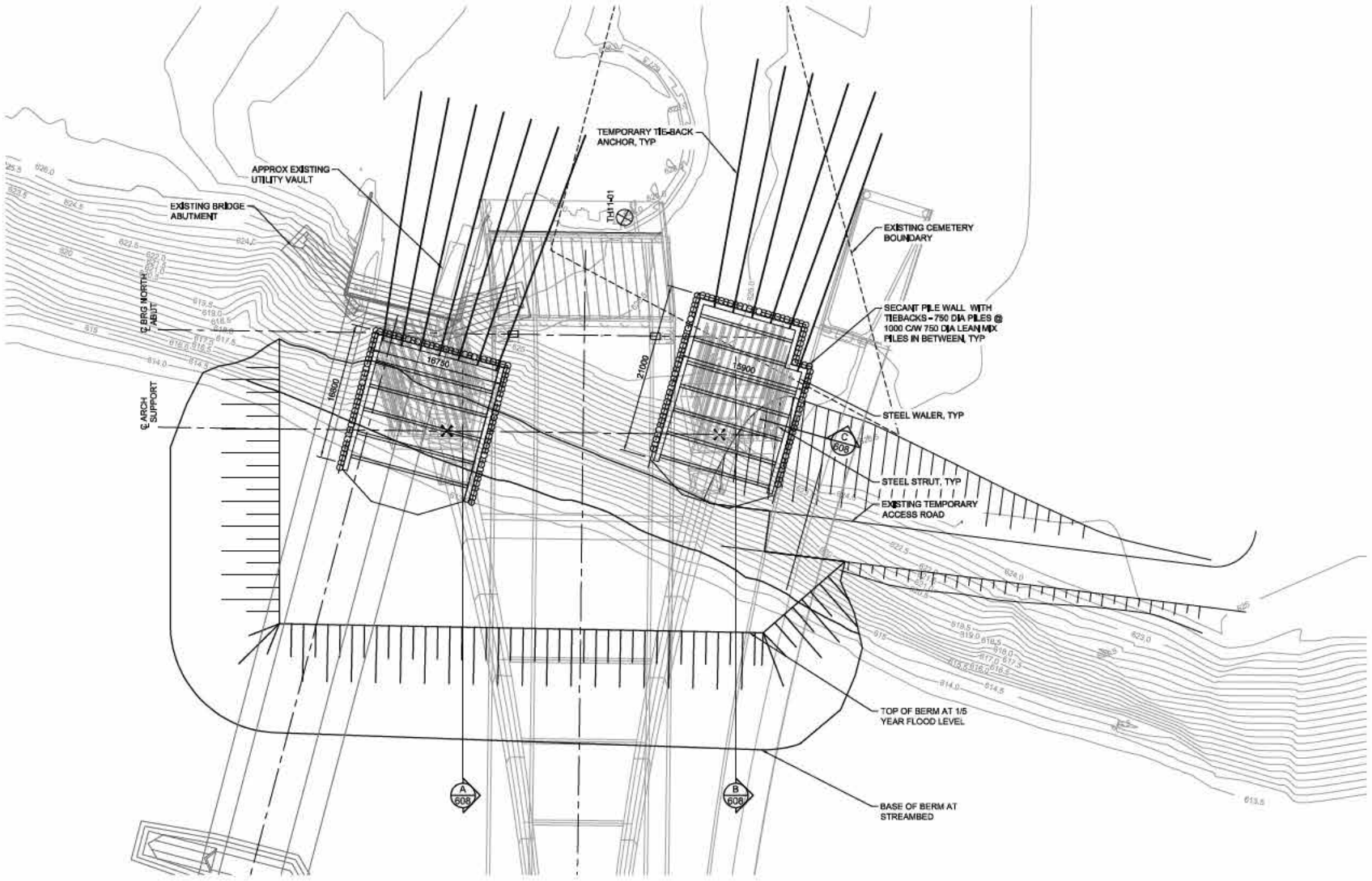
SURVEY
JOB No. 01160E0206
SCALE AS NOTED

DRAWN EW DATE 2013.01.28
DESIGNED S.B DATE 2013.01.28
CHECKED DATE

The City of Edmonton
TRANSPORTATION SERVICES
ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
CONCEPTUAL THRUST BLOCK EXCAVATION - SHEET 1

