

To: Amber Saltarelli

From: Amanda Malatesta,

Nick Schmidt

Company: Gannett Fleming

SLR Consulting (Canada) Ltd.

cc:

Project No. 243.V24414.00000

Revision 0

RE: Hydrogeological Assessment – Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario

1.0 Introduction

Palmer (part of SLR) was retained by Gannett Fleming on behalf of Ontario Northland Transportation Commission (ONTC) to undertake a desktop hydrogeological assessment in support of the design of the Timmins-Porcupine Station Project located in Timmins, Ontario (the Site).

The objective of the desktop hydrogeological assessment is to review existing information and studies to provide a description of existing local groundwater conditions in the Study Area (i.e. 500 m radius from the Site) and a high-level summary of potential impacts and mitigation measures as they relate to the proposed development.

2.0 Existing Conditions

2.1 Proposed Development

The proposed Timmins-Porcupine Station property is approximately one (1) hectare and is located along Falcon Street, between Gervais Street North and Duke Street East in Timmins, Ontario. The Site is bounded to the southeast by the existing railway line. The Whitney Multipurpose Court and a baseball diamond are located west of the Site, with residential neighbourhoods extending further east and west. The Timmins-Porcupine Station Project will involve the construction of a new passenger rail station as a terminus station situated along the Northlander route (**Figure 1**).

2.2 Regional Setting

2.2.1 Topography and Drainage

The Study Area is generally flat with a slope from the northeast to the southwest. Based on regional topography mapping, a topographic high of 288 metres above sea level (masl) is located towards the northeast area of the Site, decreasing approximately 1 to 2 m towards the southwest area of the Site (**Figure 2**).

The Study Area is located within the Porcupine River Watershed (PRW), which is under the jurisdiction of the Mattagami Region Conservation Authority. The Porcupine River drains into Night Hawk Lake to the west and ultimately to the Frederick House River System.

There is one provincially significant wetland within 500 m of the Site, Porcupine Lake Wetland lies approximately 450 m to the northeast of the Site. The closest water body is Bob's Lake, which is situated approximately 450 m southeast of the Site. Shallow Lake is approximately 750 m to the northwest of the Site.

2.2.2 Geology and Physiography

A review of available Ontario quaternary geology mapping indicated that the surficial soils at the Site are mainly comprised of clay and silt glaciolacustrine and glaciomarine deep water deposits (Ontario Geological Survey, 2010) (**Figure 3**). Bedrock geology mapping indicated that the Site is underlain by Metasedimentary bedrock bounded to the north and south by fault lines that converge to the northeast (Ontario Geological Survey, 2011) (**Figure 4**). Immediately east of the Site is a felsic to intermediate metavolcanic rock deposit which is separated from the bedrock underlying the Site by the southwest to northeast trending fault line.

2.3 Site Conditions

2.3.1 Site Geology

Palmer (2024) conducted a geotechnical investigation field investigation in 2023 at the Site. During the drilling program, twenty-one (21) boreholes (H23-NT-1 to BH23-NT-21) were advanced (**Figure 1**). Five (5) additional boreholes (BH24-NT-101 to BH24-NT-105) were drilled between June 11 and 14, 2024 as part of the 2024 geotechnical field investigation. The locations of boreholes are shown on the Site Plan (**Figure 1**). Boreholes were drilled to depths ranging from 3.1 to 16.2 m below existing ground surface (mbgs) (284.4 to 270.2 masl). Cross sections of the study area are presented in **Figures 5** to **7**.

Based on the results of the drilling program, the study area was comprised of a thin layer of topsoil which was underlain by silty clay / clayey silt, sandy silt / silty sand, sand, sand and gravel, and gravelly sand Fill materials. The Fill generally ranged from 0.7 to 3.8 mbgs (286.9 to 283.5 masl).

The Fill material was underlain by varying thicknesses of silty clay to clayey silt deposits which generally extended between 3.0 to 11.7 mbgs (284.2 to 275.5 masl). A silt to sandy silt layer was encountered beneath the silty clay to clayey silt deposits, at varying depths across the Site and varied thicknesses (1.6 to 3.1 m where measurable). This was further underlain by a silty sand till unit that was generally encountered between 13.8 to 16.2 mbgs (274.1 to 270.6 masl). A single instance of a sandy gravel layer was encountered at BH23-NT-12 and extended to a depth of 14.3 mbgs (272.7 masl).

Bedrock was not encountered during the drilling program.

2.3.2 Groundwater Elevation

As part of the geotechnical Investigation conducted by Palmer (2024), ten (10) monitoring wells were installed at the Site and stabilized groundwater measurements were obtained on August 30, 2023. The groundwater measurements are presented in Table 1 below.



Monitoring Well ID	Screened Interval (mbgs)	Water Level Depth (mbgs) / Water Level Elevation (masl)	
BH23-NT-1	3.1 - 6.1	3.9 / 284.8	
BH23-NT-3	3.1 - 6.1	3.7 / 284.7	
BH23-NT-4	12.2 – 15.2	5.1 / 283.1	
BH23-NT-7	3.1 - 6.1	3.4 / 284.7	
BH23-NT-9	10.1 – 13.1	4.8 / 283.1	
BH23-NT-12	3.1 - 6.1	1.5 / 285.5	
BH23-NT-13	3.1 - 6.1	0.6 / 286.5	
BH23-NT-17	3.1 - 6.1	1.2 / 285.9	
BH23-NT-18	3.1 - 6.1	1.5 / 286.2	
BH23-NT-21	3.1 - 6.1	1.3 / 285.9	
*mbgs = meter below ground surface			

Table 1: Groundwater Elevations

Shallow groundwater was generally found to range 0.6 to 3.9 mbgs (286.5 to 284.8 masl) across the Site and is generally found within the upper silty clay deposits.

2.3.3 Hydrogeology

Hydrostratigraphic units can be subdivided into two distinct groups based on their ability to allow groundwater movement: an aquifer and an aquitard. An aquifer is defined as a layer of soil that is permeable enough to permit a usable supply of water to be extracted. An aquitard is a layer of soil that inhibits groundwater movement due to its low permeability.

The soils at the Site would generally be considered an aquitard which would limit groundwater flow both through the soils horizontally but also limit downward flow from the ground surface (infiltration).

2.4 Source Protection

The City of Timmins obtains its drinking water from the Mattagami River which is located within the Mattagami Region Source Protection Area. A Source Protection Plan (SPP) for the Mattagami Region Source Protection Area was developed for the sole municipal drinking water source (MRCA, 2019). The closest intake protection zone (IPZ) is located approximately 14 km west of the Site. The Site is located outside of all vulnerable areas as described in the SPP.

The SPP outlines the prescribed threats and areas of vulnerability to source water within the Mattagami Source Protection Region and the policies to address them. These policies may impact development types, locations, operations, materials, applications and the need for additional risk management, assessments, plans and/or studies. Furthermore, the MECP has developed the document Best Practices for Source Water Protection (Updated November 2, 2023) for water sources and drinking water systems that are not included in a SPP or are not regulated by the Clean Water Act. Every effort will be made to protect source water in accordance with the MECP guidelines, local regulations and the Clean Water Act.



3.0 Construction Dewatering

Construction activities associated with the construction of the Timmins-Porcupine Station that will resulting in ground disturbance and below grade works may include:

- Installation of new or modification of existing site servicing including, watermains, storm and sanitary sewers, gas services, power/hydro, and telecommunications;
- Culvert installations for stormwater management;
- Site grading;
- Excavations for building foundations;

At this time, a detailed construction plan is unavailable to assess the dimensions of proposed excavations required for the above construction activities. Depending on the depth of excavations, dewatering may be required below the groundwater level to complete the construction works in the dry.

Water takings of more than 50,000 L/day are regulated by the Ontario Ministry of Environment, Conservation and Parks (MECP). The MECP requires an Environmental Activity and Sector Registry (EASR) to be registered for any construction dewatering that is between 50,000 L/day and 400,000 L/day, or a Permit to Take Water (PTTW) to be obtained for any construction dewatering that is greater than 400,000 L/day.

It is noted that hydraulic conductivity estimates were not obtained from the monitoring wells on Site. Hydraulic conductivity estimates would need to be obtained to provide accurate dewatering estimates as part of detailed design. The range of hydraulic conductivities for clay and silt glaciolacustrine deposits can range between 10⁻⁶ m/s to 10⁻¹² m/s (Freeze and Cherry, 1979).

- A hydrogeological assessment will be undertaken as part of detailed design to evaluate hydraulic conductivity and dewatering rates to establish an accurate dewatering estimate and permitting recommendation.

3.1 Water Taking Report and Discharge Report

Depending on whether an EASR or a PTTW is required for the construction dewatering works, different reporting will be required to support water taking permitting. Should an EASR be recommended, a Water Taking Report and Discharge Report will need to be prepared. Should a PTTW be recommended, a stand-alone hydrogeological report compliant with the MOE document "Technical Guidance Document for Hydrogeological Studies In Support of Category 3 Applications for Permit to Take Water" will need to be prepared.

If it is determined that water takings will be in excess of 50,000 L/day but less than 400,000 L/day, and a EASR registration is required, a Water taking Report and a Discharge Report will need to be developed by a qualified professional (QP) as defined by Ontario Regulation 63/16 prior to registering the EASR.

The Water Taking Report, as stipulated by the MECP, must include at minimum:

- A description of the construction site and construction project;
- A summary of the qualifications and experience of the person who prepared the water taking report;
- A description of the water taking activity, including the rate or volume at which the water will be taken;



- A calculated Zone of Influence expected for each dewatered work areas within the construction site;
- A ground settlement assessment conducted by a qualified engineer (P.Eng.) to the potential impact of the soil settlement that would occur as a result of the proposed water taking, including an assessment of the impact of the soil settlement on the integrity of infrastructure located in the expected area of influence for each dewatered work area;
- An analysis of the potential impact of the proposed water taking on other water users and on the natural functions of the ecosystem in the expected area(s) of influence;
- A contingency plan that includes measures to address the potential impact of the proposed water taking on other water users, a description of potential site-specific impacts and a description of a shutdown protocol if the QP assesses that such a protocol is required;
- A protocol for providing written notice to other water users who have the potential to be impacted and the applicable local ministry district office at least 48 hours prior to the initial commencement of the water taking activity; and,
- An analysis to determine whether a water monitoring plan would be needed and, if needed, a description of the plan and the circumstances in which it would be needed.

The Discharge Report, as stipulated by the MECP, must include at minimum:

- A summary of the qualifications and experience of the person who prepared the discharge report;
- An assessment of the quality and quantity of the ground water and storm water that is expected to be discharged;
- The location of the discharge;
- A recommendation of one or more of the methods of transfer or discharge;
- If the recommended method of discharge is to a surface land or to a storm sewer, a statement that the discharge will not cause an adverse effect to the environment;
- If the recommended method of discharge is to a surface land or to a storm sewer, identification of any treatment or control measures required to minimize erosion, flooding, scouring and sedimentation and a statement that addresses the quality of the discharge to ensure that it will not cause an adverse effect on the environment;
- An analysis to determine whether a monitoring plan would be needed to monitor the potential impacts of the discharge and, if needed, a description of the plan and the circumstances in which it would be needed; and,
- A contingency plan that includes measures to address: potential impacts related to the quality and quantity of the discharge, any failures of recommended treatment or control measures and other site-specific impacts such as flooding. A description of a shutdown protocol should be included if the QP assesses that such a protocol is required.

A requirement of the EASR is to record the daily water taking volumes and report them annually. Therefore, it is required that the dewatering contractor provide measurement controls suitable to measure and record the daily volume of water discharged (e.g., totalizer) and flow rate (e.g., flow meter) to confirm that discharge rates remain below the maximum permitted discharge rate.



Furthermore, any monitoring specified in either the Water Taking Report or the Discharge Report will need to be followed by the contractor completing the construction dewatering.

4.0 Impact Assessment

The following sections provide a preliminary assessment of the potential impacts of dewatering to surrounding receptors including impacts to groundwater resources, surrounding surface water, potable water sources and groundwater quality. At this time a radius of influence from dewatering has not been determined, therefore a summary of features within 500m was used for the assessment.

4.1 Water Supply

Well records from the MECP WWR database were reviewed to assess the stratigraphy and water use of wells located within a 500 m radius of the Study Area. The locations of the wells are shown in **Figure 8**, and a summary is provided below.

Five (5) MECP wells were identified within 500 m of the property. Four (4) of those wells were observation/monitoring wells or test holes and one (1) well was without a noted water use. There were no noted water supply wells. None of the available water well records provided static water level measurements.

Given that the City of Timmins obtains its drinking water from the Mattagami River, there are no anticipated impacts to drinking water supply.

Well ID	Completion Date	Depth (mbgs)	Well Use	Geology
7424776	7/24/2022	NA	NA	NA
7442959	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)
7442960	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)
7442961	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)
7442962	3/7/2023	4.7	Monitoring/Observation	Brown Fill (0 - 1.52m), Brown Silt Sand (1.52 - 4.72 m)



4.2 Natural Heritage Features

Based on a review of existing mapping, two surface water features were identified within 500 m of the Site. Porcupine Lake Wetland PSW, approximately 450 m to the northeast of the Site and Bob's Lake, approximately 430 m east of the Site. Neither surface water feature is expected to have impacts from construction related activities on the Site.

4.3 Discharge Water Quality

A Preliminary Soil and Groundwater Characterization Report (SGCR) was issued by Gannett Fleming to ONTC in March 2024. Groundwater samples were obtained from the existing monitoring wells on Site, and the analytical results were compared to MECP Table 2 SCS. A summary of the exceedances are provided below:

- Chloride in groundwater sample BH23-NT-1 (1,530,000 μg/L) exceeded the MECP Table 2 SCS (790,000 μg/L).
- Benzo(a)pyrene in groundwater sample BH23-NT-7 (0.0179 μg/L) exceeded the MECP Table 2 SCS (0.01 μg/L). The RDL for benzo(a)pyrene in groundwater sample BH23-NT-1 (<0.0135) also exceeded the MECP Table 2 SCS (0.01 μg/L).

Depending on the intended point of discharge of construction dewatering volumes, water quality should be assessed in comparison with the regulations of the receiving environment (i.e. Sewer use bylaws, PWQO, or other MECP guidelines). Groundwater quality should meet the appropriate regulations, and if not, should undergo treatment prior to discharge. Should treatment of groundwater be necessary to discharge to an accepted receiver, a mobile Environmental Compliance Approval (ECA) may be necessary to permit this treatment. A treatment specialist should be consulted if treatment is expected to be necessary.

For the management of excess groundwater or dewatering during construction, all relevant approvals for water taking (PTTW or EASR) and discharge (discharge permit / approval where required) shall be obtained prior to construction.

If discharge water is to be directed overland as deemed appropriate by the QP, discharge should be dispersed through existing vegetation and be minimum distance of 30 m away from any surface water body, as stipulated by the MECP. Due to the high potential for sediment during construction dewatering, it is recommended that discharge water be directed through a sediment filtration bag, before being discharge overland.

Proper erosion and sedimentation control measures should also be in place and stipulated in the construction plans. The measures should be installed, used, operated, and maintained in accordance with recommendations provided by the manufacturers of the control measures.

In the event that a hydrocarbon film or sheen be observed, dewatering shall cease until the source of the impact is identified, and or the discharge is sufficiently treated based on the criteria of the receiver.



5.0 References

- Chapman, L.J. and Putnam, D.F. 1984. Physiography of southern Ontario; Ontario Geological Survey.
- Freeze, A.R., Cherry, J.A. 1979. Groundwater. Prentice-Hall Inc., Englewood Cliffs, New Jersey.
- Mattagami Region Conservation Authority (MRCA), 2019. Mattagami Region Source Protection Plan. December 3, 2019.
- Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release— Data 128 Revised.
- Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1.
- Palmer, 2024. Geotechnical Investigation Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario. Draft Rev. 3. August 9, 2024.



6.0 Statement of Limitations

This report has been prepared by SLR Consulting (Canada) Ltd. (SLR) for Gannett Fleming (Client) in accordance with the scope of work and all other terms and conditions of the agreement between such parties. SLR acknowledges and agrees that the Client may provide this report to government agencies, interest holders, and/or Indigenous communities as part of project planning or regulatory approval processes. Copying or distribution of this report, in whole or in part, for any other purpose other than as aforementioned is not permitted without the prior written consent of SLR.

Any findings, conclusions, recommendations, or designs provided in this report are based on conditions and criteria that existed at the time work was completed and the assumptions and qualifications set forth herein.

This report may contain data or information provided by third party sources on which SLR is entitled to rely without verification and SLR does not warranty the accuracy of any such data or information.

Nothing in this report constitutes a legal opinion nor does SLR make any representation as to compliance with any laws, rules, regulations, or policies established by federal, provincial territorial, or local government bodies, other than as specifically set forth in this report. Revisions to legislative or regulatory standards referred to in this report may be expected over time and, as a result, modifications to the findings, conclusions, or recommendations may be necessary.

7.0 Closure

We trust that this report provides the information requested for your present requirements. Please do not hesitate to contact the undersigned should there be any questions.

Regards,

SLR Consulting (Canada) Ltd.

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Amanda Malatesta, M.Sc., P.Geo Hydrogeologist

Attachments:

Figure 1: Site Plan

- Figure 2: Site Topography and Drainage
- Figure 3: Quaternary Geology

Figure 4: Bedrock Geology

Figure 5: Cross Section 1

Figure 6: Cross Section 2

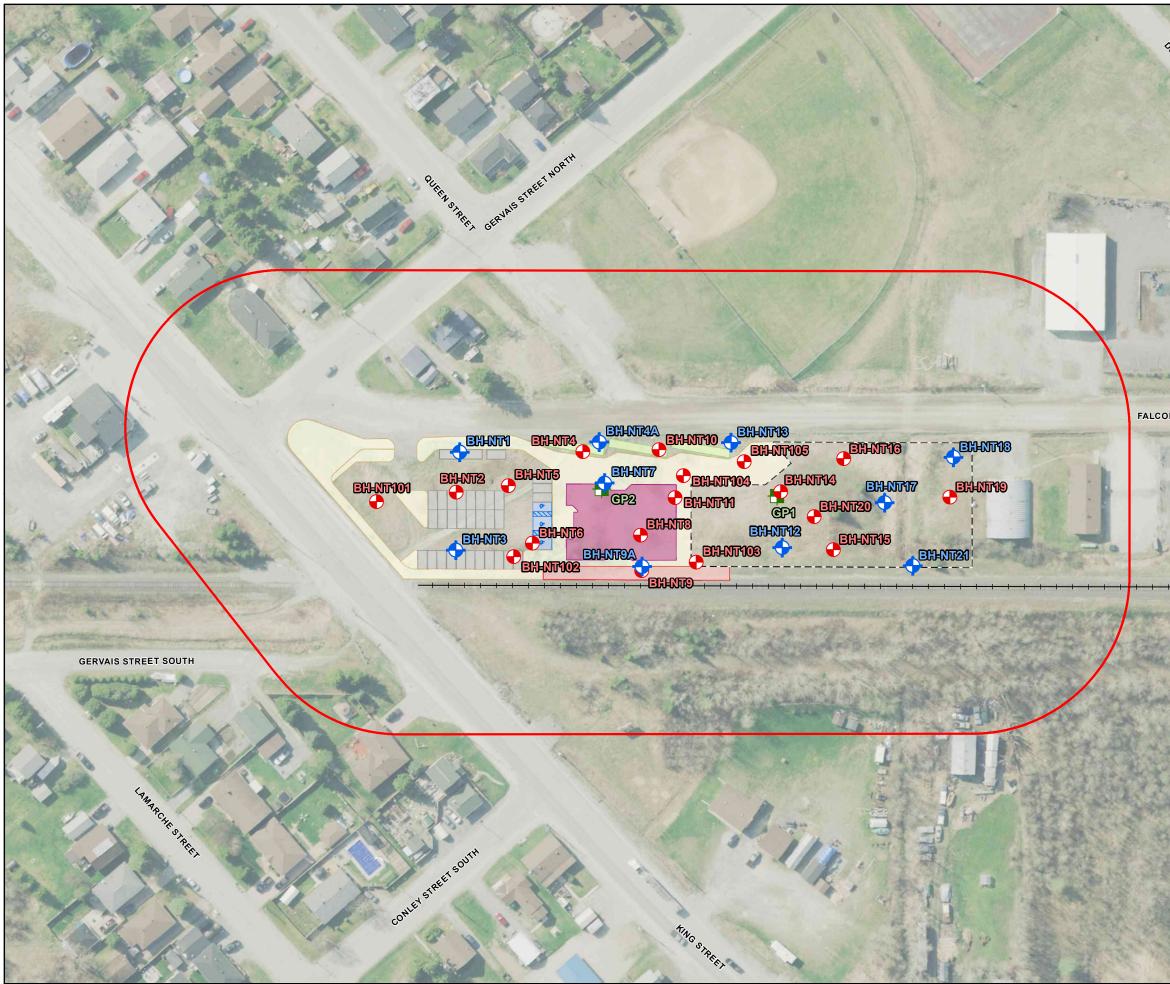
Figure 7: Cross Section 3

Figure 8: MECP Water Well Records within 500m of Study Area

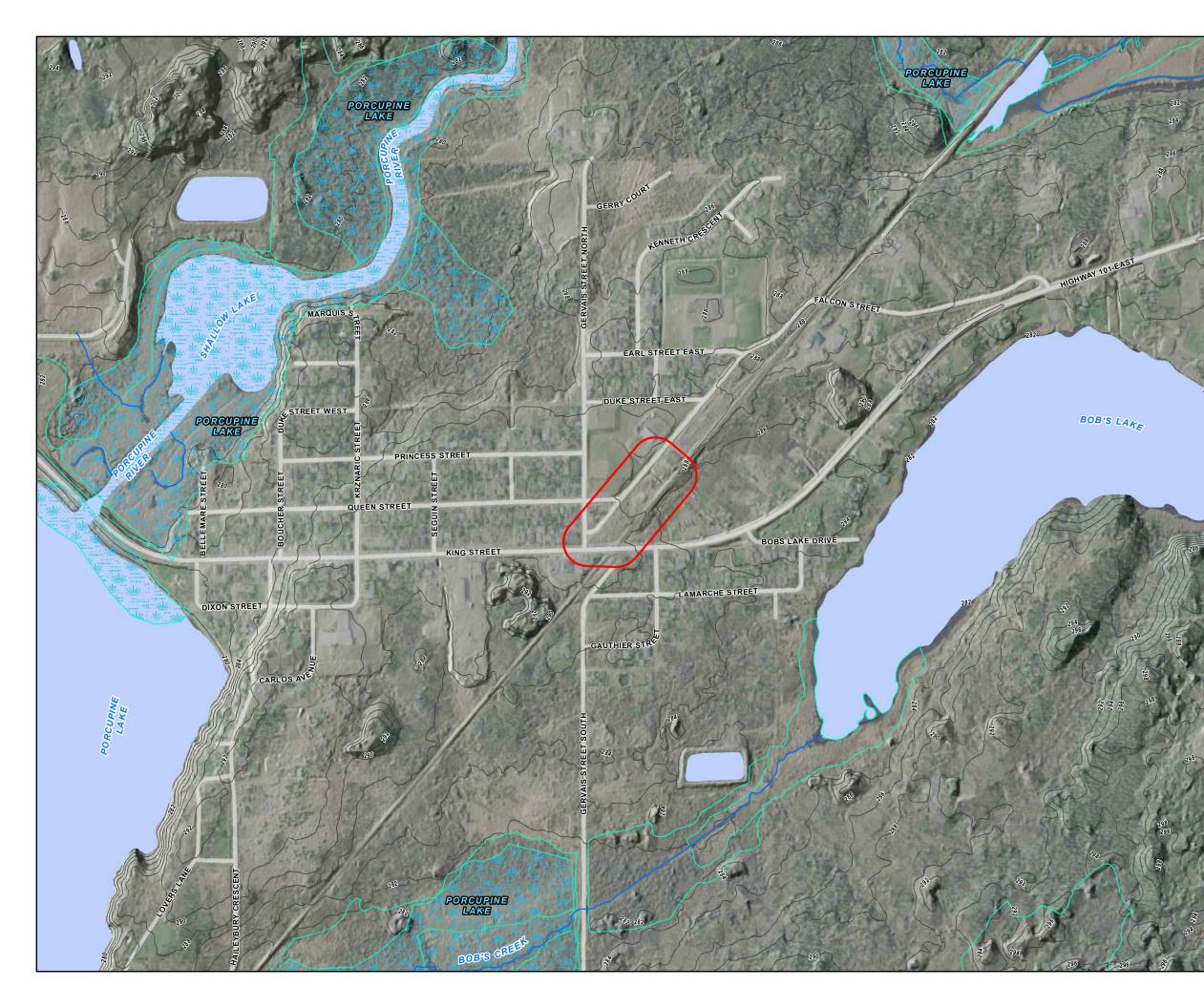
Miel Selwith

Nick Schmidt, B.Sc., P.Geo Senior Hydrogeologist





Carl A	KEY MAP		
QUAR STREET FRAST		South Porcupine	Procupine lite Location
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		Borehole/Monitori	-
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	Pu	IIICI, I ∜SLR	Figure 1





- [—] Surface Elevation Contour (2m)
- ∼ Watercourse¹
- Waterbody¹
- Wetland¹
- Wetland Evaluated Provincial¹
- Study Area

1. LIO/MNRF



North American Datum 1983 Universal Transverse Mercator Projection Zone 17

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Palmer.

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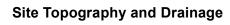
Figure 2

Source Notes: Imagery (2016, COOP) provided by Land Information Ontario map service. Contains information licensed under the Open Government Licence – Ontario.

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Hydrogeological Assessment -New Timmins Station, Ontario Northland Northeastern Passenger Rail Project



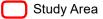
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── Watercourse¹



Quaternary Geology²

Phanerozoic / Cenozoic / Quaternary / Recent

32: Organic deposits: *peat, muck and marl*

Phanerozoic / Cenozoic / Quaternary / Pleistocene

25: Glaciomarine deposits: sand, gravelly sand and gravel nearshore and beach deposits

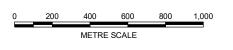
24: Glaciomarine deposits: *silt and clay, minor sand basin and quiet water deposits*

Precambrian



1: Bedrock: undifferentiated igneous and metamorphic rock, exposed at surface or covered by a discontinuous, thin layer of drift

1. LIO/MNRF 2. Ontario Geological Survey, 2017. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14



North American Datum 1983 Universal Transverse Mercator Projection Zone 17

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Quaternary Geology

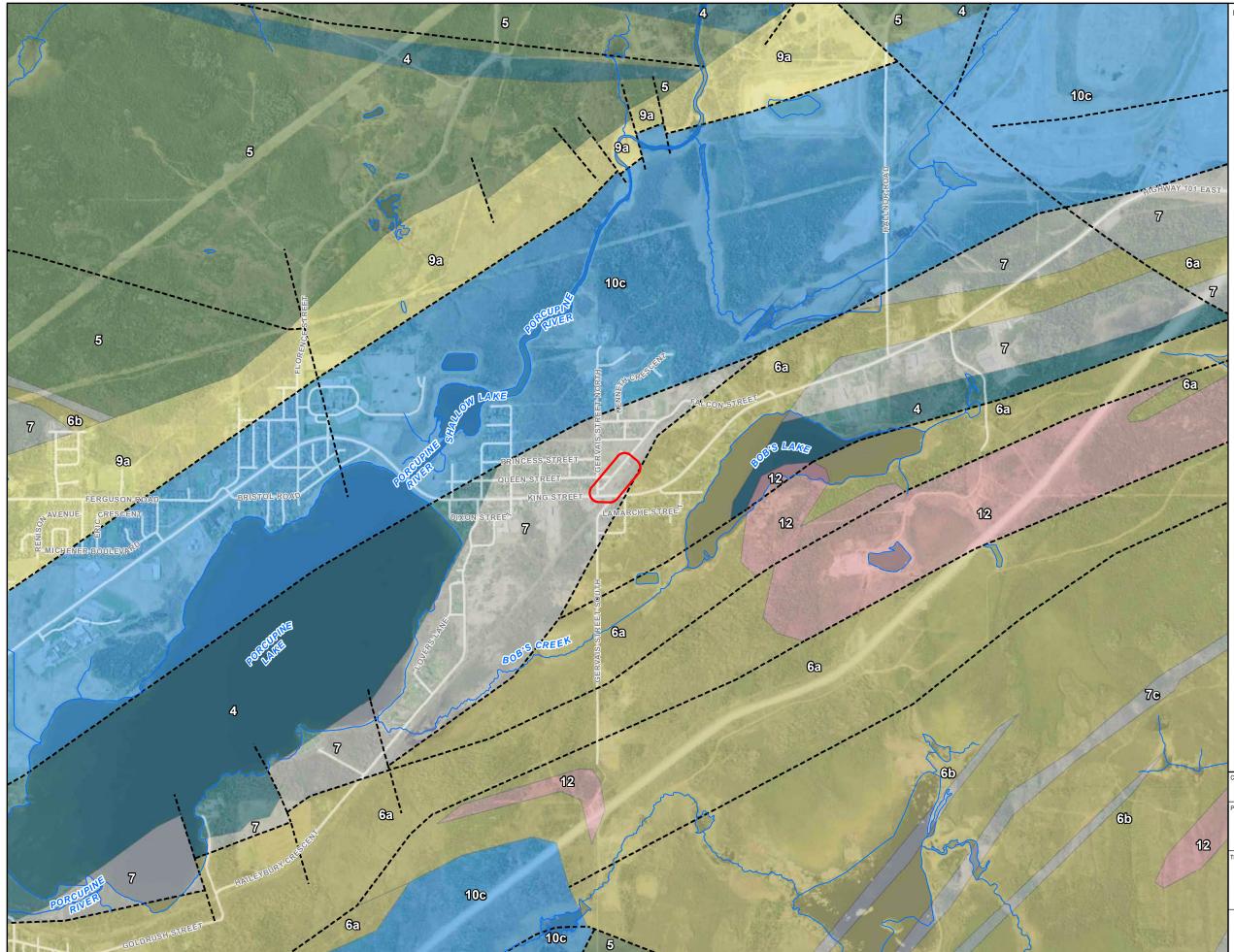
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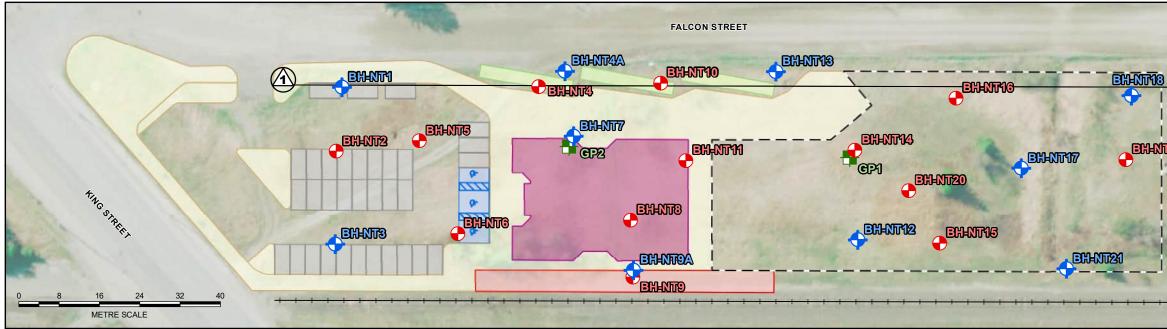
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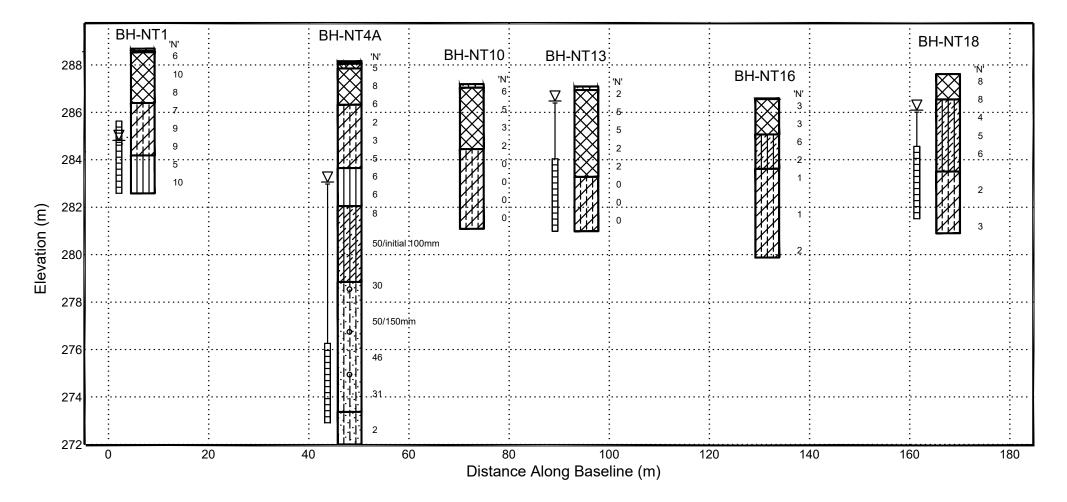
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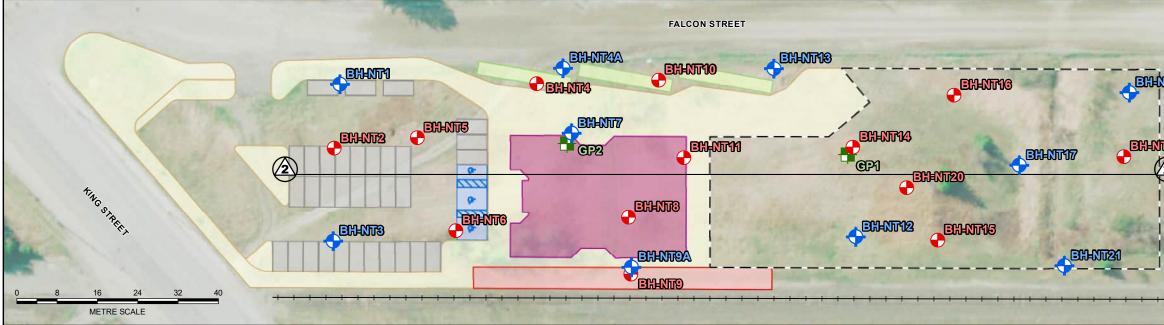


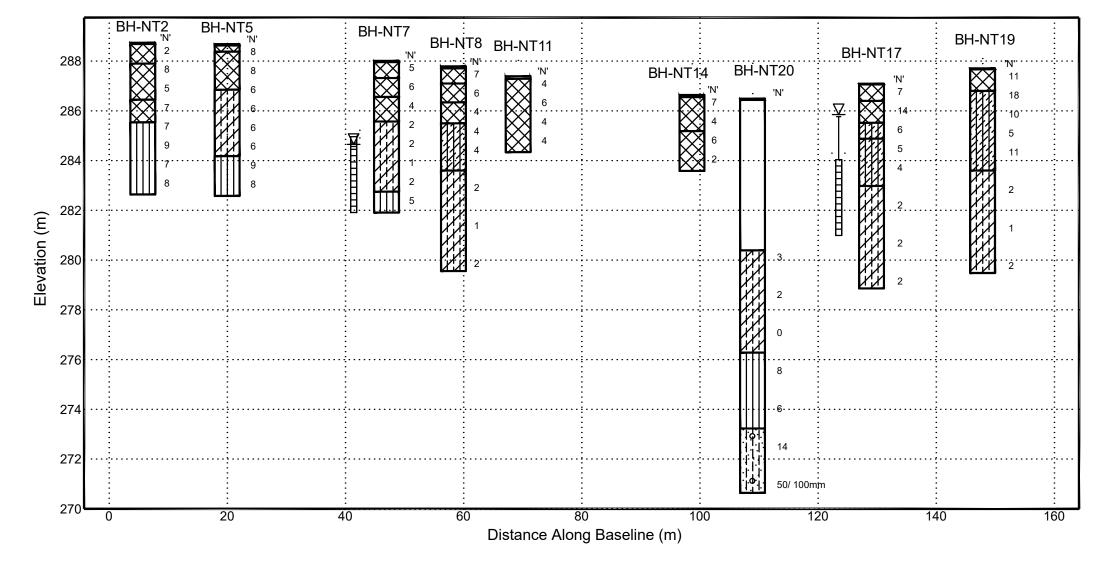
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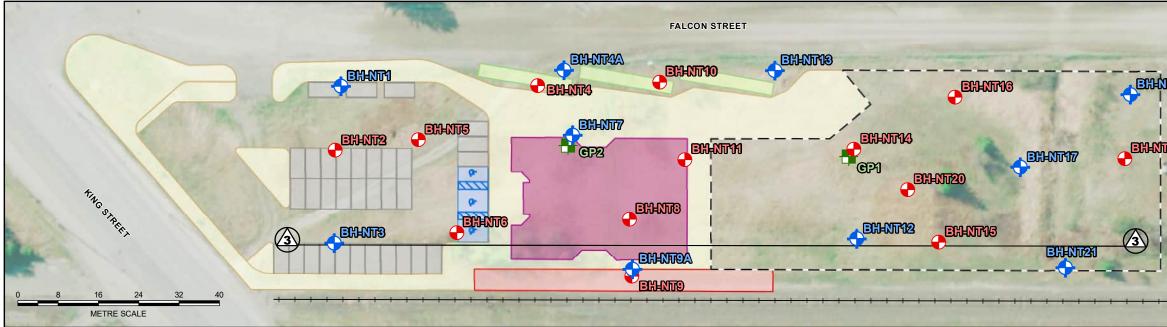