DRAWING
WALT 131 S605



NORTH BANK PLAN

1:250

NO.	REVISIONS	BY	DATE	APP'D
1	ISSUED FOR TENDER	KJL	2015/12/8	

NO.	ISSUE	BY	DATE
1	TO SAA		
2	AS-BUILT		
3	BRIDGE AWARD		

PROGRAM NO. 12-66-1466

CONTRACT NO. 1331

CONSTRUCTION RETURN

CONTRACTOR

SURVEYOR

DATE

FILE NUMBER

CONSTRUCTION ENGINEER DATE

GENERAL SUPERVISOR DATE

DESIGNER

APPROVED FOR CONSTRUCTION

CHECKER

ISL Engineering and Land Services

BUCKLAND & TAYLOR LTD. a COWI company

DIALOG

AL-TERRA

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE

MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE

SURVEY

JOB No. 0116903200

SCALE: AS NOTED

DRAWN EW 2015/01/28

DESIGNED SLS 2015/01/28

CHECKED DATE

THE CITY OF Edmonton TRANSPORTATION SERVICES ROADS DESIGN AND CONSTRUCTION BRANCH

PROJECT:

WALTERDALE BRIDGE REPLACEMENT

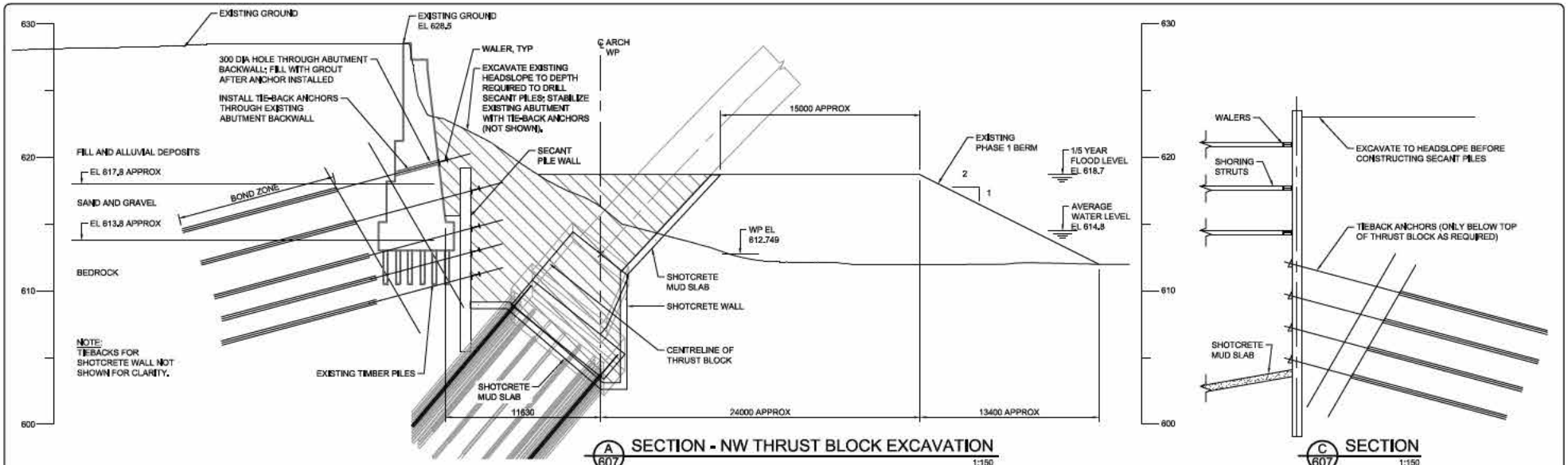
OVER THE NORTH SASKATCHEWAN RIVER

WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD

CONCEPTUAL THRUST BLOCK EXCAVATION - SHEET 3

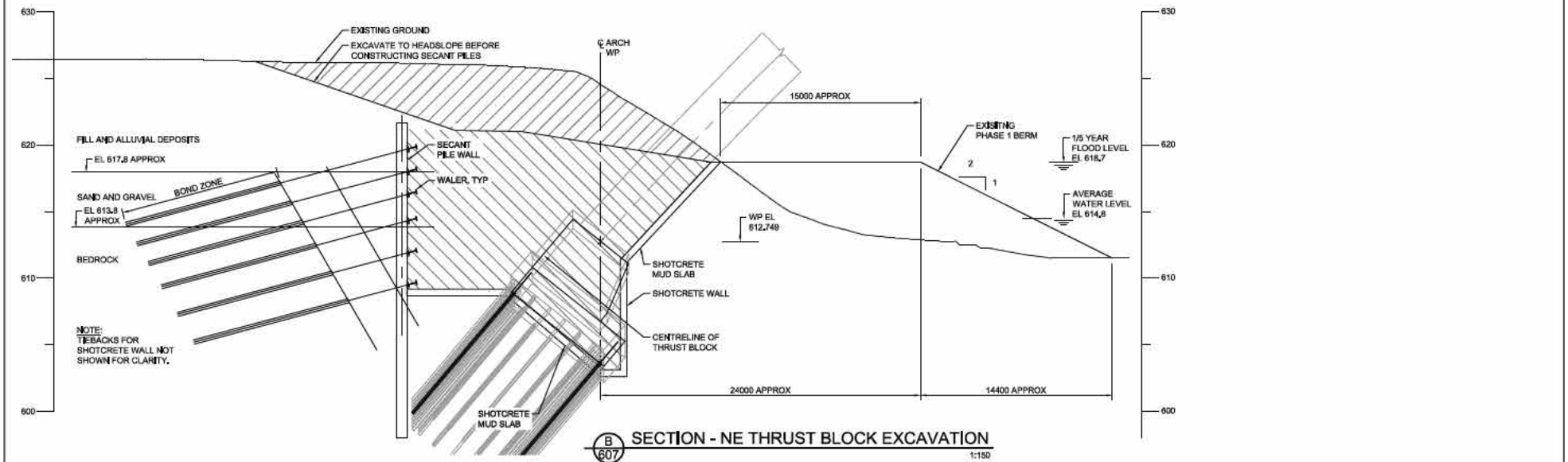
DRAWING

WALT 131 S607



A 607 SECTION - NW THRUST BLOCK EXCAVATION 1:150

C 607 SECTION 1:150



B 607 SECTION - NE THRUST BLOCK EXCAVATION 1:150

NO.	REVISIONS	BY	DATE	APP'D
1	ISSUED FOR TENDER	K.E.	2013/01/28	

NO.	ISSUE	BY	DATE
1	TO CLIENT		
2	ISSUED FOR AWARD		

PROGRAM NO. 12-66-1466
CONTRACT NO. 1331

CONSTRUCTION RETURN
CONTRACTOR
SURVEYOR
DATE
FILE NUMBER
CONSTRUCTION ENGINEER DATE
GENERAL SUPERVISOR DATE

DESIGNER

APPROVED FOR CONSTRUCTION

CHECKER

ISL Engineering and Land Services
DIALOG
BUCKLAND & TAYLOR LTD. a COWI company
Al-Terra