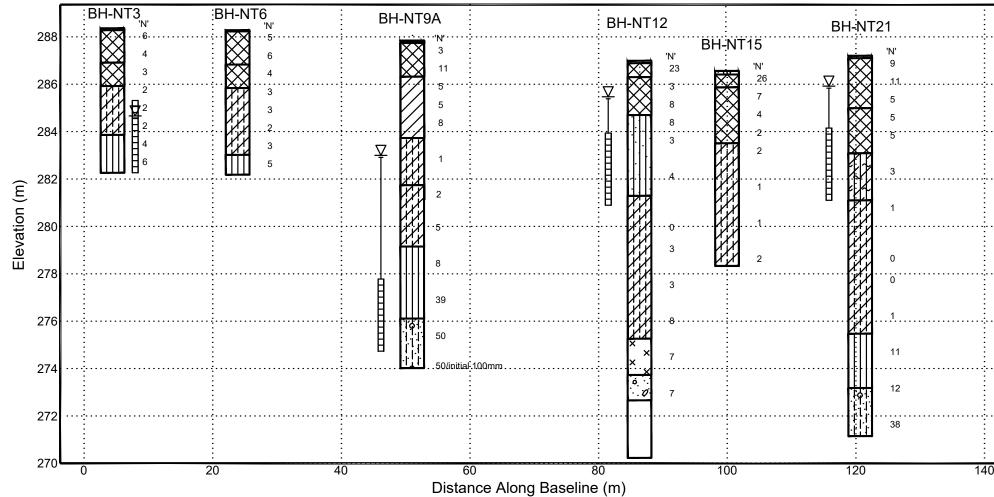
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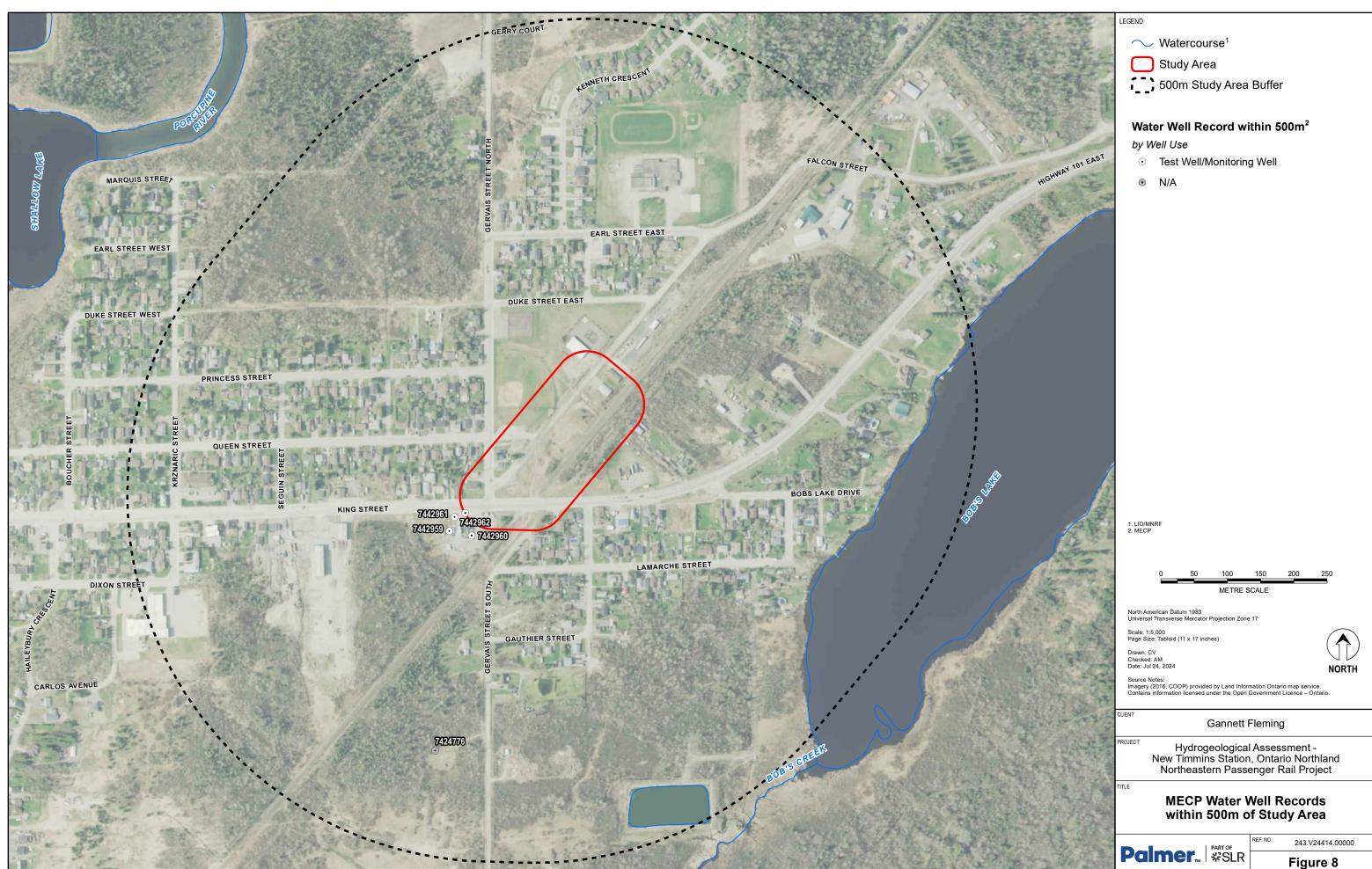


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F18	Test Pit Location	
	→→ Existing Mainline	Rail Track
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	Proposed Parking	J
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Appendix A

Geotechnical Report



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Geotechnical Investigation – Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario (Draft Rev 3)

Palmer Project #

2304202

Prepared For

Gannett Fleming

August 9, 2024

Samira Ebrahimi K. Gannett Fleming Royal Bank Plaza, South Tower 200 Bay Street, Suite 1600 Toronto, ON M5J 2J3

Dear Samira:

 Re:
 Geotechnical Investigation – Ontario Northland Northeastern Passenger Rail Service: New Timmins Station, Timmins, Ontario (Draft Rev 3)

 Project #:
 2304202

Palmer is pleased to submit the attached report describing the results of our geotechnical investigation for the project at the subject site ("the Site") located in Timmins, Ontario.

The report provides site information from our site investigation, laboratory testing, records reviews, and our interpretations/recommendations for your consideration.

Thank you for the opportunity to be of service on this project. We trust that this report will be satisfactory for your current needs. If you have any questions or require further information, please contact our office at your convenience. This report is subject to the Statement of Limitations provided at the end of this report.

Yours truly,

Palmer, SLR

Draft

Alonzo Rowe, P.Eng. Geotechnical Engineer

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Appendix A

Notes on Sample Descriptions Explanation of Terms Used in the Record of Borehole Borehole Logs

Appendix B

Geotechnical Laboratory Results

Appendix C

Infiltration Testing Results

Appendix D

Corrosivity Laboratory Results

August 9, 2024

2304202_Geotechnical Investigation Ontc_Timmins Station_Draft Rev 3 Working

Encl. Nos. 1 to 23



1. Introduction

Palmer was retained by Gannett Fleming on behalf of Ontario Northland Transportation Commission (ONTC) to undertake a geotechnical investigation in support of the design of a new train station located in Timmins, Ontario.

In this stage of analysis, a geotechnical investigation is to provide a broad understanding of subsurface conditions across the site by means of twenty-one (21) exploratory boreholes drilled in July 2023 and Five (5) additional boreholes drilled in June 2024 for additional soil parameters. This report has been revised based on the updated site grading plan provided to Palmer in June 2024 and the additional boreholes drilled in 2024. Supplemental boreholes are being completed and will be added in a separate revision.

The report is provided on the basis of the terms of reference presented above, and on the assumption that the design will be in accordance with applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the changes. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and may not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report deals with geotechnical issues only.

This report supersedes all previous Palmer reports prepared for this site and has been prepared for ONTC, Gannett Fleming and their designers. Use of this report by third party without Palmer's consent is prohibited. The limitations of the report presented within form an integral part of the document and they must be considered in conjunction with this report

2. Site and Regional Geology

The project limits consist of a block of land on Falcon Street Between Gervias Street North and Duke Street East, Timmins, Ontario.

A review of available Ontario surficial geology mapping indicated that the overburden materials of the majority of the site block are comprised of clay and silt glaciolacustrine and glaciomarine deep water



deposits (Ontario Geological Survey, 2010). Bedrock geology mapping indicated that the site is underlain by Metasedimentary bedrock (Ontario Geological Survey, 2011).

3. Field and Laboratory Work

The field work for the geotechnical investigation was carried out from July 5 to 9 and July 17 to 19, 2023 by drilling specialists CSC Engineering Service and Marathon Underground Constructors Corporation subcontracted to Palmer. During this time, twenty-one (21) boreholes (BH23-NT-1 to BH23-NT-21) were advanced. It should be noted that Borehole BH23-NT-4 and BH23-NT-9 were extended after initial drilling and were labeled as BH23-NT-4A and BH23-NT-9A respectively. Additionally, five (5) additional boreholes (BH24-NT-101 to BH24-NT-105) were drilled from June 11 to 14, 2024 for additional data for settlement analysis. The locations of boreholes are shown on the Borehole/Monitoring Well Location Plan, **Drawing** 1. The boreholes were drilled to depths ranging from 3.1 to 16.2 m below existing ground surface (Elev. 284.4 to 270.2).

The boreholes were advanced with a power auger drilling machine utilizing a 140-pound (63.5 kg) automatic hammer, where soil stratigraphy was recorded by observing the quality and changes of augered materials which were retrieved from the boreholes, and by sampling the soils at regular intervals of depth using a 50 mm O.D. split spoon sampler, in accordance with the Standard Penetration Test (SPT) method (ASTM D1586). This sampling method recovers samples from the soil strata, and the number of blows required to drive the sampler 300 mm depth into the soil (SPT 'N' values) gives an indication of the compactness condition or consistency of the sampled soil material. The SPT 'N' values are indicated on the borehole logs (Refer to **A**pp**endix A**). In addition to SPT testing, dynamic cone penetration tests (ASTM D6951) and pocket penetrometer tests were also conducted on the soil samples during the field work. The field work for this investigation was supervised by Palmer engineering staff, who also logged the boreholes, conducted field testing and cared for the recovered samples. Five undisturbed (Shelby tube) samples were taken from Borehole BH23-NT-12, BH24-NT-101 to BH24-NT-103 and BH24-NT-105 from approximately 4.5 to 8.3 m below existing ground surface (Elev. 282.9 to 280.0)

Ten (10) monitoring wells were installed in Boreholes BH23-NT-1, BH23-NT-3, BH23-NT-4A, BH23-NT-7, BH23-NT-9A, BH23-NT-12, BH23-NT-13, BH23-NT-17, BH23-NT-18, and BH23-NT-21 to determine the stabilized groundwater levels. The remaining boreholes without monitoring wells installed were backfilled and sealed upon completion of drilling. The stabilized groundwater levels were measured on August 30, 2023. The monitoring wells installation details and the measured groundwater levels are summarized in **Table 1** and shown in the individual borehole logs.

All soil samples obtained during this investigation were brought to our laboratory for further examination. These soil samples will be stored for a period of three (3) months after the day of issuing the final report,



after which time they will be discarded unless Palmer is advised otherwise in writing. In addition to visual examination in the laboratory, all soil samples from geotechnical boreholes were tested for moisture contents and in-situ vane tests (ASTM D2573) were conducted in select boreholes. One undisturbed (Shelby tube) sample of silty clay was subject to oedometer (consolidation) test (ASTM D2435-04). 20 kg of subgrade soil was also submitted for California Bearing Ratio (CBR) testing (ASTM D1883-21) The geotechnical lab testing results are presented in **Appendix B**

The approximate elevations at the as-drilled borehole locations were surveyed using a differential GPS unit. The elevations at the as-drilled borehole locations were not provided by a professional surveyor and should be considered as approximate. Contractors performing the work should confirm the elevations prior to construction. The locations plotted on **Drawing** 1 were based on the survey and should be considered as approximate.

4. Subsurface Conditions

The borehole locations are shown on **Drawing** 1 with a representation of the subsurface profile shown in **Drawing** 2 to 4. General notes on soil sample description are presented on the "Explanation of Terms Used in the record of borehole" sheet in **Appendix A**. The subsurface conditions in the boreholes are presented in the individual borehole logs (Enclosures 1 to 23 inclusive, **Appendix A**). The subsurface conditions in the boreholes are summarized in the following paragraphs.

4.1 Soil Conditions

Topsoil

A 25 to 150 mm thick layer of surficial topsoil was encountered at the surface of all boreholes except for Borehole BH23-NT-12. It should be noted that the thickness of the topsoil encountered at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site.

Fill Materials

Fill materials consisting of silty clay / clayey silt, sandy silt / silty sand, sand, sand and gravel, and gravely sand were encountered at the surface of Borehole BH23-NT-12 or below the topsoil in all other boreholes. The fill materials extended to depths typically ranging from about 0.7 to 3.8 m below existing ground surface (Elev. 286.9 to 283.5) with an outlier at BH23-NT-21 with possible fill to 6.1 m (Elev. 281.1). Historical satellite imaging shows that the potential cause of this deep fill may be a manmade water drainage area. The standard penetration 'N' values ranging from 2 to 26 blows per 300 mm penetration indicated a very

loose to compact compactness condition or very loose to firm consistency. The in-situ moisture contents measured in the fill samples ranged from approximately 2% to 43%.

California Bearing Ratio (CBR) testing was also conducted on a bulk sample from this soil. The results are presented in **A**pp**endix B**. The reported overall CBR-value at 2.54 mm penetration was 5.3%.

Silty Clay

Silty clay was encountered below the fill materials in Borehole BH23-NT-1, BH23-NT-3 to BH23-NT-7, BH23-NT-10, BH23-NT-13, BH23-NT-18 and BH23-NT-21 and below the clayey silt in Borehole BH23-NT-8. BH23-NT-9, and BH23-NT-16 to BH23-NT-19 and below the sandy silt in BH23-NT-12. The silty clay deposit extended to a depth of 4.5 to 11.7 m below existing ground surface (Elev. 284.2 to 275.5). Boreholes BH23-NT-8 to BH23-NT-10, BH23-NT-13, and BH23-NT-15 to BH23-NT-19 were terminated in this deposit. The standard penetration 'N' values ranging from 0 to 8 blows per 300 mm penetration along with in-situ vane tests indicated a very soft to firm consistency. The natural moisture contents measured in the soil samples ranged from approximately 18% to 38%.

Grain size analyses were conducted on three (3) selected samples (BH23 NT 15/SS6, BH23-NT-19/SS7 and BH23-NT-21/SS8) from the silty clay deposit. The results are presented on the borehole logs and in **A**pp**endix B**, with the following fractions:

Gravel:	0%
Sand:	1%
Silt:	35% to 55%
Clay:	44% to 64%

Consistency (Atterberg) limits tests on the same three (3) samples of the fines content of the soil matrix component of the samples indicate liquid limits ranging from 39 to 49, plastic limits ranging from 20 to 24, and plasticity indices ranging from 20 to 25 (see Appendix B). According to the modified Unified Soil Classification System, BH23 NT 15/SS6 and BH23 NT 21/SS8 are classified as medium plasticity silty clay (CI) while BH23-NT-19/SS7 is classified as low plasticity silty clay (CL).

Clayey Silt

Clayey silt was encountered below the fill materials in Borehole BH23-NT-8, BH23-NT-9, BH23-NT-15 and BH23-NT-16 to BH23-NT-18, and BH23-NT-19; below the silty clay in BH23-NT-9A and BH23-NT-12, and below the silt in BH23-NT-4. The clayey silt deposit extended to a depth of 3.0 to 9.3 m below existing ground surface (Elev. 283.7 to 278.9). The standard penetration 'N' values ranging from 2 to 18 blows per

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300 mm penetration indicated a very soft to very stiff consistency. The natural moisture contents measured in the soil samples ranged from approximately 15% to 26%.

Grain size analyses were conducted on two (2) selected samples (BH23-NT-8/SS6 and BH23-NT-16/SS4) from the clayey silt deposit. The results are presented on the borehole logs and in **A**pp**endix B**, with the following fractions:

 Gravel:
 0%

 Sand:
 3%

 Silt:
 73%

 Clay:
 24%

Consistency (Atterberg) limits tests on the same two (2) samples of the fines content of the soil matrix component of the samples indicate liquid limits ranging from 21 to 25, plastic limits ranging from 18 to 19, and plasticity indices of 6 (see **A**pp**endix B**). According to the modified Unified Soil Classification System, both samples are classified as low plasticity clayey silt with low compressibility (CL-ML).

Silt / Sandy Silt

Silt to sandy silt was encountered below the fill materials in Borehole BH23-NT-2 and BH23-NT-12, and below the silty clay in BH23-NT-1, BH23-NT-3, BH23-NT-4, BH23-NT-6, BH23-NT-9, BH23-NT-12, BH23-NT-20 and BH23-NT-21. The silt to sandy silt deposit extended to a depth of 5.7 to 14.0 m below existing ground surface (Elev. 282.7 to 273.7). Boreholes BH23-NT-1, BH23-NT-2, BH23-NT-3 and BH23-NT-4 were terminated in this deposit. The standard penetration 'N' values ranging from 10 to greater than 50 blows per 300 mm penetration indicated a loose to very dense compactness condition. The natural moisture contents measured in the soil samples ranged from approximately 11% to 29%.

Grain size analyses were conducted on four (4) selected samples (BH23-NT-2/SS6, BH23-NT-3/SS7, BH23-NT-6/SS8 and BH23-NT-12/SS5) from the silt to sandy silt deposit. The results are presented on the borehole logs and in **A**ppendix **B**, with the following fractions:

Gravel:	0%
Sand:	1% to 20%
Silt:	71% to 85%
Clay:	9% to 18%

Silty Sand (Till)

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Silty sand was encountered below the silt to sandy silt in Borehole BH23-NT-9, BH23-NT-20, and BH23-NT-21, and below the clayey silt in BH23-NT-4. The silty sand deposit extended to a depth of 13.8 to 16.2 m below existing ground surface (Elev. 274.1 to 270.6). Boreholes BH23-NT-4, BH23-NT-9, BH23-NT-20 and BH23-NT-21 were terminated in this deposit. The standard penetration 'N' values ranging from 2 to greater than 50 blows per 300 mm penetration indicated a very loose to very dense compactness condition. The natural moisture contents measured in the soil samples ranged from approximately 15% to 25%.

Grain size analyses were conducted on three (3) selected samples (BH23-NT-4A/SS5, BH23-NT-9A/SS5 and BH23-NT-20/SS6) from the silty sand deposit. The results are presented on the borehole logs and in **A**pp**endix B**, with the following fractions:

Gravel:	5% to 6%
Sand:	43% to 57%
Silt:	34% to 45%
Clay:	4% to 7%

Sandy Gravel

Locally, a sandy gravel deposit was encountered below the silt in BH23-NT-12. The sands gravel extended to sampling termination at a depth of 14.3 m below existing ground surface (Elev. 272.7). The standard penetration 'N' value of 7 indicated a loose compactness condition. The natural moisture content measured in the soil sample was approximately 15%.

4.2 Groundwater Conditions

Ten (10) monitoring wells (50 mm dia.) were installed to monitor stabilized groundwater levels. The stabilized groundwater levels were measured on August 30, 2023. The monitoring well installation details and the measured groundwater levels are summarized in **Table** 1 and shown in the individual borehole logs.

Monitoring Well ID	Screen Interval (mBGS)	Water Level Depth (mBGS)/ Water Level Elevation (m) August 30, 2023
BH23-NT-1	3.1 ~ 6.1	3.9/284.8
BH23-NT-3	3.1 ~ 6.1	3.7/284.7

Table 1: Monitoring Well Details and Water Levels

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Monitoring Well ID	Screen Interval (mBGS)	Water Level Depth (mBGS)/ Water Level Elevation (m) August 30, 2023
BH23-NT-4	12.2 ~ 15.2	5.1/283.1
BH23-NT-7	3.1 ~ 6.1	3.4/284.7
BH23-NT-9	10.1 ~ 13.1	4.8/283.1
BH23-NT-12	3.1 ~ 6.1	1.5/285.5
BH23-NT-13	3.1 ~ 6.1	0.6/286.5
BH23-NT-17	3.1 ~ 6.1	1.2/285.9
BH23-NT-18	3.1 ~ 6.1	1.5/286.2
BH23-NT-21	3.1~6.1	1.3/285.9

Note: mBGS = meter below ground surface

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

4.3 In-Situ Infiltration Testing

Infiltration tests were completed at two (2) locations on site, with the first location (GP1) completed on July 27, 2022, and the second location (GP2) completed on August 8, 2023 using a constant head permeameter method (Guelph Permeameter) (Figure 1). All tests were completed using the combined reservoir and single-head test method. Field saturated hydraulic conductivity (K_{fs}) vales were calculated using the Guelph Permeameter K-sat Calculator (2012) using the single head method for all infiltration tests. The depths of the tests were limited by the saturated nature of the site, with tests performed at depths of 0.4 and 0.8 mbgs, prior to reaching wet soils.

Infiltration rates were approximated using the K_{fs} values obtained from the in-situ test and using the relationship provided by the SG-6 Percolation Time and Soil Descriptions of the Supplementary Guidelines of Ontario Building Code 1997, and the following empirical correlation presented in the Stormwater Management Criteria of TRCA.

$$K = (6 \times 10^{-11}) I^{3.7363}$$

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Where:

K = hydraulic conductivity (cm/s) I = infiltration rate (mm/hr)

The average infiltration rate for the site was estimated to be 44.5 mm/hr based on the two testing locations. Considering a factor of safety (FOS) of 2.5, the average rate is 17.8 mm/hour The K_{fs} values and infiltration rates for each test are summarized in **Table** 2 and results are provided in **Appendix C**.

Soil Description	Percolation Test Location	Depth of Auger Hole H (m) (mbgs)		Field Saturated Hydraulic Conductivity (K _{fs}) (m/s)	Calculated Infiltration Rate (mm/hr)	Infiltration Rate with 2.5 FOS	
	GP1	0.40	20	7.8x10 ⁻⁷	43	17.2	
Clayey Silt	GP2	0.80	15	1.0x10 ⁻⁶	46	18.4	
	Mean V	/alue	8.9x10 ⁻⁷	44.5	17.8		

Table 2: Estimated Infiltration Rates

5. Recommended Design Parameters

Suggested geotechnical parameters (unfactored) for soils encountered at the site are summarized in **Table** 3. The recommended soil parameters are based on SPT N-values, soil laboratory test results and supplemented by the judgement based on local and regional experience with these soil types.

SOIL TYPE	NE GRAI R F	NULA	EXISTING FILL	NON-COHESIVE NATIVE SOILS – SAND AND GRAVEL TO SANDY SILT (TILL)						COHESIVE NATIVE SOIL – SILTY CLAY (TILL)				
SPT 'N'	' A '	'B'	4-50	5-10	11-14	15-29	30-39	40 – 50	>50	3-9	10-14	15-29	30-50	>50
U nit w eight (k N/m³)	22	21	19	19	20	21	21.5	22	22.5	19	20.5	21	21.5	22.5

Table 3: Recommended Soil Parameters for Design

August 9, 2024

SOIL TYPE	GRAI	NEW ANULA FILL SUB NON-COHESIVE NATIVE SOILS - SAND AND GRAVEL TO SANDY SILT (TILL) SILTY CLAY (TILL)						SAND AND GRAVEL TO SANDY						. –
SPT 'N'	'A'	'B'	4-50	5-10	11-14	15-29	30-39	40 - 50	>50	3-9	10-14	15-29	30-50	>50
Effective angle of internal friction (°), φ'	35	32	24	26	28	30	32	34	37	26	28	30	32	34
Effective cohesion, c' (kPa)	-	-	-	-	-	-	-	-	-	0	2	5	10	10
Undrained shear strength (kPa)	-	-	-	-	-	-	-	-	-	40	70	100	200	300
Coefficient of lateral earth pressure														
Active, Ka	0.27	0.31	0.42	0.39	0.36	0.33	0.31	0.28	0.25	0.39	0.36	0.33	0.31	0.28
At rest, K₀	0.43	0.47	0.59	0.56	0.53	0.50	0.55	0.60	0.80	0.56	0.53	0.50	0.60	1.00
P assive , K p	3.69	3.25	2.37	2.56	2.77	3.00	3.25	3.54	4.03	2.56	2.77	3.00	3.25	3.54
Elastic modulus (MPa)	-	-	-	5	6.3	8	30	40	50	4	8	15	30	50
Poission's ratio	-	-	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Modulus of subgrade reaction, k (MN/m ³) (*)	-	-	-	5/B	6.3/B	8/B	30/B	40/B	50/B	4/B	8/B	15/B	30/B	50/B
Lateral modulus of subgrade reaction, K _h (MN/m ³) (*)	-	-	-	5/B	6.3/B	8/B	30/B	40/B	50/B	4/B	8/B	15/B	30/B	50/B

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(*) B is the width of footing or width of wall/pile in metres.

6. Discussion and Recommendations

6.1 Foundation Design Considerations

It is understood that there are plans to design and construct a new rail station in Timmins, Ontario for the Ontario Northland Northeastern Passenger Rail Service. The proposed development plans will include a new station building, station platform, new parking and access roads. It is also understood that site grading will result in raised grades of approximately 0.5 to 1.5 m though the placement of fill in some areas.

6.1.1 Settlement

Based on the borehole information, the shallow soil found on site is not suitable to support proposed building foundations with the required structural column loads of 200 kN in SLS and 300 kN in ULS and the perimeter foundation loads of 25 kN/m in SLS and 35 kN/m in ULS. Additionally, train platform loading is expected to be in the order of 15 kPa SLS.

The soil stratigraphy encountered on site particularly native silty clay soils encountered below about Elev. 284.0 consisted of very soft, silty clay which put the proposed structures at risk of excessive settlement. To determine the magnitude, settlement analysis was conducted using the properties of the soils found on site. Soil parameters from the laboratory tests used in this analysis can be found in **A**pp**endix B**. These tests include one consolidation test from the original scope and four additional from the 2024 scope.

A 3-dimensional computer model was used to compute the settlement on the site utilizing Boussinesq's method for stress computation. This model was created using Settle3 Build 5.024 by Rocscience. The soil stratigraphy and soil properties were determined from borehole information, in-situ and laboratory testing.

The following conditions were used during the computerized modeling of the settlement:

- A groundwater level at elevation 284.0 representing a high groundwater level condition.
- Assumed unit weight of 18 KN/m³ for the fill on site.
- Typical traffic loading of 15 kPa where applicable.

Three main areas on site were evaluated:

• The proposed parking lot;

- The proposed bus loop;
- And the proposed train platform.

6.1.1.1 Station Building Shallow Foundations

It is assumed that footings for the proposed station building will be placed at least 2.4 m below the final site grade (Elev. 284.7 to 285.1) in accordance with MTO Hydrotechnical Design Chart 4.03 (2023) due to the required protection depths from frost penetration. Soils found at this depth results in settlements for the proposed station building that are expected to exceed 300 mm. Due to this, shallow foundations on native soils are not recommended, and deep foundations or ground improvement should be considered.

Gound improvement would allow for structural design of the building using shallow foundations supported on the stabilized working platform where ground improvement methods will transfer loads to the more competent soil layers. Details about deep foundations and ground improvement can be found in **Sections** 6.1.2 and 6.1.3.

6.1.1.2 Parking Lot

Settlement modeling for the proposed parking lot consisted of interpolated soil stratigraphy between boreholes BH24-NT-101 and BH24-NT-102 and results from laboratory consolidation testing from the thin walled tubes taken from the silty clay from elevation 283.8 to 282.0.

The model considered the removal of all fill materials, the replacement of the fill with approved fill materials and the placement of the suggested pavement structure that will be discussed in **Section** 6.7. This model also considers the additional grade change to 0.5 m above the current elevation.

Considering the required sub excavation and proposed grading plan including the removal of the unsuitable fill materials and the replacement of engineered fill, settlements in the proposed parking lot are expected to be in the magnitude of 25 to 40 mm.

If such settlements can be tolerated, it is recommended that a pavement structure utilizing both geogrid and geotextile on the subgrade should be considered to help mitigate differential settlement. The top course of asphalt should be delayed by a minimum of one year to a allow for settlements to occur. In addition a maintenance program including resurfacing should be considered to address defects in the pavement surface. If settlement cannot be tolerated, ground improvement can be utilized.



The use of 1.3 m of lightweight fill to reduce loads on the soil was also considered with the resulting in settlement in the order of 20 mm. The results are negligible due to the requirement of a significant pavement structure. Given the additional costs associated with the placement of lightweight fill, this is not recommended.

6.1.1.3 Bus Loop

Settlement modeling for the proposed bus loop consisted of interpolated soil stratigraphy between boreholes BH23-NT-4 and BH24-NT-105 and results from laboratory consolidation testing from the thin walled tube taken from borehole BH24-NT-105 at elevation 282.4.

Considering the proposed pavement structure that will be discussed in **Section** 6.7, the required sub excavation and proposed grading plan that include fills of up to 1.5 m, expected settlements in the proposed bus loop are expected to be in the magnitude of 40 to 60 mm. As with the parking lot, it is recommended that a pavement structure utilizing both geogrid and filter cloth should be considered to help mitigate differential settlement.

Similar to the parking lot, the use of 2.6 m of lightweight fill to reduce loads on the soil was considered. This resulted in settlement in the order of 30 mm due to the requirement of a significant pavement structure. Given the additional costs associated with the placement of lightweight fill, this is not recommended.

6.1.1.4 Train Platform

Using the same modeling methodology and considering the removal of the unsuitable fill materials and the replacement of engineered fill up to the elevation of the proposed grading plan, the train platform would result in the total settlement in the magnitude of about 80 to 120 mm. As this is a settlement sensitive structure, ground improvement can be utilized to reduce these excessive settlements. Alternatively, the platform structure can be supported on helical piles.

6.1.1.5 Preloading

Preloading using a surcharge load to consolidate the soils prior to construction would require a lengthy surcharge to sufficiently consolidate the underlying soils. Due to the proximity of the rail tracks this method may impart settlements on the right of way and should not be considered given the tracks are considered settlement sensitive.

A comprehensive study focusing on the impact to the tracks would be required along with an extensive settlement monitoring program. A preloading program would require monitoring and instrumentation of the clay soils.

6.1.2 Deep Foundations

6.1.2.1 Helical Piles

The proposed station building and platform may be supported by helical piles founded in the very dense or hard native soils below elevation 276.2 to 273.2 m, providing the required pile torque rating is capable of installing piles into the deep founding levels. Possible large obstructions such as buried concrete slabs or existing foundations within the fill materials or boulders within the tills may be encountered during the installation of the helical piles and may prevent the piles from reaching proposed founding depths.

Helical piles/anchors are proprietary products design, supplied and installed by specialty contractors. Bearing capacity and other design details regarding helical piles can be discussed with the specialized contractor. Geotechnical comments concerning installation and design capacities are provided in the following paragraphs. It must be noted that they are considered to be preliminary values suitable for preliminary design only. The actual design and installation of helical piles should be undertaken by contractors in Ontario that are approved by the manufacturer.

The designer should define the depth and type of helical piles according to the soil conditions and the required design loads. The designer should also consider the buckling resistance in weak soils and their lateral capacity. The contractor should also be responsible for the design capacity of the foundation units. In this regard, it is recommended that compression and tension tests be conducted to verify helical pile capacities prior to final design.

Table 4 below shows the capacities of various Chance piles that may be appropriate for this site. These values are taken from EBS Geostructural (specialty geotechnical contractor) and have been confirmed through field capacity testing.

"N" value Cohesionless	"N" value	Pile Type	Compressio	on Capacity	Tension	Capacity
Soil	Cohesive Soil	(size)	SLS (kN)	ULS (kN)	SLS (kN)	ULS (kN)
25-30	25-35	SS5 (38 mm)	200	270	60	80
30-35	35-45	SS175 (44 mm)	370	500	115	150
40-50	50-60	SS200 (51 mm)	500	670	205	270

Table 4: Chance Helical Pile Factored Geotechnical Resistances



Detailed design services are available through a number of specialty helical pile contractors, and shop drawings should be provided to Palmer for review. In general, helical piles should be advanced into the competent material found at the following depths:

- Station Building: Elev. 274.0
- Station Platform: Elev. 276.2 to 273.2

Piles should be driven to these elevation at a minimum or until the design torque is achieved.

The provided capacities are preliminary and must be confirmed with a specialty helical pile contractor and verified with field load tests on a sacrificial pile in accordance with ASTM D1143. A minimum of one (1) pile test should be conducted per structure on site. If multiple pile sizes are selected additional load tests would be required for each pile size.

It should be noted that there is a possibility that the very dense or hard stratum may not extend uniformly throughout the areas and the need for deeper helical piles in some areas must not be overlooked.

If site grades are raised, consideration should be given to the effects of negative skin friction on the helical piles.

It is recommended that Palmer be retained to monitor and document helical pile installation to verify that the recommended capacity is achieved.

6.1.2.2 Micropiles

Alternatively, micropiles can be adopted to support the station building and platform and be installed into very dense or hard native soils below elevation 276.2 to 273.2. Micropiles can be drilled through the obstructions or boulders and can be installed in most conditions below groundwater table.

A bond stress value of 100 kPa could be used to compute the geotechnical axial capacity of a pressure grouted micropile installed in the very stiff or dense soils. For preliminary planning purposes, the geotechnical capacity of a 244 mm diameter micropile would be in the order of 440 kN ULS based on the casing extending into the dense silty sand till (at depths of 11.7 to 14.0 m) and a 12 m bond length. Design of the micropile can provide tailored capacities based on the structural requirements for the project by altering the diameter and bond length.

The skin friction between the pile shaft and the fill materials and weak native soils can be ignored. These suggested bond values are for preliminary design purpose only, as the actual bond values will depend on the installation and grout procedures of the piles and must be determined by the field load testing. A



specialty contractor must be retained to design and construct the micropiles. The specialty contractor should determine the length and size of the piles, based on the required design loads, the subsurface conditions and their installation method/procedure. Stamped shop drawings must be provided for review prior to construction.

Field pile load testing is recommended to confirm the design capacity. The test piles must be loaded to at least 1.6 times its design bearing value at ULS. In order to ignore the group effect, the center-to-centre distance between adjacent micropiles should be at least 3 times its diameter.

The production micropiles must be installed after the pile load testing, only when the design load is confirmed by the pile load test results. The installation and load testing of the test micropile must be monitored by a qualified geotechnical engineering personnel.

6.1.2.3 Lateral Resistances of Piles

Lateral capacity on the recommended pile types (helical piles and micropiles) are minimal due to the slender nature of these piles. If lateral capacity will be required for the proposed designs, battered piles can be considered.

6.1.3 Ground Improvement

As an alternative to deep foundation methods, ground improvement techniques such as rammed aggregate piers (RAPs) or controlled modulus columns (CMCs) may be considered for this Site. Utilizing RAPs or CMCs would have several potential benefits for this Site, including higher bearing capacity, increased Seismic Site Class, as well as potentially reducing excess soil and earthworks compared to other deep foundation methods.

A ground improvement will be installed through a granular working platform. The design would include diameter, spacing and depths to provide an improved subgrade designed to support the required footing and floor slab loads and control settlement within tolerable limits.

CMCs are vertical semi-rigid inclusions, i.e. injected columns, with concrete or mortar, installed with a hollow full displacement auger. During the auger extraction process, the column is developed by grouting under controlled limited pressure through the stem of the auger. Column diameters varies between 250 and 450 mm. A load transfer platform is designed between the top of the columns and the structure (slab or foundation) to transfer the load to the CMC. The solution is to provide increased stiffness to the soil mass to safely control both total and differential settlements. The structure's loads are transferred between the soil and the CMC elements.

A specialty contractor must be retained to design and install ground improvement. The designer of specialty contractor should design the depth and methods of installation according to the soil conditions and the required design loads. Further recommendations regarding bearing capacity and other design details regarding RAPs or CMCs can be discussed with the specialty contractor. Detailed design services of ground improvement are available through a number of specialty design-build contractors, and stamped shop drawings should be provided to Palmer for review.

6.2 Excavations, Backfill and Groundwater Control

Excavations can be carried out with a heavy hydraulic backhoe. It should be noted that the (glacial) tills are non-sorted sediments and therefore may contain boulders. Possible large obstructions such as buried concrete pieces and existing foundations may also be encountered at the site and in the fill materials. Provisions must be made in the excavation contract for the removal of possible boulders in the till or obstructions in the fill material.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill materials and the loose cohesionless soils would be classified as Type 3 Soils above the groundwater table and Type 4 soils below the groundwater table. The soft to very soft silty clay to clayey silt would be classified as Type 4 Soils both above and below the groundwater table.

It is anticipated that foundation excavations at the site will consist of temporary open cuts with side slopes not steeper than 1 horizontal to 1 vertical (1H:1V). However, depending on the construction procedures adopted by the contractor and weather conditions at the time of construction, some local flattening of the slopes might be required. Where side slopes of excavations are to be steepened, then a temporary excavation support system such as steel sheeting will be required.

For excavations near or adjacent to existing tracks, temporary support systems and track protection will be required. Disturbances to the track structures must be monitored and recommendations for a monitoring program are discussed in **Section** 6.6.

The existing fill in the boreholes is generally not suitable for re-use as backfill. The native soils free from topsoil and organics can be used as general construction backfill. Loose lifts of soil, which are to be compacted, should not exceed 200 mm. Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use.

Under floor fill should be compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD). The excavated soils are not considered to be free draining. Where free draining backfill is required,



imported granular fill such as OPSS Granular "B" should be used. Imported granular fill, which can be compacted with handheld equipment, should be used in confined areas.

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

It is expected that any seepage above the groundwater table can be removed by pumping from sumps in the building development area. However, due to the high groundwater level encountered at the site, significant seepage should be expected once the excavations extend below the prevailing groundwater tables in the cohesionless sandy silt/silty sand/sand and gravel soils at the site. Depending upon the actual thickness and extent of these soils, the prevailing groundwater level at the time of construction, "active, advance" dewatering measure using well points/eductors may be required to maintain the stability of the base and side slopes of the excavations in these areas. These 'active dewatering' measures would have to be installed and then operated for a week or two in advance of excavation work progressing to these areas. A contractor specializing in dewatering should be retained to design the active dewatering systems.

It should be noted that if the construction dewatering system/sumps result in a water taking of more than 50,000 L/day but less than 400,000 L/day, a registration should be made in the Environmental Activity and Sector Registry (EASR). If a water taking is more than 400,000 L/day, a permit to take water (PTTW), issued by the MECP, may be required.

6.3 Floor Slab / Slab Drainage

The existing fill and soft/loose native are considered not suitable for supporting the floor and platform slabs. A reinforced structural slab fully supported on the deep foundations can be utilized to support floor slab loads where fills are encountered.

Ground improvement techniques as discussed in **Section** 6.1.3 can be used to support the floor lab using conventional methods.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

6.4 Seismic Considerations

The 2012 Ontario Building Code (OBC 2012) came into effect on January 1, 2014 and contains updated seismic analysis and design methodology. The seismic site classification methodology outlined in the code is based on the subsurface conditions within the upper 30 m below existing grade.

The conservative site classification is based on physical borehole information obtained at depths of less than 30 m and based on general knowledge of the local geology and physiography. In this regard, Palmer's drilling program included boreholes drilled to depths up to 16.2 m below the existing ground surface. Based on the borehole information showing average standard penetration 'N' values less than 15 and undrained shear strengths of less than 50 kPa, a Site Class E may be used for the building design.

Should optimization of the site class be recommended by the structural engineer, in situ geophysical testing or a deep borehole extending to 30 m may be considered. Ground improvement measures would also improve site classification.

6.5 Frost Protection

All foundations exposed to seasonal freezing conditions must have at least 2.4 metres of soil cover for frost protection in accordance with the MTO Hydrotechnical Design Chart 4.03.

It is also emphasized that underfloor drainage and/or an adequate free draining gravel base is required to minimize the risk of floor dampness. Floor dampness could lead to temporary icing and the risk of accidents.

6.6 Monitoring and Instrumentation

Vibrations in the pile installation and construction process may result in damage to existing track structure. A preconstruction condition survey and baseline measurements of the existing structures is recommended to further monitor/minimize any effects during and after excavation, pile installations and construction. The preconstruction condition survey is discussed in **Section** 6.6.1. Ground movement monitoring and vibration monitoring program of the existing track structure would be required for work within the 60 m right of way.