DIRECTOR OF ROADS DESIGN AND CONSTRUCTION DATE
MANAGER OF ROADS DESIGN AND CONSTRUCTION DATE

SURVEY
JOB No. 0119003200
SCALE: AS NOTED

DRAWN EW 2013.01.28
DESIGNED SI B 2013.01.28
CHECKED DATE

THE CITY OF Edmonton TRANSPORTATION SERVICES ROADS DESIGN AND CONSTRUCTION BRANCH

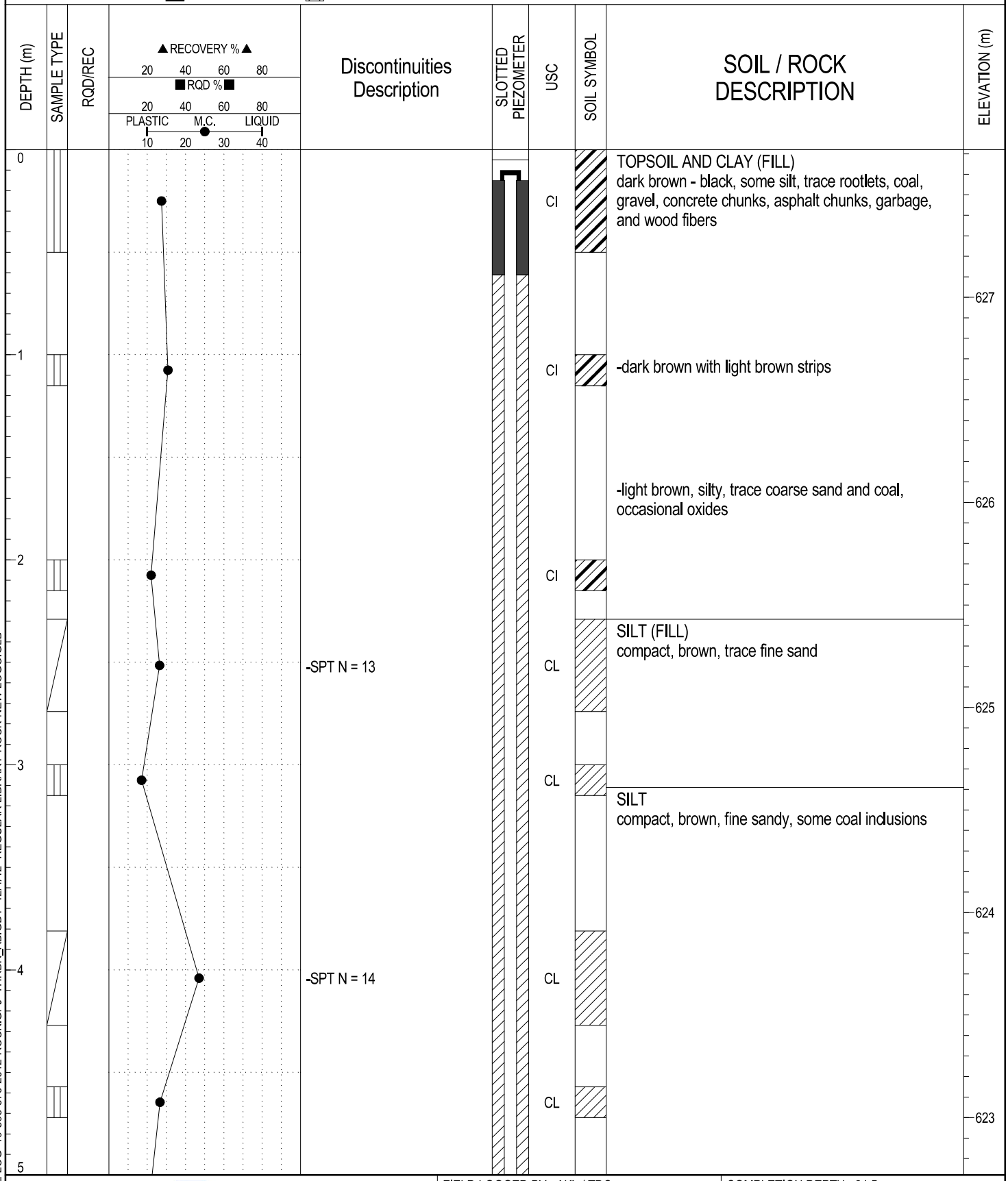
PROJECT
WALTERDALE BRIDGE REPLACEMENT
OVER THE NORTH SASKATCHEWAN RIVER
WALTERDALE HILL ROAD / QUEEN ELIZABETH PARK ROAD
CONCEPTUAL THRUST BLOCK EXCAVATION - SHEET 4

DRAWING
WALT 131 S608

CLIENT: ISL ENGINEERING & LAND SERVICES LTD	PROJECT: WALTERDALE BRIDGE REPLACEMENT	BOREHOLE NO: **TH12-14**
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: July 4 to 6, 2012	PROJECT NO: 19-598-370
DRILL/METHOD: M11 XLT / Solid Stem Augers	LOCATION: N5933098.849, E33044.779	ELEVATION: 627.720 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | CORE