Ground Movement Monitoring Program

The purpose of a ground movement monitoring program would be to monitor horizontal and vertical movement of existing adjacent tracks. A ground movement monitoring program consisting of the following control points and benchmarks may be considered:

- Deep settlement points (DSP);
- Shallow settlement points (SSP);
- Surface monitoring points (SMP) and/or Reflective targets (RT) and/or Standard iron bars (SIB);
- Benchmarks (BM)

The intent of control point is to measure any ground movement potentially caused by construction. To provide reference points for the survey operation, BMs will be established. BMs will consist of 100 mm

O.D. 1.5 m deep concrete pylons in which a 15 mm dia. steel rod will be embedded to support a cap with reflective target. BMs will be located outside the zone of influence of the construction. Alternatively, nearby existing structures, not subject to vibration or movements, may be used as BMs. Locations of BMs will be established in the field at time of installations.

The final locations and spacing of the control points should be designed by qualified engineers experienced in monitoring and instrumentation.

Vibration Monitoring Program

Vibration monitoring program could be carried out in conjunction with ground movement monitoring program using seismographs, at locations where foundations of the existing adjacent structures may be sensitive to vibration. The conditions of all adjacent structures and their vibration tolerance should be determined by engineer specializing in vibration monitoring.

Once the installation is complete, a monitoring program of all points is to be conducted in accordance with the following instructions:

1. Monitoring should start before the installation and be done at least twice per day for no less than two days. This is required to establish a baseline reading and demonstrate the achievable accuracy.

2. Monitoring should proceed through the construction period and should be completed at least twice daily after pile driving begins.

3. Monitoring should continue for at least 10 days on a daily basis after the completion of construction.

4. If there is any movement of ground during construction, any reason to believe movement is identified during construction or subsequent monitoring period, the monitoring must be continued until the geotechnical engineer deems it is safe to discontinue such monitoring.

The above guidelines should provide sufficient frequency to capture the unexpected performance at the earliest possible stage and be evaluated in a timely manner. If any abnormal monitoring measurements or observations are made on the ground conditions or during the installation process, more stringent monitoring protocol should be followed. Two alarm levels are proposed:

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Level 1:

"WARNING" will be indicated on the field memo when a measurement of 50% of the critical monitoring threshold (ground movement or vibration tolerance) is obtained from monitoring points. Additional survey of the monitoring points will then be conducted immediately, and work will be authorized to continue only if no more soil movement has been measured. If ongoing soil movement is recorded, monitoring will be continued until movement ceases. Construction work may then be authorized to continue upon approval by engineers.

Level 2:

"CRITICAL" will be indicated on the field memo when a settlement of 80% of the critical monitoring threshold is obtained from the monitoring points. Additional survey of the monitoring points will then be conducted immediately, and work may be authorized to continue only if no more soil movement is measured for at least two (2) readings taken 12 hours apart. If ongoing soil movement is recorded, monitoring will be continued until movement ceases. The contractor must stop work and submit a new construction procedure to the engineers for approval to resume the work.

The "Warning" and "Critical" alarm levels at specific monitoring points should be provided based on the locations and types of the nearby building foundations. The critical monitoring threshold must be approved by engineers prior to construction.

6.6.1 Precondition Construction Survey

It is recommended that a preconstruction survey of the neighbouring buildings, utilities and structures be carried out prior to commencing construction. In addition, the types and conditions of all adjacent structures and underground services should be reviewed by the structural and geotechnical engineer. Each utility owner should be contacted to establish deformation limits. The deformation should be monitored throughout the construction period.

6.7 Pavement Design

The recommended pavement structures provided in **Tables** 5 and 6 are based upon borehole information obtained in this investigation. The values may need to be adjusted based on the municipality/regional standards. Consequently, the recommended pavement structures should be considered for preliminary reference purposes only. A functional design life of eight to ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to



determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Pavement Layer	Compaction Requirements	Light Duty Pavement (Parking for Cars)	Heavy Duty Pavement (Access Road, Fire Routes, Buses and Delivery Trucks)
	93%	40 mm HL 3	40 mm HL 3 HS
Asphaltic Concrete	Maximum Relative Density (MRD)	50 mm HL 8	100 mm HL 8 HS
OPSS Granular "A" Base (or 20mm Crusher Run Limestone)	100% SPMDD*	150 mm	150 mm
OPSS Granular "B" (or 50mm Crusher Run Limestone)	100% SPMDD	1050 mm	1760 mm

Table 6: Recommended Rigid Pavement Structure Thickness

P ave m ent Layer	Compaction Requirements	Heavy Duty Pavement (Access Road, Fire Routes, Buses and Delivery Trucks)		
Concrete	-	300 mm		
OPSS Granular "A" Base (or 20mm Crusher Run Limestone)	100% SPMDD*	150 mm		
OPSS Granular "B" (or 50mm Crusher Run Limestone)	100% SPMDD	1760 mm		

* Denotes Standard Proctor Maximum Dry Density, ASTM-D698

Based on N-vales and CBR the existing subgrade generally consists of soft to stiff silty clay fill with localized soft/loose areas. Some subgrade repairs may be required prior to raising grades. The pavement structure assumes that the construction will be completed at a drier time of year and the subgrade is stable, If the subgrade becomes wet or rutted during construction activities additional subbase may be required. The subgrade must be compacted to 98% SPMDD for at least the upper 500 mm unless accepted by Palmer.



The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be overemphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening. This is particularly important in heavy-duty pavement areas.

Additional comments on the construction of access road, internal roadways and parking areas are as follows:

- As part of the subgrade preparation, proposed parking areas and access roadways should be stripped of topsoil, fill materials, weak native soils, and other obvious objectionable material. Fill required to raise the grades to design elevations should conform to backfill requirements outlined in previous sections of this report. The subgrade should be properly shaped, crowned then proofrolled in the full-time presence of a qualified engineering personnel. Soft or spongy subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98% SPMDD.
- 2) The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed lot grading. Assuming that satisfactory crossfalls in the order of two percent have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that shallower crossfalls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by a specialized pavement engineer.

The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted access lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.

6.8 Geotechnical Quality of Excavated Soils

Reference to the borehole logs suggests that the excavated materials with respect to their compaction characteristics can be divided into three groups:

 Group 1 comprises the native clayey silt and clayey silt and have moisture content very close to or above its optimum water content. This material will excavate in clods and would thus require a heavy pad footed compactor or hoe pack to break it down and adequately compact it. Given the water content of the clayey silt to silty clay, it may not be possible to obtain a degree of compaction



of this material much above 95% of SPMDD. This degree of compaction might be acceptable within landscaped areas above which pavements or infrastructure are not expected to be built in the future.

- Group 2 soils comprise the cohesionless silts, sands and gravels. The compaction of these soils will require a very tight control of their moisture content during placement and compaction. At moisture contents more than 3% below the optimum, the soil will likely be dusty and "flour" like while at moisture contents ±1% higher than optimum, the soil will be "spongy" and will "pump".
- **Grou**p 3 soils consist of unsuitable materials because of their high moisture, organic inclusions, or deleterious inclusions, including all of the existing fill materials. These soils should be either disposed off-site or should be used only in "soft" landscaping areas where they can be placed with nominal compaction, and where surface settlements are tolerable.

As a general requirement, all backfill material should be placed in 200 to 300 mm thick loose lifts and compacted to at least 96% of SPMDD, at a placement moisture content within $\pm 2\%$ of the optimum. Below existing/future roads, the backfill must be Granular "A" or "B" material, and the top 1.5m of subgrade backfill below the underside of the pavement structure should be compacted to 98% of SPMDD

6.9 Concrete Exposed to Sulphate Attack

The sulphate (SO₄) resistance of the concrete in contact with the soil was evaluated by performing watersoluble sulphate tests on ten (10) soil samples. The tested samples and their corresponding sulphate concentrations are summarized in **Table** 7 below. The analytical data is provided as part of laboratory Certificate of Analysis in **A**pp**endix D**.

Sample ID	Soil Depth (mBGS)	Soil Type	Sulphate Concentration (%)
BH23NT-21 SS5	3.0 - 3.6	Fill	0.0022
BH23NT-19 SS4	2.3 – 2.9	Clayey Silt	<0.0020
BH23NT-17 SS2	0.8 - 1.4	Fill	<0.0020
BH23NT-17 SS3	1.5 – 2.1	Clayey Silt	<0.0020
BH23NT-17 SS4	2.3 – 2.9	Clayey Silt	<0.0020

Table 7: Summary of Sulphate Concentration Test

²³⁰⁴²⁰²_Geotechnical Investigation Ontc_Timmins Station_Draft Rev 3 Working

Sample ID	Soil Depth (mBGS)	Soil Type	Sulphate Concentration (%)
BH23NT-9 SS3	1.5 – 2.1	Clayey Silt	<0.0020
BH3NT-6 SS2	0.8 - 1.4	Fill	<0.0020
BH23NT-3 SS4	1.5 – 2.1	Fill/Silty Clay	0.0030
BH23NT-4A SS3	9.1 - 9.7	Clayey Silt/Silty Sand Till	0.0051
BH23NT-1 SS3	1.5 – 2.1	Fill	0.0024

Note: mBGS = meters below ground surface

The category of severity of attack is "negligible" based on CSA Standard CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction. The final selection of the type of concrete should be made by the Engineer taking into account all aspects of design considerations.

6.10 Corrosivity Potential

The corrosivity of soils towards ferrous metal was evaluated by performing corrosivity tests on ten (10) soil samples. The corrosivity of soils was evaluated using the 10-point method which is based on five soil properties: sulphides, resistivity, pH, Redox potential, and moisture content. **Table** 8 summarizes the ANSI/AWWA rating for the tested soil sample for the potential for corrosion towards buried grey or ductile cast iron pipe. A score of ten (10) points or more indicates potential for corrosion. The analytical data is provided as part of laboratory Certificate of Analysis in **A**pp**endix D**.

					Paramet	er (Score)		
Sample ID	Depth (mBGS)	Soil Type	рН	Resistivity (ohm.cm)	Sulphide (mg/kg)	Redox potential (mV)	Moisture content (%)	Total Points
BH23NT- 21 SS5	3.0 - 3.6	Fill	7.77 (0)	4850 (0)	0.29 (2)	258 (0)	31.1 (2)	3
BH23NT- 19 SS4	2.3 – 2.9	Clayey Silt	7.72 (0)	6670 (0)	<0.24 (2)	275 (0)	18.5 (1)	3
BH23NT- 17 SS2	0.8 - 1.4	Fill	7.78 (0)	5080 (0)	<0.24 (2)	283 (0)	17.0 (1)	3
BH23NT- 17 SS3	1.5 – 2.1	Clayey Silt	7.73 (0)	7140 (0)	<0.24 (2)	293 (0)	18.0 (1)	3
BH23NT- 17 SS4	2.3 – 2.9	Clayey Silt	7.68 (0)	4720 (0)	<0.24 (2)	271 (0)	17.0 (1)	3
BH23NT-9 SS3	1.5 – 2.1	Clayey Silt	7.71 (0)	9520 (0)	<0.23 (2)	292 (0)	16.1 (1)	3
BH3NT-6 SS2	0.8 - 1.4	Fill	7.61 (0)	6170 (0)	<0.23 (2)	304 (0)	14.8 (1)	3
BH23NT-3 SS4	1.5 – 2.1	Fill/Silty Clay	7.73 (0)	3150 (0)	<0.28 (2)	300 (0)	29.0 (1)	3
BH23NT- 4A SS3	9.1 - 9.7	Clayey Silt/Silty Sand Till	8.09 (0)	4900 (0)	<0.22 (2)	279 (0)	10.4 (1)	3
BH23NT-1 SS3	1.5 – 2.1	Fill	7.73 (0)	2420 (0)	<0.26 (2)	296 (0)	26.0 (1)	3

Table 8: Summary of Corrosivity Potential of Soils

Note: mBGS = meters below ground surface

According to the ANSI/AWWA rating system, the tested samples do not pose a potential for corrosion of ductile iron pipe.

It is recommended that measures to limit corrosion are implemented if ductile iron pipes are utilized in this watermain replacement project. Note that there may be other overriding factors in the assessment of

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corrosion potential, such as the application of de-icing salts on the roadway and subsequent leaching into the subsoil, stray currents, etc.

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7. Certification

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

This report was prepared and reviewed by the undersigned:

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General Comments and Limitations of Report

Palmer should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Palmer will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes and test pits required to determine the localized underground conditions between boreholes and test pits affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole and test pit results, so that they may draw their own conclusions as to how the subsurface conditions may affect them. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to Palmer at the time of preparation. Unless otherwise agreed in writing by Palmer, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

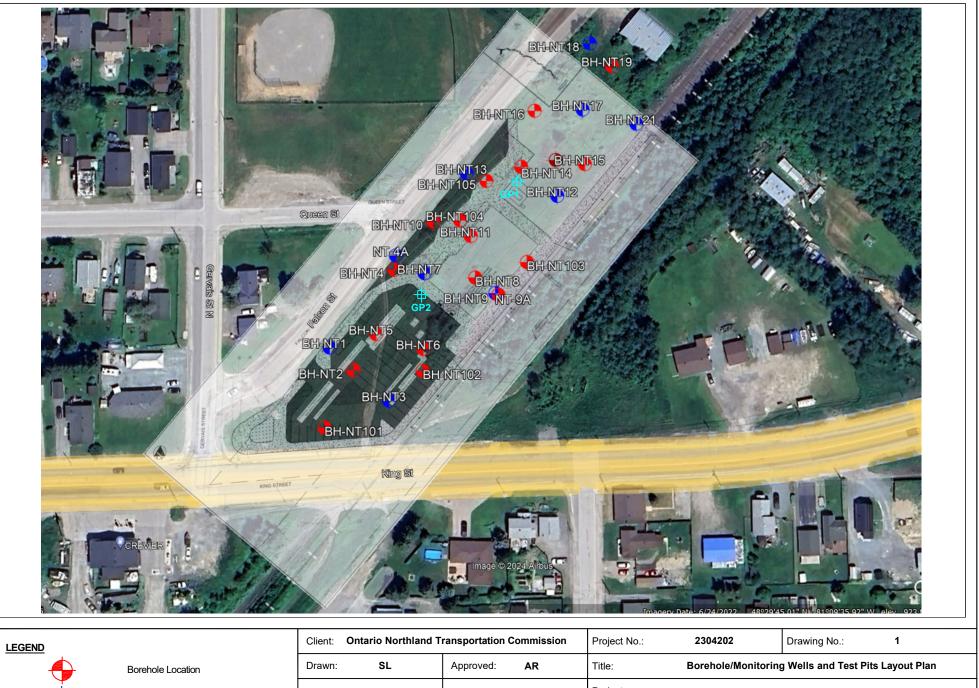
The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Palmer accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

August 9, 2024



Drawings

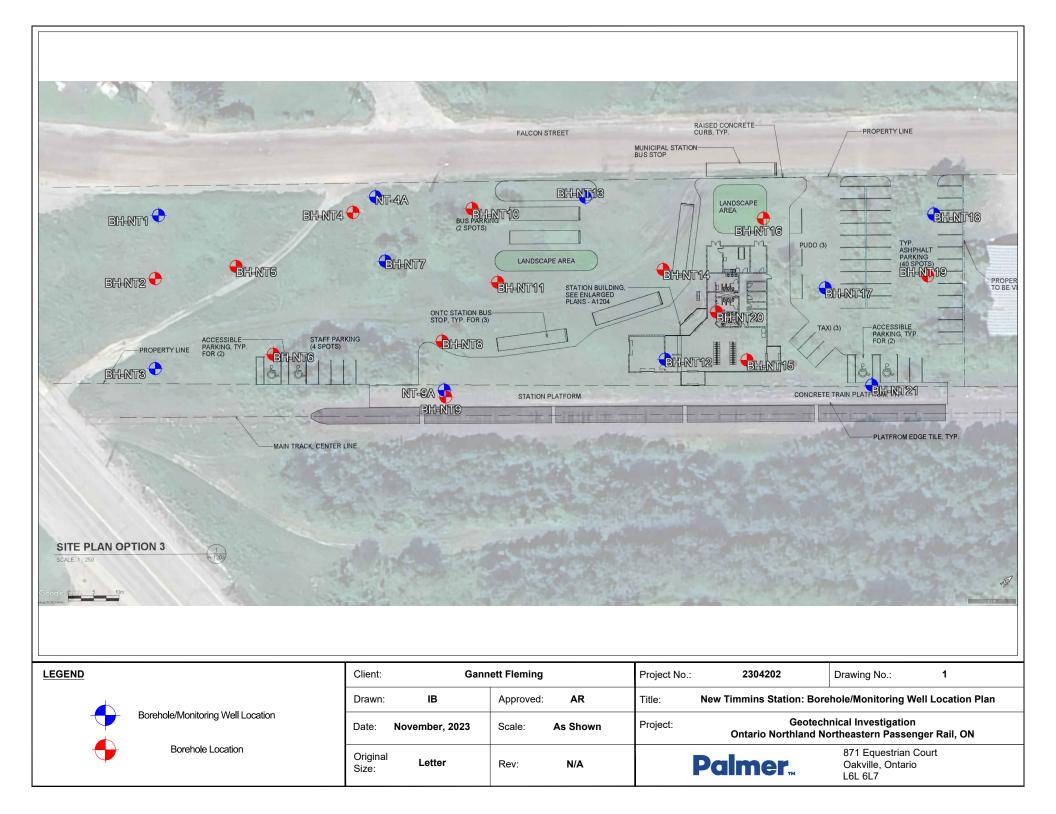


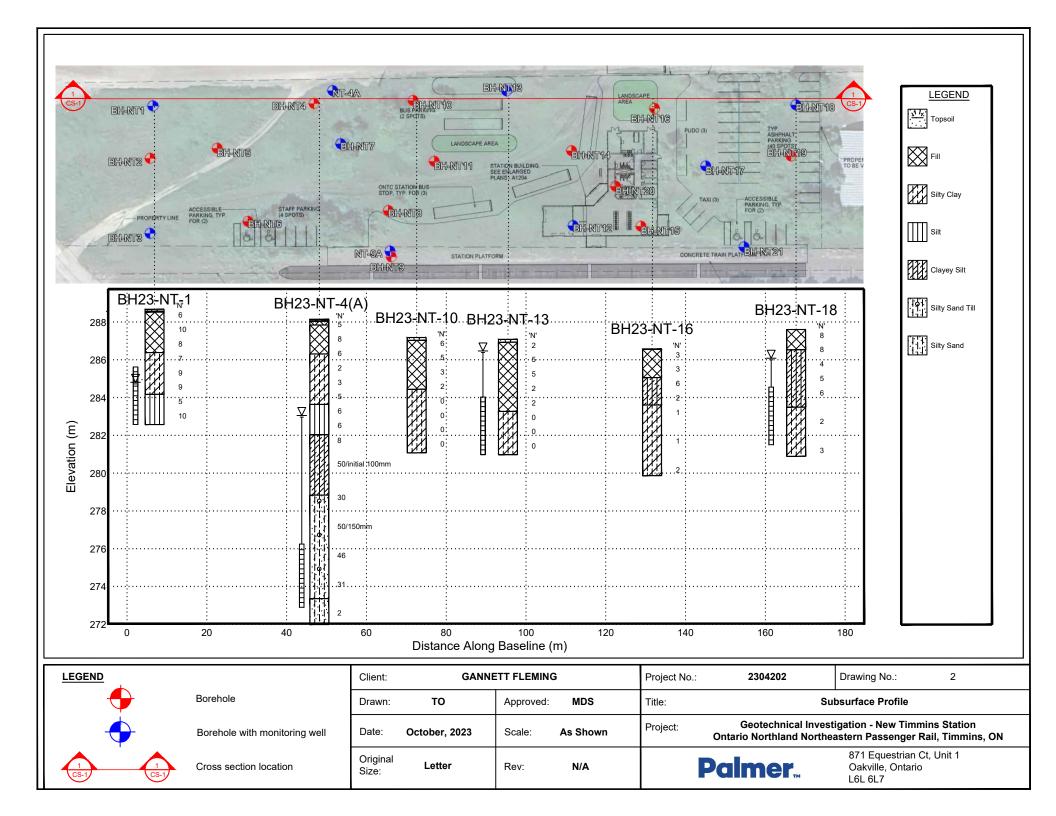
Borehole/Monitoring Well Location

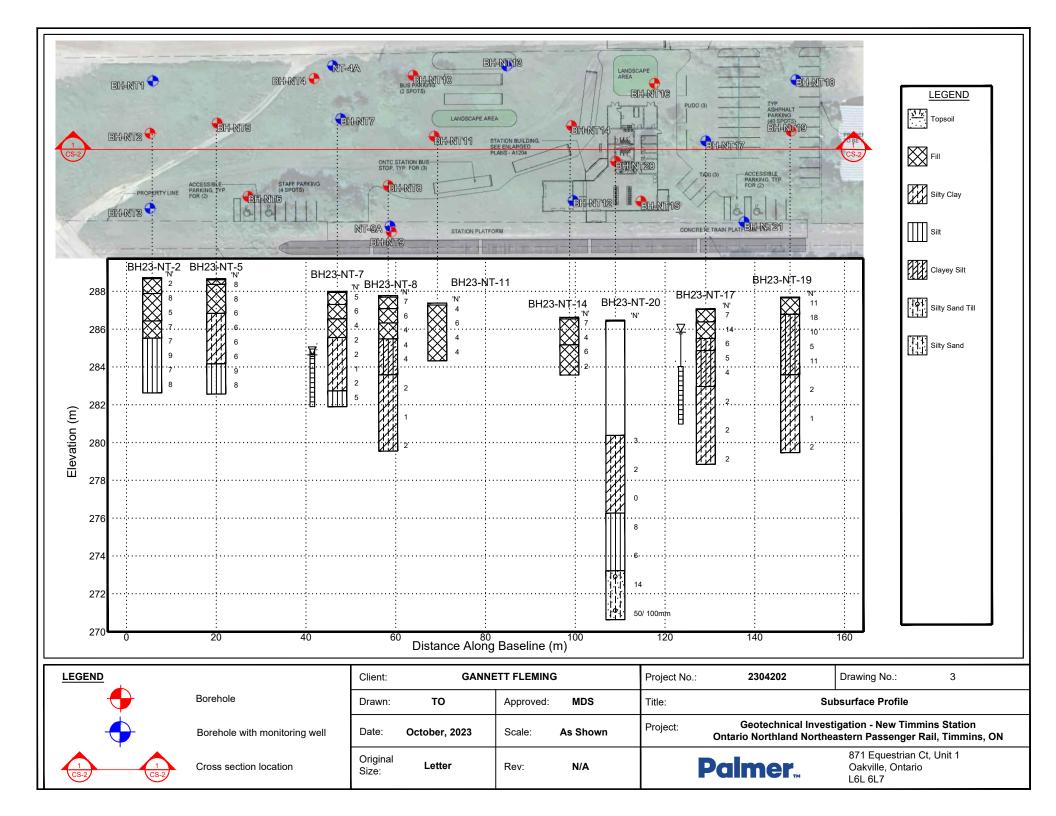
Test Pit Location

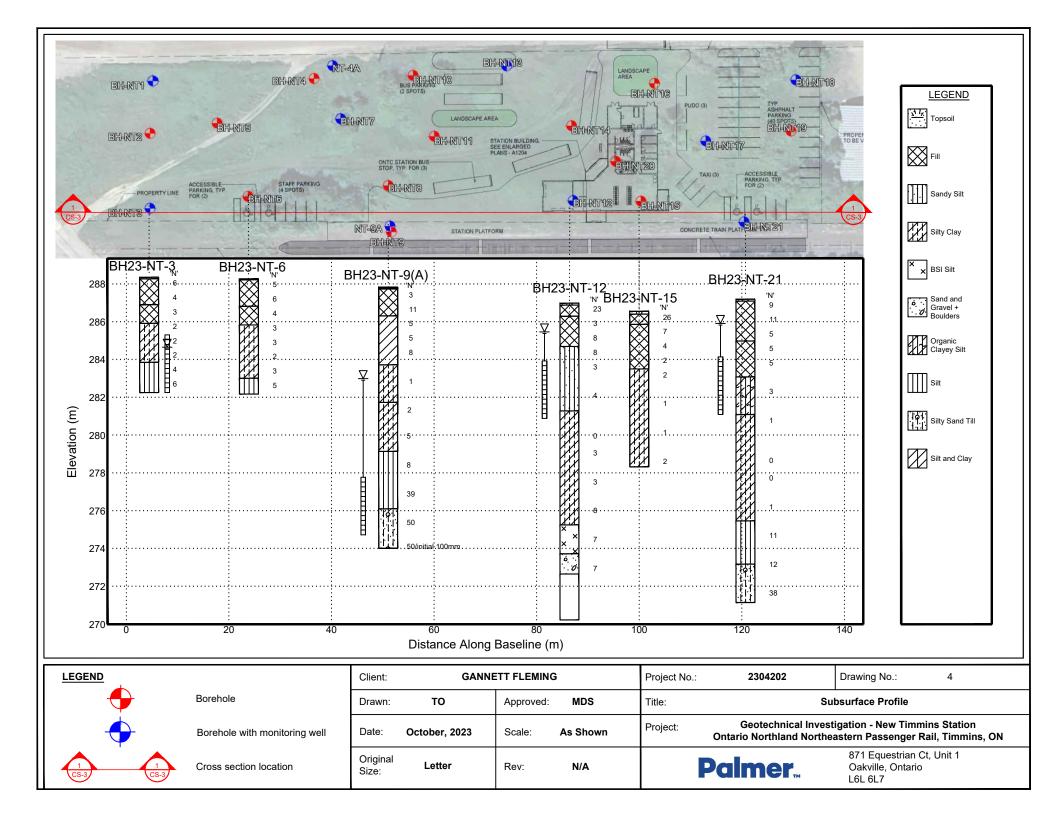
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Client:	Ontario Northland T	ransportation Commission	Project No.	Project No.: 2304202 Drawing No.: 1			
Drawn:	SL	Approved: AR	Title: Borehole/Monitoring Wells and Test Pits Layout Pla			₋ayout Plan	
Date:	August 2024	Scale: As Shown	Project:	Ontario Northland Northeaste	ern Passenger Rail - N	ew Timmins 2024	
Original Size:	Letter	Rev: N/A	Pa		871 Equestrian Ct, Oakville, ON L6L 6L7		















Notes On Sample Descriptions

 All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by PECG also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION													
CLAY		SILT			SAND				GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM		COARSE	FINE	MEDIUM		COARSE		
0.0	002	0.006	0.02 ().06 	0.2	0.6		2.0	6.0 	20	60) 20	00
EQUIVALENT GRAIN DIAMETER IN MILLIMETRES													

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE	
SILT (NONPLASTIC)	SAND			GRAVEL		
UNIFIED SOIL CLASSIFICATION						

- 2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
- 3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.



Explanation of Terms Used in the Record of Borehole

Sample Type

- AS Auger sample
- BS Block sample
- CS Chunk sample
- DO Drive open
- DS Dimension type sample
- FS Foil sample
- RC Rock core
- SC Soil core
- SS Spoon sample
- ST Slotted tube
- TW Thin-walled, open
- TP Thin-walled, piston
- WS Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

Dynamic Cone Penetration Resistance, N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Textural Classification of Soils

Particle Size
>300 mm
75 mm-300 mm
4.75 mm-75 mm
0.075 mm-4.75 mm
0.002 mm-0.075 mm
<0.002 mm

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	>35%

Soil Description

a) Cohesive Soils

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value		
Very soft	<12	0-2		
Soft	12-25	2-4		
Firm	25-50	4-8		
Stiff	50-100	8-15		
Very stiff	100-200	15-30		
Hard	>200	>30		

b) Cohesionless Soils

Density Index (Relative Density) SPT "N" Value

Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water	content

- w_p Plastic limit
- w₁ Liquid limit
- C Consolidation (oedometer) test
- CID Consolidated isotropically drained triaxial test
- CIU consolidated isotropically undrained triaxial test with porewater pressure measurement
- D_R Relative density (specific gravity, Gs)
- DS Direct shear test
- ENV Environmental/ chemical analysis
- M Sieve analysis for particle size
- MH Combined sieve and hydrometer (H) analysis
- MPC Modified proctor compaction test
- SPC Standard proctor compaction test
- OC Organic content test
- V Field vane (LV-laboratory vane test)
- γ Unit weight

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PRO	IECT: Geotechnical Investigation - Ontai	rio N	orthl	and No	ortheas	stern P	asseng	er Ra	il Servi	се									
CLIE	NT: Gannett Fleming							Met	hod: Ho	llow St	em Au	ugers			TE	ECHNI	CIAN	I: T.	Ou
PRO	IECT LOCATION: Timmins, Ontario							Diar	neter: 2	200mm					R	EF. NC	D.: 23	3042	02
DATU	JM: Geodetic							Date	e: Jul 5	, 2023					E	NCL N	0.: 1		
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-	organics, brown, moist, firm to stiff.	\mathbb{K}					288	Ē											
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- 286.5		\bigotimes	}					F											
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4	contains dilatant silt layers, grey	Ĥ	6	SS	9]:₩	W. L.	284.8	3 m/										
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- 4.5	SILT: trace to some clay, trace sand, dilatant, grey, wet, loose.					1:目:	Scree	E .											
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	was installed upon completion in																		
	the borehole. Water Level Readings:																		
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	JECT LOCATION: Timmins, Ontario								eter: 2			32.0					EF. NC			
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2.3	FILL: silt, some clay, trace sand,	X						_												
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- 3.2	SILT: interval with silty clay seams/layers, trace sand, oxidized,		5	SS	7			F							0					
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LOG OF BOREHOLE BH23-NT-2

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	sand, trace gravel, trace organics, dark brown to brown, moist to wet,	\bigotimes	1				288	; -												
	firm to soft.	\bigotimes						F												
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	contains silt seams, brown	\otimes	2	SS	4			E								0				
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1.5	FILL: silty clay, trace sand,	1XX	<u> </u>				-Bento													
	contains silt seams/layers, brown, moist, soft to very soft.	\mathbb{X}		00				È.												
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	moist to wet, very soft.	Ŕ	1					E												
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4.5	SILT: interval with silty clay seams/layers, dilatant, grey, wet,					ł:E	· -+Scree	en E												
	very loose to loose.		7	SS	4	ΙE		E								c	þ			0 1 81
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PRO	JECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern Pa	ssenge	er Rail	Servio	ce										
CLIE	NT: Gannett Fleming							Meth	od: Ho	llow S	em A	ugers				TE	CHN	CIAN	I: Т.	Ou
PRO	JECT LOCATION: Timmins, Ontario							Diam	eter: 2	00mm						R	EF. NC).: 23	3042	02
DAT	UM: Geodetic							Date:	Jul 6	, 2023						E١		0.: 4		
BH L	OCATION: See Borehole Location Plan	N 53	37133	34.45 E	E 4881	50.78														
5.12	SOIL PROFILE		1	SAMPL				DYNA	MIC CO		NETR	ATION								
		1.				GROUND WATER CONDITIONS							00	PLAST LIMIT	C NAT	URAL	LIQUID LIMIT	z	NATURAL UNIT WT (kN/m ³)	REMARKS AND
(m)		STRATA PLOT			<u>د</u> ار	NS	z		I	1	L	-	00	WP		TENT N	WL	POCKET PEN. (Cu) (kPa)	n) ش	GRAIN SIZE
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0.3	greyish brown, moist, loose.	ŔŔ	1	SS	5			-							_ c	þ				
-	FILL: silty clay, trace sand, contains silt seams, brown, moist,	\mathbb{X}]					-												
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1.8	SILTY CLAY: interval with silt seams, trace sand, oxidized, brown,							-												
	moist to wet, firm to very soft	KX.					286									-				
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	mer "						BORE				1-4/	•								1 OF
	ECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern	Passeng				o.n.c. ^						-01151	<u></u>		.
	IT: Gannett Fleming									llow St	em Au	igers								
	ECT LOCATION: Timmins, Ontario									200mm							EF. NO		.0420	12
	M: Geodetic		- · -			- -		Date	: Jul 1	7, 2023	5					E١	NCL NO	J.: 5		
SH LC	OCATION: See Borehole Location Plan	N 53	1			50.24	+	DYN4			NETRA	TION								
	SOIL PROFILE		<u>۽</u>	Sampl	. <u>ES</u>	H ۲		RESI	STANC	DNE PE E PLOT	\geq			PLASTI		URAL STURE	LIQUID LIMIT		ž	REMARK
m)		5			0	N TE	<u>»</u>		20 4	40 6	0 8	0 1	00	LIMIT W _P	CON	ITENT	LIMIT	POCKET PEN. (Cu) (kPa)	LIND ()	AND GRAIN SIZ
<u>EV</u> PTH	CLASSIFICATION	A PL	2		BLOWS 0.3 m					RENG	ГН (kF	Pa) FIELD V & Sensiti	ANF	••• _P		o	WL	CKET 2u) (k	RAL (kN/m	DISTRIBUT
РІН		STRATA PLOT	NUMBER	ТҮРЕ		GROUND WATER	ELEVATION		INCONF QUICK T	RIAXIAL				WA	TER CO	ONTEN	T (%)	Ч, С	NATURAL UNIT WT (kN/m ³)	(%)
	Ground Surface		Ŋ	₽	ŗ	6.6	3 =		20 4	40 6	0 8	0 1	00	1	10 2	20 3	30			GR SA SI
3 8.0 0.1	TOPSOIL:100mm Auger directed to 4.5m without samples	·				Č.	▼Conc ∵ . -Sand	rete												
	Sumples							-												
								E												
							287	-												
								-												
							286													
								-												
								-												
							285	-												
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							284	-												
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						$\overline{\nabla}$		È.												
							W. L.	283.1 [m 											
								-												
2.1							-Bento	l- F												
5.1	CLAYEY SILT: trace sand, trace cobbles/boulders, contains wet silty sand pockets brownish group maint		1	SS	8										0					•
	sand pockets, brownish grey, moist to wet, stiff to hard.		Ĺ					-												Auger grir
				VANE			281	-			2.7 +69.	4					1			
			2	ŞS/NF	50/			F												Auger grin
					initial 100mr	ł														
							280	-									-			
								-												
								[
3.9 9.3	grey SILTY SAND TILL: trace to some			00	00		279	-								_	+			
	gravel, trace clay, trace cobbles, grey, wet, compact to very dense.		3	SS	30			Ē								0				
			<u> </u>		1			Ē												

PROJ	IFCT: Control Investigation Onto																				
	IECT: Geotechnical Investigation - Ontar	io No	orthla	and No	ortheas	stern Pa	assenge	er Rail	Servio	e											
CLIEM	NT: Gannett Fleming							Metho	d: Hol	low St	em Au	ugers				TE	CHNI	CIAN	l: T.	Ou	
PROJ	IECT LOCATION: Timmins, Ontario							Diam	eter: 2	00mm						R	EF. NC).: 23	3042	02	
DATL	JM: Geodetic							Date:	Jul 1	7, 202	3					E١		D.: 5			
BH L(OCATION: See Borehole Location Plan	N 53	7133	86.72 E	E 4881	50.24															
	SOIL PROFILE		5	SAMPL	ES			DYNA RESIS	MIC CO TANCE	NE PE	NETR	ATION			ΝΑΤΙ					DEMA	DVC
						GROUND WATER CONDITIONS							00	PLASTI LIMIT	C MOIS	URAL TURE TENT	LIQUID LIMIT	ż	NATURAL UNIT WT (kN/m ³)	REMAR ANI	
(m)		STRATA PLOT			S L	NS NS	z		0 4 R STI	l	L	I	1	Wp		N	WL	POCKET PEN. (Cu) (kPa)	Nn "	GRAIN	SIZE
ELEV EPTH	CLASSIFICATION	A P	КШ		BLOWS 0.3 m		0E		NCONF		È.	FIÉLD V	ANE			>		OCKE	(KN)	DISTRIBU	
		RA1	NUMBER	ТҮРЕ		ND ND	ELEVATION	• Q	JICK T	RIAXIA	LΧ	& Sensitiv TORVA	ANE		TER CO			£ -	NAT	(%))
	Continued		ž	È	ŗ	50	Ш	2	0 4	0 6	6 E	80 10	00	1	0 2	20 3	30			GR SA S	SI C
	SILTY SAND TILL: trace to some gravel, trace clay, trace cobbles,	1¢1 1,1					278														
	grey, wet, compact to very							-													
	dense.(Continued)	ŀ						-													
								-													
	contains clayey silt pockets		4	SS	50/ 150mr			-								•					
	contains clayey sin pockets				130111		277														
		וּיָּו						-													
								-													
		말						-													
							-Sand	-													
							2/6														
		liģi				[::目::		-													
			5	SS	46		1	-							0					5 57 3	34 4
		1 ₀ 1				ŀ:⊟:.		-													
						「目:		-													
						L:目:	275														
		ן ין י				:目::		-													
						に目:	1	-													
							Scree	n L													
	contains dilatant silt layers		6	SS	31	ľ:⊟:		-													
		ļ	Ŭ	00	0.		274														
						に目:															
		ŀ¦				[:目:		_													
273.4 14.8	SILTY SAND: trace gravel, trace					ŀ.⊟∙.		_													
14.0	clay, contains dilatant silt pockets,	hh				 ∙⊟∙															
	grey, wet, very loose.						273														
							-Sand	-													
			7	SS	2			-							0						
							-Bento	nite													
272.0								L			-	L									
272.0 16.2	END OF BOREHOLE	u tr	-				272					\rightarrow							-		
	Notes:																				
	 Refer to NT-4 borehole log from 0.1m to 4.5m. 																				
	2) 50mm diameter monitoring well																				
	was installed upon completion in the borehole.																				
	Water Level Readings:																				
	Date W. L. Depth (mBGS) 2023-08-30 5.09																				
												1	1			1	1	•			

Pa	Imer.			L	.0G	OF B	ORE	HOL	EB	123-1	NT-5	5								1 C	DF 1
PRO	JECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern Pa	issenge	er Rail	Servic	e											
	NT: Gannett Fleming						Ũ		od: Hol		em Au	igers				TE	CHNI	CIAN	I: T.	Ou	
	JECT LOCATION: Timmins, Ontario								eter: 2			0					F. NO				
	JM: Geodetic							Date:	Jul 6,	2023							ICL NO				
	OCATION: See Borehole Location Plan	N 53	7130)7.16 E	4881	42.54												00			
	SOIL PROFILE	1100	-	SAMPL				DYNA	MIC CC	NE PE	NETRA	TION									
						GROUND WATER CONDITIONS								PLASTI LIMIT	1000	JRAL TURE	LIQUID LIMIT	ź	ΓWT	REMAR AND	
(m)		LOT			SI C	NS NS	z		Ĺ	0 6			00	WP	CON ⁻	TENT	WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	GRAIN S	
ELEV DEPTH	CLASSIFICATION	A P	К		BLOWS 0.3 m		OF		AR STI		ì	FIÉLD V	ANE			`		OCKE	URAL (kN/	DISTRIBU	TION
1		STRATA PLOT	NUMBER	ТҮРЕ		Do 20	ELEVATION	• Q	UICK TI	RIAXIAI	_ ×	TORVA	ANE		FER CC		. (///	ē.	NAT	(%)	
288.7	Ground Surface	., .,	ž	F	ż	ΰŭ	Ш	2	20 4	06	8 0	0 10	00	1	0 2	0 3	0			GR SA S	I CL
288.4	TOPSOIL: 50mm FILL: clayey silt, sandy, trace	\bigotimes						-													
- 0.3	topsoil, dark brown, moist, firm.	\boxtimes	1	SS	8										0						
F	FILL: silty clay, some sand, trace gravel, trace organics, brown,	\bowtie	<u> </u>			-	288	-													
E	moist, firm.	\bigotimes	┢──				200	_													
1	contains sandy silt pockets	\boxtimes	2	SS	8			L							0						
Ł		\bigotimes						-													
Ł		\bigotimes						-													
-		\bigotimes					287	-													
286.9 2 1.8	SILTY CLAY: interval with sandy	ŔŶ	3	SS	6			-							0						
-	silt and silt seams, trace sand,	K.						-													
-	brown, moist, firm.	X	<u> </u>			-		-													
F		Ĥ		SS	6			E													
-		H.	4	33	6		286								0						
3		R.				-		_													
E								_													
-	brown to grey	HX.	5	SS	6			-							0						
F		H.						-													
È.						1	285	-													
4		1X	1					-													
È.	contains dilatant silt layers	H.	6	SS	6			-								0					
284.2			<u> </u>					-													
4.5	SILT: interval with silty clay	ΠÌ	 			-	284	_													
E	seams/layers, trace sand, dilatant, grey, wet, loose.		7	SS	9		204									0					
5								_													
Ł								-													
È.								-													
È.			8	SS	8		283	_								0					
-								-													
⁶ 282.6 6.1	END OF BOREHOLE																				
10-19																					
8.GPU 23																					
W TIMMIN																					
NTRY - NE																					
4T DATA E																					
10G GP																					
OIL - 2018																					
PALMER S																					
	NDWATER ELEVATIONS					GRAPH	+ 3	×3.	Number	s refer		8 =3%	Strain	at Failu							