BACKFILL TYPE: BENTONITE | DRILL CUTTINGS



BOREHOLE LOG 19-598-370-2012-ROCK.GPJ THRBR_AB.GDT 12/4/12- REGULAR LIBRARY-ROCK-NEW LOGO.GLB

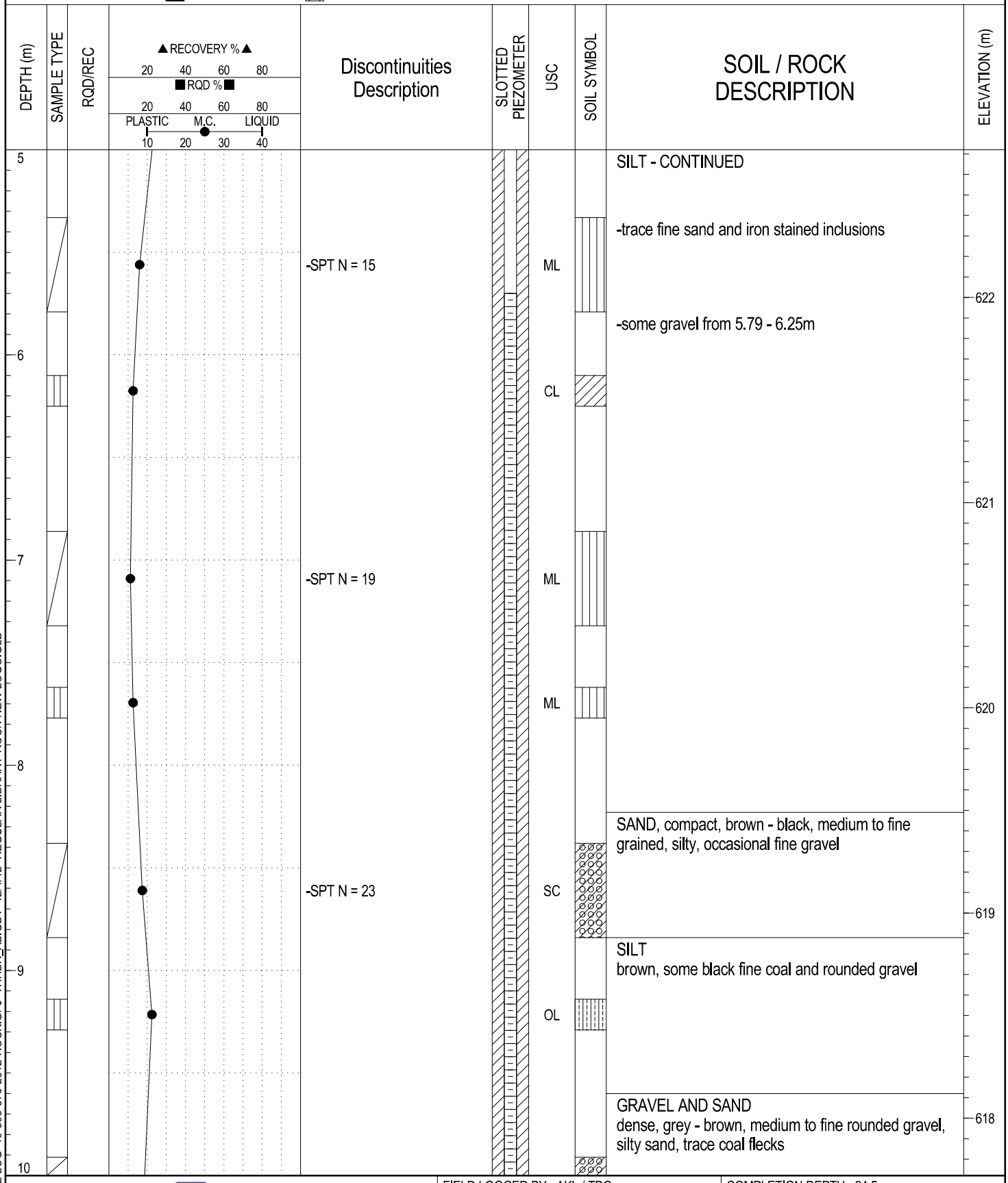
THURBER ENGINEERING LTD.

FIELD LOGGED BY: AKL / TDC	COMPLETION DEPTH: 24.5 m
PREPARED BY: XW	COMPLETION DATE: 7/6/12
REVIEWED BY: HER	Page 1 of 5

CLIENT: ISL ENGINEERING & LAND SERVICES LTD	PROJECT: WALTERDALE BRIDGE REPLACEMENT	BOREHOLE NO: **TH12-14**
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: July 4 to 6, 2012	PROJECT NO: 19-598-370
DRILL/METHOD: M11 XLT / Solid Stem Augers	LOCATION: N5933098.849, E33044.779	ELEVATION: 627.720 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | CORE

BACKFILL TYPE: BENTONITE | DRILL CUTTINGS



FIELD LOGGED BY: AKL / TDC	COMPLETION DEPTH: 24.5 m
PREPARED BY: XW	COMPLETION DATE: 7/6/12
REVIEWED BY: HER	Page 2 of 5

THURBER ENGINEERING LTD.