	ECT: Geotechnical Investigation - Onta	rio No	orthla	and No	ortheas	stern Pa	issenge														
	IT: Gannett Fleming									low St		ugers									
	ECT LOCATION: Timmins, Ontario									00mm , 2023							EF. NO		30420	52	
	DCATION: See Borehole Location Plan	N 53	7130	0 11 5	1991	50 65		Date.	Jui o,	2023						EN	ICL NO	J.: 7			
	SOIL PROFILE	N 55		SAMPL				DYNA RESIS		DNE PE E PLOT		ATION			ΝΔΤΙ	IRAI			_	REMA	BKS
(m)		Τ				GROUND WATER CONDITIONS				0 6			00	PLASTI LIMIT	C NATU MOIS CON	TURE	LIQUID LIMIT	eN.	NATURAL UNIT WT (kN/m ³)	AN	D
ELEV		PLO	~		BLOWS 0.3 m	⊿W D	NO	SHEA	R STI	RENG	L TH (kl	Pa)		W _P	v (v 	WL	POCKET PEN. (Cu) (kPa)	AL UI	GRAIN DISTRIB	
DEPTH	CLASSIFICATION	STRATA PLOT	NUMBER	щ		NDUN	ELEVATION		NCONF			FIELD V/ & Sensitiv TORV/		WAT	FER CC	NTEN	Г (%)	90 00	NATUF)	(%	
	Ground Surface	STF	INN	ТҮРЕ	ŗ	GR CO	ELE			0 6		30 10		1	0 2	03	0			GR SA	SI CL
- 28 8 : 2	TOPSOIL: 50mm FILL: clayey silt, contains sandy silt	\boxtimes						-													
-	pockets/layers, trace sand, trace	\bigotimes	1	SS	5		288								0						
E	organics, brown, moist, firm.	\bigotimes																			
			-																		
-			-							0											
- 286.8		287																			
1.5	FILL: silty clay, trace sand,		-																		
-	contains silt seams/layers, brown, moist, firm to soft.		-							0											
2																					
		286	-																		
285.8	SILTY CLAY: interval with silt	X						-													
-	seams/layers, trace sand, brown, moist, soft to very soft.		4	SS	3							×			0			25			
3								-													
								-													
-			5	SS	3		285	-		:	×					>		50			
E																					
								-													
-			6	SS	2			-	×							o		0			
-							284														
E								-													
			7	SS	3			-										0.5			
5			'	- 33	3					×						C	1	25			
- <u>283.0</u> 5.3	SILT: interval with silty clay layers,	[]]					283	-													
- 5.5	trace sand, dilatant, grey, wet,							-													
-	loose.		8	SS	5											0				0 1	85 14
						-		-													
6.1	END OF BOREHOLE							-													
5																					
5																					
0																					
al	IDWATER ELEVATIONS			I		GRAPH	. 3	v 3. I	Vumbei	rs refer		8 =3%	<u>.</u>	-+ 5 "			1				

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LOG OF BOREHOLE BH23-NT-6

	Imer⊪			L	.OG	OF	BORE	HOL	E Bł	123-	NT-7									1 OF 1
PRO	IECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern I	Passeng	er Rai	Servic	e										
CLIE	NT: Gannett Fleming							Meth	od: Hol	llow St	em A	ugers				TE	CHNI	CIAN	I: Т.(Ou
PRO	IECT LOCATION: Timmins, Ontario							Diam	eter: 2	00mm						RE	EF. NC).: 23	30420	02
DATU	JM: Geodetic							Date:	: Jul 6,	, 2023						E١		0.: 8		
BH LO	OCATION: See Borehole Location Plan	N 53	87132	28.07 E	E 4881	61.35														
	SOIL PROFILE		5	SAMPL	ES			DYNA	MIC CC		NETR	ATION								
						GROUND WATER							00	PLASTI LIMIT	C MOIS	URAL	LIQUID LIMIT	z	NATURAL UNIT WT (kN/m ³)	REMARKS AND
(m)		[0]			SN L	LAN SN	z	-	20 4 AR STI	í		⊥	I	WP		TENT N	WL	POCKET PEN. (Cu) (kPa)	L UNI	GRAIN SIZE
ELEV DEPTH	CLASSIFICATION	TAP	ЦЦ		BLOWS 0.3 m		0 IT		NCONF		ì	FIELD V & Sensiti	ANE			0		POCK (CU)	(kN	DISTRIBUTIOI (%)
		STRATA PLOT	NUMBER	ТҮРЕ	"z	ROL NOL	ELEVATION				LΧ	TORV	ANE		TER CC		``	Ľ	¥	
	Ground Surface	S S S S S S S S S S S S S S S S S S S	z	⊢ ⊢	£) ш ▼ <mark>-</mark> Conc		20 4	0 6	3 0	30 1	00	1	0 2	20 3	30		\mid	GR SA SI C
28 0 :0	FILL: sandy silt, trace clay, trace.	\bigotimes		SS	5		Sand	F												
	trace rootlets, brown, moist, loose.	\bigotimes		33	5			È.												
287.4		\bigotimes						F												
0.7	FILL: clayey silt, trace sand,brown, moist to wet, firm.	\bigotimes						È.												
1		\bigotimes	2	SS	6		287	, <u> </u>	<u> </u>							•				
		\bigotimes						-												
286.6	FILL: silty clay, trace sand,	\bigotimes					-Bento													
1.5	contains silt seams, trace organics,	\bigotimes					Dent	F												
	brown, moist, firm to soft.	\bigotimes	3	SS	4			F							0	þ				
2		\bigotimes					286	si	<u> </u>											
205 0		\bigotimes	1					E												
285.6	SILTY CLAY: trace sand, oxidized,	XX						F												
	brown, moist, very soft.	K.	4	SS	2			E				×			0			50		
3		Ŵ					Sand	E												
2			┣			┟┊╞╡	285	;[-											
	grey	1X	5	SS	2			E							0			50		
		Ĥ	ľ			ĿĒ	: W. L.	284.7 ⊨	m											
		K	╞			目		Ł												
4		1				1:目	÷	È.												
-		K	6	SS	1	l:E	284	-	×							0		0		
		Ŵ						L												
		ĥ					Scree	F an												
		K						Ē												
5	contains silt seams	1	7	SS	2		÷	-		×						0		25		
282.8		Ĥ	<u> </u>				283	3 -												
5.3	,		1—			₽₽	2	F												
	trace sand, dilatant, grey, wet, loose.		8	SS	5	に目		F								0				
			ľ	00		日		F												
<u></u> 282.0			<u> </u>				282	E]		
6.1	END OF BOREHOLE								1									1	\square	
	Note: 1) 50mm diameter monitoring well							1												
	was installed upon completion in																			
	the borehole. Water Level Readings:							1												
	Date W. L. Depth (mBGS)							1												
	2023-08-30 3.36							1												
								1												
								1												
								1												
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																				1

Pa	Imer			L	.0G	OF B	ORE	HOL	E Bł	123-	NT-8	3									1 OF	: 1
PRO	JECT: Geotechnical Investigation - Ontai	rio No	orthla	and No	ortheas	stern Pa	ssenge	er Rail	Servio	e												
	NT: Gannett Fleming						Ū			low St	em Au	ugers				TE	CHNI	CIAN	I: T.	Эu		
	JECT LOCATION: Timmins, Ontario							Diam	eter: 2	00mm						RE	F. NC).: 23	30420)2		
DATU	JM: Geodetic							Date:	Jul 8	2023						EN	ICL N	0.: 9				
BHL	OCATION: See Borehole Location Plan	N 53	7133	4.22 E	E 4881	90.18																
	SOIL PROFILE			SAMPL				DYNA		DNE PE E PLOT	NETRA	ATION										
						GROUND WATER CONDITIONS							00	PLASTI LIMIT	MOIS	URAL	LIQUID LIMIT	z	NATURAL UNIT WT (kN/m ³)		MARK AND	5
(m)		LOJ			SNE	WA ⁻	z			RENG	L T L L /L.F	 	1	W _P		ITENT W	WL	POCKET PEN. (Cu) (kPa)	L UN	GR/	AIN SIZ	
ELEV DEPTH	CLASSIFICATION	TAF	BER		BLOWS 0.3 m		АТІС		NCONF		ì	Pa) FIELD V & Sensiti	ANE vity			0		CC CC	TURA (KN	DISTI	RIBUTI (%)	ON
		STRATA PLOT	NUMBER	ТҮРЕ	ž	SRO	ELEVATION			RIAXIAI 0 6		TORV/ 30 1	ANE DO			ONTEN ⁻ 20 3	T (%) 60		A	00.0		0
287.8	Ground Surface TOPSOIL: 75mm	51/2	2	н	-	00	ш	-	-											GR 5	A SI	UL
200:1	FILL: sand mix with topsoil, trace	\bowtie	1	SS	7			-								0						
-	gravel, dark brown, moist, loose.	\bigotimes		00				-								-						
287.1	FILL: sandy silt, trace gravel,	\bigotimes						-														
	greyish brown, moist, loose.	\bigotimes					287	-														
E		\bowtie	2	SS	6									0								
286.3		\bigotimes						-														
- 1.5	FILL: silt, trace to some clay, trace gravel, trace straw, brown, moist,	\boxtimes						-														
-	loose.	\bigotimes	3	SS	4		286	-						0								
2		\bigotimes	Ŭ					-														
285.5		\bigotimes						_														
2.3	CLAYEY SILT: trace sand, contain dilatant sandy silt and silt seams,							-														
-	brown, wet, soft.		4	SS	4			-							ト	•				0 3	3 73	24
F.							285	-														
3			-					-														
-	contains dilatant silt layers		5	SS	4			-								0						
-	contains unatain sin layers		Ŭ	00	-			-														
-							284															
4							204	-														
283.6								-														
4.2	SILTY CLAY: trace sand, contain dilatant silt seams, grey, wet, very							-														
-	soft.							-														
-			6	SS	2		283										0					
5		K.	Ŭ	00	-												-					
E .								-														
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_≗ [279.6		Ŵ	Ŭ	00				-										I				
8.2	END OF BOREHOLE	x:x						-										1				—
6=-01=07																						
- 116.00																						
200																						
ADL 807																						
TO ANY																						
								L		-						1		<u> </u>				
						<u>GRAPH</u>	, 3	V3.1	vumbei	rs refer	~	8=3%	- · ·	at Failu								

PROJ	PROJECT: Geotechnical Investigation - Ontario Northland Northeastern Passenger Rail Service																						
CLIENT: Gannett Fleming										low St	em Au	igers			TECHNICIAN: T.Ou								
PROJECT LOCATION: Timmins, Ontario									Diameter: 200mm							REF. NO.: 2304202							
DATUM: Geodetic Date: Jul 9, 2023 ENCL NO.: 10																							
BH LOCATION: See Borehole Location Plan N 5371327.66 E 488190.31 SOIL PROFILE SAMPLES										DYNAMIC CONE PENETRATION RESISTANCE PLOT						<u> </u>							
				SAIVIPLES				20 40 60 80 100					20	PLASTIC NATURAL LIMIT MOISTURE LIQUID CONTENT					T WT	REMARKS AND			
(m)		STRATA PLOT			SN NS	GROUND WATER CONDITIONS	N	2 SHF4						WP	١	N	WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	GRAIN SIZE			
ELEV DEPTH	CLASSIFICATION	ATA F	NUMBER		BLOWS 0.3 m		ELEVATION	O UI		INED	+	FIELD V	ANE vity			o ONTEN	T (%)	POCK (Cu)	ATURA (KN	DISTRIBUTION (%)			
287.9	Ground Surface	STR	NUN	ТҮРЕ	ž	GRC CON	ELEV	• Q	JICK TF	RIAXIAI	- ×	10RVA 0 10	ANE				0		Ż	GR SA SI CL			
280.0	TOPSOIL: 50mm	X						-															
-	FILL: sand, some gravel, trace silt, trace rootlets, grey, moist, loose to	\bigotimes	1	SS	3			-						0									
-	compact.	\boxtimes						-															
		\boxtimes					287																
-	gravelly, contains wood pieces, wet	\bigotimes	2	SS	11		20.	-															
-		\bigotimes						-															
286.4	CLAYEY SILT: trace sand,	Ŵ						-															
E	contains dilatant silt seams, brown, wet, firm.	W	3	SS	5		286	-							c								
2		\mathcal{N}					200	-															
-		\mathbb{N}						-															
-		\mathbb{N}	4	SS	5			-								0							
-							205	-															
3							285	-															
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LOG OF BOREHOLE BH23-NT-9

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	ECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern F	Passenge													-
	IT: Gannett Fleming									llow Ste	m Au	gers					ECHNI			
PROJ	ECT LOCATION: Timmins, Ontario									00mm						R	EF. NC	D.: 23	3042	02
	IM: Geodetic							Date:	Jul 1	8, 2023						E	NCL N	0.: 1	1	
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8.7	SILT: trace to some clay, dilatant, grey, wet, firm to hard.		1				279	-	-					I						
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PRO	JECT: Geotechnical Investigation - Onta	rio No	orthla	and No	ortheas	stern Pa	issenge	er Rail	Servio	ce										
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	JECT LOCATION: Timmins, Ontario									50 mm						RE	EF. NO): 23	3042	02
	JM: Geodetic								Jul 7											-
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		11 23	-			04.01		DYNA	MIC CO	ONE PE	NETRA	ATION		<u> </u>				<u> </u>		
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287.2 289:0	Ground Surface TOPSOIL: 150mm	<u>x 1,,</u>	-		-			-	-						1					
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	organics, brown, moist to wet, firm	\otimes	l'	33	0			-												
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PRO	JECT: Geotechnical Investigation - Onta	rio N	orthic	and No	orthese	stern Pa	ssena	er Rail	Servic	e.										
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						GROUND WATER CONDITIONS				10 6		_	00	PLASTI LIMIT	C MOIS	TURAL STURE NTENT	LIQUID LIMIT	ż	NATURAL UNIT WT (kN/m ³)	REMARKS AND
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- 28 0.9 - 0.1	FILL: sandy silt. trace to some	\bigotimes	1	SS	4			-							0					
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	ECT: Geotechnical Investigation - Ontai	rio N	orthla	and No	ortheas	stern P	asseng													
	IT: Gannett Fleming							Method:			Augers					ECHNI				
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86.3	compact.	\bigotimes						[/												
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PROJECT LICATION Timeting, Order DIMA decade BIOL MAXAGENE BIOL PROFILE SOL PRO	PROJ	ECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern Pa	assenge	er Ra	ail Servi	ce										
DATURE DATURE DATURE DATURES DATE HEATER BH LOCATION BENDRIA LECENTRY AND	CLIEN	IT: Gannett Fleming							Met	hod: Ho	llow S	tem A	ugers				TE	ECHNI	ICIAN	I: Т.	Ou
BULCCATION: See Boshold Locator Plan N STY365.39 E 48274.09 CLASSIFICATION CLASSIFICAT	PROJ	ECT LOCATION: Timmins, Ontario							Dia	meter: 2	200mm	ı					R	EF. NC	D.: 23	3042	02
SOLE PROFILE SAMPLES (minute) Market (minute) Construction (minute) Construction (minute) <thconstruction (minute) Construction (mi</thconstruction 	DATU	M: Geodetic							Date	e: Jul 1	8, 202	3					E	NCL N	0.: 1	4	
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and to seft. (Continued) contains dilatant sit layers 10 \$S 8 276 11.7 SILT: some clay to clayer, dilatant, grey, wet, looke. - - - 11.7 SILT: some clay to clayer, dilatant, grey, wet, looke. - - - 11.3 SANDY ORAVEL: trace to some situation clay, grey, wet looke. - - - 12.3 SANDY ORAVEL: trace to some situation clay, grey, wet looke. - - - 12.3 Dynamic cone without samples - - - - 770.2 Dynamic cone without samples - - - - 770.2 ND Of BOREHOLE - - - - 10.8 ND Of BOREHOLE - - - - 10.9 Extra competion in trace site status on the status of the status on the status of the status on the status of th		SILTY CLAY: trace sand, contains	r,r	-		-	00		-	1	1			1			-	1			
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275.3 SILT: some clay to clayey, dilatant, grey, wel, loose.			1.						F												
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173.7 SANDY GRAVEL: trace to some sill, trace clay, grey, wet to saturated, losse. 274 12 5S 7 13.3 Dynamic cone without samples 273 14.3 Dynamic cone without samples 271 170.2 END OF BOREHOLE 271 10.8 Noic: 271 15.8 Noic: 271 15.8 Noic: 271 16.8 Noic: 271 170.2 END OF BOREHOLE 271 Noic: 271 271			×	11	SS	· /			F								c c)			
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270.2 18.8 END OF BOREHOLE Note: 1) 50mm diameter monitoring well was installed upon completion in the borehole. Water Level Readings: Date W. L. Depth (mBGS) 2023-08-30 1.52								272	-		<u>}</u>										
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16.8 END OF BOREHOLE Note: 1) 50mm diameter monitoring well was installed upon completion in the borehole. Water Level Readings: Date W. L. Depth (mBGS) 2023-08-30 1.52									E				\searrow		1						
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BROLINDWATER ELEVATIONS GRAPH + 3, × 3. Numbers refer O = 3% Strain at Failure															1						
BROLINDWATER ELEVATIONS GRAPH + 3, ×3. Numbers refer O = 3% Strain at Failure															1						
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PRO	JECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern Pa	assenge	er Rai	l Servi	се										
CLIE	NT: Gannett Fleming						-	Meth	od: Sc	lid Ste	m Aug	ers				TE	CHNI	CIAN	I: T.(Ou
PRO.	JECT LOCATION: Timmins, Ontario							Diam	neter: ²	150 mn	n					R	EF. NC).: 23	30420	02
DATU	JM: Geodetic							Date	: Jul 7	, 2023						E١	ICL NO	D.: 18	5	
BH L	OCATION: See Borehole Location Plan	N 53	7137	75.25 E	E 4881	77.92														
	SOIL PROFILE		s	SAMPL	ES	~		DYN/ RESI	AMIC C STANC	one pe e plot		ATION			_ NAT	JRAL			т	REMARKS
(m)		F				GROUND WATER CONDITIONS			20	40 e	50 8	30 1	00	PLASTI LIMIT	CON	JRAL TURE TENT	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	AND
ELEV	CLASSIFICATION	PLO	_ س		BLOWS 0.3 m	D N/	NO			RENG	TH (kF	- Pa) FIELD V	A.N.E	W _P	\	v >	WL	u) (kP.	RN/m ³	GRAIN SIZE
DEPTH	CLASSIFICATION	STRATA PLOT	NUMBER	щ		NUN	ELEVATION		INCON	FINED TRIAXIA	Ŧ	& Sensiti	ivity	WA	FER CO	NTEN	T (%)	90 00	NATUF)	(%)
287.1	Ground Surface		ΝΩ	ТҮРЕ	ż	GR	ELE						00	1	0 2	0 3	30			GR SA SI CL
- <u>280.9</u> - 0.2							Conci	rete— ⊦												
-	gravel, grey, wet, very soft to firm.	\bigotimes	1	SS	2	. • .	. Curia	F								0				
Ē		\bigotimes	<u> </u>			Ϋ́	W. L. :	L 286 5	 m											
-		\bigotimes					VV. L.	200.0 F	Ϊ											
-		\bigotimes	2	SS	5		286									o				
-		\bigotimes						Ē												
F		\bigotimes	-				-Bento	nite												
-	greyish brown	\bigotimes	3	SS	5			-								0				
2		\bigotimes	Ŭ				285	-								-				
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È.	trace strow contains conducilt	\boxtimes						F												
F	trace straw, contains sandy silt seams	\bigotimes	4	SS	2			-								0				
3		\bigotimes	<u> </u>				Sand	Ē												
-		\bigotimes				11	. 284	-												
ŀ	grey	\bigotimes	5	SS	2			-								0				
F		\bigotimes						Ē												
283.3	SILTY CLAY: trace sand, contains	X				▋┋	·	[
-	dilatant sandy silt pocket, grey, wet, very soft.		6	SS	0	l:≣:	283	-	×							0		0		
F		Ĥ			-	[]目.		F												
F		12				ŀ₿:	Scree	E n												
-	contains silt seams							ŧ.												
5		H.	7	SS	0	目:			<							c		0		
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E						1.目.		L.												
-		R	8	SS	0	l:≣:		F	×								0	0		
281.0						目		Ē												
281.0	END OF BOREHOLE	<u>rx</u>					281													
	Note: 1) 50mm diameter monitoring well																			
	was installed upon completion in																			
	the borehole. Water Level Readings:																			
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<u>GROUI</u>	NDWATER ELEVATIONS 1st 2nd 3rd 4th					GRAPH NOTES	+ 3,	×3:	Numbe to Sens	ers refer sitivity	0	s =3%	Strain	at Failu	re					