BOREHOLE LOG 19-598-370-2012-ROCK.GPJ THRBR_AB.GDT 12/4/12- REGULAR LIBRARY-ROCK-NEW LOGO.GLB

CLIENT: ISL ENGINEERING & LAND SERVICES LTD	PROJECT: WALTERDALE BRIDGE REPLACEMENT	BOREHOLE NO: **TH12-14**
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: July 4 to 6, 2012	PROJECT NO: 19-598-370
DRILL/METHOD: M11 XLT / Solid Stem Augers	LOCATION: N5933098.849, E33044.779	ELEVATION: 627.720 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | CORE

BACKFILL TYPE: BENTONITE | DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	RQD/REC	RECOVERY % / RQD % / PLASTIC M.C. LIQUID	Discontinuities Description	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
10				-SPT N = 42		SC		GRAVEL AND SAND - CONTINUED	
								GRAVEL AND CLAY brown - black, rounded to angular gravel in silty clay matrix with some fine coal	
						CI			617
11									
				-SPT N = 50 for 150mm		CS		CLAY SHALE dark brown, silty, carbonaceous, some coal stringers	
									616
12									
						CH		-dark grey, massive	
									615
13				-Start coring at 13.05m -Core breaks at 13.10m, 13.22m, 13.30m, and 13.38m				CLAY SHALE extremely weak, fresh, grey, silty, cemented siltstone inclusions	
		16/100		-Fractured and rubbled from 13.43 - 13.46m, 13.51 - 13.74m, 13.81 - 15.01m, 15.39 - 15.50m, 15.64 - 15.67m, and 15.74 - 15.81m				-soft wet zone	
									614
14								-cemented siltstone clasts	
								-occasional cemented siltstone inclusions	
		9/77							613
15									

BOREHOLE LOG 19-598-370-2012-ROCK.GPJ THRBR_AB.GDT 12/4/12- REGULAR LIBRARY-ROCK-NEW LOGO.GLB

THURBER ENGINEERING LTD.

FIELD LOGGED BY: AKL / TDC	COMPLETION DEPTH: 24.5 m
PREPARED BY: XW	COMPLETION DATE: 7/6/12
REVIEWED BY: HER	

CLIENT: ISL ENGINEERING & LAND SERVICES LTD	PROJECT: WALTERDALE BRIDGE REPLACEMENT	BOREHOLE NO: **TH12-14**
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: July 4 to 6, 2012	PROJECT NO: 19-598-370
DRILL/METHOD: M11 XLT / Solid Stem Augers	LOCATION: N5933098.849, E33044.779	ELEVATION: 627.720 (m)

SAMPLE TYPE: GRAB SAMPLE | SPT | CORE

BACKFILL TYPE: BENTONITE | DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	RQD/REC	▲RECOVERY %▲ 20 40 60 80 / ■RQD %■ 20 40 60 80 / PLASTIC M.C. LIQUID 10 20 30 40	Discontinuities Description	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
15								CLAY SHALE - CONTINUED	
								-occasional coal inclusions	612
16				-Joint at 15.85m at 50° TCA, undulating, rough -Rubble from 15.85 - 15.92m -Core breaks at 15.97m, 16.01m, 16.08m,16.29m, and 16.42m		CS			
		65/89							
				-Fractured and rubbled from 16.52 - 16.57m -Core break at 16.62m					611
17									
				-Fractured and rubbled from 17.33 - 17.64m				-dark brown, carbonaceous	
		38/88		-Joints from 17.64 - 17.73m at 40° TCA, irregular, rough -Rubble from 17.73 - 17.79m -Core break at 17.90m -Joint at 17.96m at 80° TCA, undulating, rough -Core breaks at 18.04m and 18.07m -Fractured and rubbled from 18.10 - 18.13m -Joint at 18.18m at 80° TCA, stepped, smooth -Fractured and rubbled from 18.21 - 18.25m -Joint at 18.58m at 80° TCA, planar, rough -Clay infilling from 18.58 - 18.64m -Core breaks at 18.73m and 18.83m -Joint at 18.92m at 80° TCA, planar, smooth -Core breaks at 19.06m, 19.19m, 19.25m, and 19.27m -Fractured and rubbled from 19.44 - 19.49m -Core breaks at 19.55m and 19.66m				-becomes black, highly carbonaceous, some coal inclusions	610
18								-becomes grey - green and bentonitic from 18.21 - 18.25m	
								-very weak, dark brown, carbonaceous, occasional coal inclusions	609
						SI		Siltstone, very weak, fresh, cemented	
19						CS		-brown	
						SS		Sandstone, very weak, fresh	
						CS			608
20		83/100							

THURBER ENGINEERING LTD.

FIELD LOGGED BY: AKL / TDC	COMPLETION DEPTH: 24.5 m
PREPARED BY: XW	COMPLETION DATE: 7/6/12
REVIEWED BY: HER	Page 4 of 5

BOREHOLE LOG 19-598-370-2012-ROCK.GPJ THRBR_AB.GDT 12/4/12- REGULAR LIBRARY-ROCK-NEW LOGO.GLB

CLIENT: ISL ENGINEERING & LAND SERVICES LTD	PROJECT: WALTERDALE BRIDGE REPLACEMENT	BOREHOLE NO: **TH12-14**
DRILLING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: July 4 to 6, 2012	PROJECT NO: 19-598-370
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SAMPLE TYPE: GRAB SAMPLE | SPT | CORE

BACKFILL TYPE: BENTONITE | DRILL CUTTINGS

DEPTH (m)	SAMPLE TYPE	RQD/REC	▲RECOVERY %▲ 20 40 60 80 / ■RQD %■ 20 40 60 80 / PLASTIC M.C. LIQUID 10 20 30 40	Discontinuities Description	SLOTTED PIEZOMETER	USC	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	ELEVATION (m)
20				-Fractured and rubbled from 19.79 - 19.93m -Joint at 19.98m at 75° TCA, planar, rough -Joint at 20.15m at 80° TCA, undulating, smooth -Fractured and rubbled from 20.25 - 20.43m -Core breaks at 20.53m and 20.66m		SS		Sandstone, very weak, fresh CLAY SHALE - CONTINUED	
									607
21				-Joint at 20.97m at 80° TCA, irregular, rough -Core breaks at 21.19m, 21.31m, 21.55m, and 21.59m				-occasional sandstone inclusions	
				-Joints from 21.64 - 21.74m at 50° TCA, undulating, smooth -Joint at 21.74m at 70° TCA, undulating, smooth					606
22				-Joint at 21.79m at 80° TCA, planar, smooth -Core breaks at 21.85m, 21.92m, 22.00m, and 22.12m -Fractured and rubbled from 22.18 - 22.24m -Joint at 22.39m at 70° TCA, undulating, rough -Joint at 22.46m at 75° TCA, undulating, smooth -Core break at 22.51m		CS		-occasional siltstone inclusions	
									605
23		59/97	■ ▲	-Fractured and rubbled from 22.65 - 22.89m and 22.97 - 23.35m				-trace coal inclusions	
				-Joint at 23.39m at 70° TCA, undulating, rough -Core break at 23.43m -Joint at 23.51m at 80° TCA, planar, smooth -Joint at 23.72m at 80° TCA, undulating, smooth -Core break at 23.75m				-light brown	604
24				-Rubble from 23.89 - 23.91m -Joint at 24.05m at 80° TCA, irregular, rough -Joint at 24.12m at 60° TCA, partially closed -Core breaks at 24.28m and 24.45m		SS		SANDSTONE, extremely weak, fresh, grey, trace coal and siltstone inclusions	
				-July 6, 2012 = Dry -August 10, 2012 = 11.6m -August 17, 2012 = 11.6m				END OF TEST HOLE AT 24.5m UPON COMPLETION: Standpipe piezometer installed in adjacent test hole (drilled to 11.8m depth) WATER LEVEL BELOW GROUND SURFACE:	603
25									

THURBER ENGINEERING LTD.

FIELD LOGGED BY: AKL / TDC	COMPLETION DEPTH: 24.5 m
PREPARED BY: XW	COMPLETION DATE: 7/6/12
REVIEWED BY: HER	Page 5 of 5

BOREHOLE LOG 19-598-370-2012-ROCK.GPJ THRBR_AB.GDT 12/4/12- REGULAR LIBRARY-ROCK-NEW LOGO.GLB

Location of Additional Retaining Wall West of Legislature Power Plant