PROJ	IECT: Geotechnical Investigation - Ontai	rio No	orthla	and No	rtheas	stern Pa	issenge	er Rail	Servio	e										
	NT: Gannett Fleming								od: Sol		-	ers					CHN			
	IECT LOCATION: Timmins, Ontario								eter: 1		1						EF. NC)2
	JM: Geodetic DCATION: See Borehole Location Plan	N 53	7137	7 85 5	1881	00 20		Date:	Jul 7,	2023						EN	ICL N	0.: 16	5	
DITE	SOIL PROFILE			AMPL	F٩			DYNA	MIC CO	NE PE	NETRA	ATION			NAT					REMARKS
(m)		F				ATER				0 6			00	PLASTI LIMIT	MOIS CON	URAL STURE ITENT	LIQUID LIMIT	a) EN.	IN TIN	AND
ELEV	CLASSIFICATION	A PLC	Я		BLOWS 0.3 m	NOI	NOL		AR STI		TH (kf	Pa)		W _P	\ 	w 0	WL	CKET F u) (kPa	RAL UI (KN/m ³)	GRAIN SIZE
DEPTH		STRATA PLOT	NUMBER	ТҮРЕ	<u>-B</u> 0.	GROUND WATER CONDITIONS	ELEVATION	• Q	NCONF	RIAXIAI	_ ×		NE			ONTEN		8 O	NATU	(%)
	Ground Surface TOPSOIL: 75mm	LS XX	N	È	"N	50	Ш	-	20 4	0 6	8 0	80 10	00	1	0 2	20 3	30			GR SA SI CL
-288:0 -	FILL: silty sand, some gravel, trace clay, greyish brown, moist to wet,	\bigotimes	1	SS	7			-						o						
_	loose to very loose.	\bigotimes																		
-		\bigotimes					286													
1		\bigotimes	2	SS	4			-							0					
-		\bigotimes						-												
- <u>285.2</u> - 1.5		ĚŽ						-												
-	organics, brown, wet, firm to soft.	\bigotimes	3	SS	6		285	-								0				
2		\bigotimes						-												
		\bigotimes						-												
-		\bigotimes	4	SS	2		284	-								0				
-		\bigotimes					204	-												
<u>-283.6</u> 3.1	END OF BOREHOLE	\sim						-												
						GRAPH			Number	re refer		• - 00/		at Failu						

1 OF 1

RECT DATE FORMT NEW

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PROJ	ECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern Pa	ssenge	er Rail	Servio	e											
CLIEN	IT: Gannett Fleming							Metho	od: Hol	llow St	em A	ugers				TE	CHN	CIAN	l: T.(Du	
PROJ	ECT LOCATION: Timmins, Ontario									00mm						RE	EF. NC	0.: 23	30420)2	
	IM: Geodetic							Date:	Jul 8	, 2023						EN	ICL N	0.: 1	7		
BHLC	CATION: See Borehole Location Plan SOIL PROFILE	N 53	-	SAMPL		25.86		DYNA		DNE PE E PLOT	NETR	ATION		<u> </u>				1			
			3		.E3	Ш							~~	PLASTI LIMIT	C NAT	URAL	LIQUID LIMIT	z	r wt		ARKS ND
(m)		STRATA PLOT			SN SN	GROUND WATER CONDITIONS	z		L	RENG		1	00	W _P		TENT W	WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	GRAI	N SIZE
ELEV DEPTH	CLASSIFICATION	ATA F	BER		BLOWS 0.3 m	UND	ELEVATION	οu	NCONF	INED	+	FIÉLD V & Sensit	ANE		TER CO		T (0()	POCK (Cu)	ATURA (kN		IBUTION %)
286.6	Ground Surface	STR/	NUMBER	ТҮРЕ	z	GRO CON	ELEV			RIAXIAI 0 6			ANE 00				1 (%) 30		≥	GR SA	SI CL
286.4	TOPSOIL: 150mm	<u>×1//.</u>						-												-	
0.2	FILL: sand and gravel mix with topsoil, trace silt and clay, dark	\bigotimes	1	SS	26			-									4	4			
- 285.9	brown, wet, compact.	\bigotimes				-	286														
0.7	FILL: clayey silt, trace sand, grey, moist to wet, firm to very soft.	\boxtimes	-					-													
-		\bigotimes	2	SS	7			-							0						
-		\bigotimes						-													
-		\otimes	-				285	-													
E		\otimes	3	SS	4			-													
2		\bigotimes						-													
-		\bigotimes						-													
-	trace straw, contains wet silt seams/layers	\bigotimes	4	SS	2		284	-									•				
-		\bigotimes						-													
<u>-283.5</u> 3.1	SILTY CLAY: trace sand, contains	K)	—					-													
	silt seams, grey, wet, very soft.		5	SS	2			-								0					
F							283	-													
-								-													
4		R						-													
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F		R					282	-													
-	contains dilatant silt layers	R	6	SS	1			-										0		0 1	55 44
5	contains dilatant sin hypers	H.	ľ					-	<u> </u>											0 1	55 44
-		H.						-													
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-			7	SS	1		280	-	×							0		0			
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7		H						-													
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-		H					279	-													
-		H						-													
8			8	SS	2			-	×								0	0			
278.3	END OF BOREHOLE							-													
1 23-10-19																					
WWW CD																					
TRY - NEW																					
NT ONLY BY																					
18 106 6																					
ER 80L - 2																					
ALLA																		I			
	IDWATER ELEVATIONS					GRAPH	+ 3	¥ 0. I	 umpel 	rs refer	0	ງ ∎=3%	Strain	ot Eoilu	ro						

1 OF 1

DEPTH CLASSIFICATION	
PROJECT LOCATION: Timmins, Ontario Diameter: 200mm REF. NO.: 230420 DATUM: Geodetic Date: Jul 8, 2023 ENCL NO.: 18 BH LOCATION: See Borehole Location Plan N 5371399.91 E 488204.61 Date: Jul 8, 2023 ENCL NO.: 18 Image: Content of the second sec	2 REMARKS AND GRAIN SIZE DISTRIBUTION (%)
DATUM: Geodetic Date: Jul 8, 2023 ENCL NO.: 18 BH LOCATION: See Borehole Location Plan N 5371399.91 E 488204.61 SOIL PROFILE SAMPLES VIEW OF CONFERNMENT CONE PENETRATION RESISTANCE PLOT OF CONTENT UNIT CONTENT OF CONTENT. TOT OF CONTENT OF CONTENT OF CONTENT OF CONTENT OF CONTENT OF CONTENT OF CONTENT. CONTENT OF CONTENT OF CONTENT OF CONTENT OF CO	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
DATUM: Geodetic Date: Jul 8, 2023 ENCL NO.: 18 BH LOCATION: See Borehole Location Plan N 5371399.91 E 488204.61 SOIL PROFILE SAMPLES VIEW OF CONFERNMENT CONE PENETRATION RESISTANCE PLOT OF CONTENT UNIT CONTENT OF CONTENT. TOT OF CONTENT OF CONTENT OF CONTENT OF CONTENT OF CONTENT OF CONTENT OF CONTENT. CONTENT OF CONTENT OF CONTENT OF CONTENT OF CO	AND GRAIN SIZE DISTRIBUTION (%)
BH LOCATION: See Borehole Location Plan N 5371399.91 E 488204.61 OPYNAMIC CONE PENETRATION RESISTANCE PLOT OPYNAMIC CONE PENETRATION RESISTANCE PLOT (m) 0 0 0 (m) 0 0 0 0 0 0 OEPTH CLASSIFICATION 0 0 0 0 0 286.7 Ground Surface 0 <	AND GRAIN SIZE DISTRIBUTION (%)
SOIL PROFILE SAMPLES (m) U ELEV CLASSIFICATION 0 U 0 <td< td=""><td>AND GRAIN SIZE DISTRIBUTION (%)</td></td<>	AND GRAIN SIZE DISTRIBUTION (%)
(m) Louing Louing Louing Louing (m) ELEV CLASSIFICATION Image: Stress of the	AND GRAIN SIZE DISTRIBUTION (%)
286.7 Ground Surface 5 2 2 5 2 5 3 20 40 60 80 100 10 20 30 10 288.0 TOPSOIL: 25mm	GRAIN SIZE DISTRIBUTION (%)
286.7 Ground Surface 5 2 2 5 2 5 3 20 40 60 80 100 10 20 30 10 288.0 TOPSOIL: 25mm	(%)
286.7 Ground Surface 5 2 2 5 2 5 3 20 40 60 80 100 10 20 30 10 288.0 TOPSOIL: 25mm	
288.0 TOPSOIL: 25mm FILL: organic clayey silt, sandy, trace wood pieces, dark brown, moist, soft. 1 SS 3	GR SA SI CL
FILL: organic clayey silt, sandy, trace wood pieces, dark brown, moist, soft. 1 SS 3 286 286	
trace wood pieces, dark brown, moist, soft.	
1.5 CLAYEY SILT: trace sand, contains wet sand seams, brown,	
moist to wet, firm to soft.	
brown to grey	
brown to grey 4 SS 2 284	0 3 73 24
283.7	
3.0 SILTY CLAY: trace sand, contains 117 dilatant silt seams, grey, wet, very 117	
soft. o 0	
7 SS 2 X 0 0	
280.0 280 280 280 280 280 280 280 280 280 28	
$\frac{\text{GRAPH}}{\text{GROUNDWATER ELEVATIONS}} + \frac{3}{3} \times \frac{3}{3}$ Numbers refere $O^{\text{s}=3\%}$ Strain at Failure	

PROJ	ECT: Geotechnical Investigation - Ontai	rio No	orthla	and No	ortheas	stern Pa	asseng	er Rai	l Serv	се										
CLIEN	IT: Gannett Fleming							Meth	od: Ho	ollow St	em Au	ugers				TE	CHNI	CIAN	I: T.(Ou
PROJ	ECT LOCATION: Timmins, Ontario							Diam	neter:	200mm						RE	EF. NC).: 23	30420	02
DATU	M: Geodetic							Date	: Jul 8	3, 2023						E١	ICL NO	D.: 19	9	
BH LC	OCATION: See Borehole Location Plan	N 53				3.47	-											_		
	SOIL PROFILE	_	S	ampl	.ES	Ľ.		RESI	STANC	ONE PE E PLOT	\geq			PLAST			LIQUID		WΤ	REMARKS
(m)		ь О			<u>ဖ</u> ု_	GROUND WATER CONDITIONS	7		-	40 6		I	00	LIMIT WP	CON	TENT	LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	AND GRAIN SIZE
ELEV DEPTH	CLASSIFICATION	IA PI	ER		BLOWS 0.3 m		IOITA		AR SI INCON	RENG	IН (кн +	7a) FIELD V & Sensiti	ANE	<u>-</u>		o	—ī) (IOCKE	URAL (KN/i	
		STRATA PLOT	NUMBER	ТҮРЕ		ROU OND	ELEVATION	• 0	UICK .	FRIAXIAL	- ×	TORV	ANE			ONTEN		۹.	NAT	(%)
287.1	Ground Surface	5	Ĩ	F	ŗ	υŭ			20	40 6	8 0	80 1	00	1	0 2	20 3	30 			GR SA SI CL
- 280:0	FILL: sandy silt, some organics,	\bowtie	1	SS	7		-Conci -Sand	Ele—							0			1		
	trace rootlets, trace wood pieces, dark brown, moist, loose.	\bigotimes	1	33	<i>'</i>										U					
286.4		\bigotimes						-												
0.7	FILL: clayey silt, some organics, trace sand, dark brown, wet, stiff.	\bigotimes						-												
-		\bigotimes	2	SS	14		286									0				
-		\bigotimes				¥	W. L.	F 285.9	m											
-285.5		X					-Bento	nite												
1.6	CLAYEY SILT: trace sand, contains sandy silt pockets/layers,		3	SS	6			-							0					
2	brown, wet, firm.		Ŭ	00			005	-												
284.9	CLAYEY SILT: trace sand, brown,						285	_												
- 2.2	wet, firm to soft.							E												
			4	SS	5			F												
-							Sand	-												
-						l:E:	284													
-			5	SS	4	Ľ₿:	·	E								0				
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-						l:目:	·	ŀ												
- 						∶ <u></u> ∃∶		-												
4.1	SILTY CLAY: trace sand, contains						283	-												
-	dilatant silt seams/layers, grey, wet, soft.					[:目:		E												
-							Scree	n F												
			6	SS	2	l:目:	,	F								o				
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-							281	-	1											
			7	SS	2			Ę,	<								0	0		
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8			8	SS	2			-	×								0	0		
278.9		KX.					279	-										1		
8.2	END OF BOREHOLE 1) 50mm diameter monitoring well																			
	was installed upon completion in the borehole.																			
	Water Level Readings:																			
	Date W. L. Depth (mBGS) 2023-08-30 1.24																			



PROJ	ECT: Geotechnical Investigation - Ontar	io No	orthla	and No	ortheas	stern Pa	asseng	er Rai	Servio	ce										
	IT: Gannett Fleming							Meth	od: Ho	llow St	em Au	igers				TE	CHNI	CIAN	I: T.(Du
	ECT LOCATION: Timmins, Ontario									:00mm							EF. NC			02
	M: Geodetic							Date:	Jul 9	, 2023						EN	ICL N	0.: 20	0	
BHLC	OCATION: See Borehole Location Plan I SOIL PROFILE	N 53		SAMPL				DYNA		DNE PE E PLOT	NETRA	TION			NAT				_	REMARKS
(m)		т				GROUND WATER CONDITIONS				40 6			00	PLASTI LIMIT	C NAT MOIS	TURE	LIQUID LIMIT	Ľ	NATURAL UNIT WT (kN/m ³)	AND
(m) ELEV		STRATA PLOT	~		BLOWS 0.3 m	AW C	NO			RENG	TH (kF	∟ Pa)	I	W _P		N 0	WL	POCKET PEN. (Cu) (kPa)	AL UN	GRAIN SIZE
DEPTH	CLASSIFICATION	RATA	NUMBER	ш	BLC 0.3	INNC	ELEVATION			FINED RIAXIAL	+	FIELD V/ & Sensitiv	ANE vity ANE	WAT	TER CO	DNTEN	Т (%)	0 0 0 0	ATUR (F	(%)
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- 286.6		\bigotimes	2	SS	8			-							0					
[1.1	CLAYEY SILT: trace sand, contains dilatant silt seams, brown,		-	00				F												
-	wet, firm to soft.					I⊻	Rento													
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- 4.1	SILTY CLAY: trace sand, contains							Ē												
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281.0		XX					281	<u>L</u>												
6.7	END OF BOREHOLE Note:																			
	 50mm diameter monitoring well was installed upon completion in 																			
	the borehole. Water Level Readings:																			
	Date W. L. Depth (mBGS) 2023-08-30 1.52																			
	2023-00-30 1.32																			
2																				
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· · · · ·	IDWATER ELEVATIONS				•	GRAPH	3	• • 3.	Numbe	rs refer		8 =3%	Ctuain	at Failu						

GO.GLB FORMT NEW RECT DATE

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Palmer.

LOG OF BOREHOLE BH23-NT-18

	IT: Gannett Fleming									llow St		ugers					CHNI				
	ECT LOCATION: Timmins, Ontario									00mm							EF. NC			02	
	IM: Geodetic		.	o 1-		o		Date:	Jul 9	, 2023						EN	ICL N	0.: 2	1		
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		⊢				GROUND WATER CONDITIONS		1					00	PLASTI LIMIT	MOIS CON	URAL TURE TENT	Liquid Limit	Ľ.	NATURAL UNIT WT (kN/m ³)	REM A	IARKS
n) .EV		STRATA PLOT	~		BLOWS 0.3 m	AW C	NO	SHEA	R STI	RENG	L TH (ki	∟ Pa)		W _P	V	N 2	WL	POCKET PEN. (Cu) (kPa)	AL UN	GRAI DISTRI	
PTH	CLASSIFICATION	RATA	NUMBER	щ		INNC	ELEVATION				+	FIELD V. & Sensiti TORV/	ANE vity ANF	WAT	ER CC		T (%)	0 <u>0</u>	ATUR 4)	("	(%)
	Ground Surface	STF	Ŋ	ТҮРЕ	ż	GR	ELE						00	1	0 2	20 3	30		Ĺ	GR SA	SI
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6.8 0.9	CLAYEY SILT: trace sand, contains silt seams, brown, wet,		2	SS	18	-	287	- - - -							0			-			
	very stiff to firm.					-		- - -													
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						-	284	- - - -													
<u>3.6</u> 4.1	SILTY CLAY: trace sand, contains silt seams, grey, wet, very soft.							- - - -													
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9.5 8.2	END OF BOREHOLE	K.						-											⊢	┝──	
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	ECT: Geotechnical Investigation - Onta						Ŭ				om ^.	Idere				Ŧſ			. т	0
	IT: Gannett Fleming									llow Ste 00mm	em Ai	ugers								
	ECT LOCATION: Timmins, Ontario IM: Geodetic									00mm 9, 2023	2						EF. NC			υZ
	DCATION: See Borehole Location Plan	N 53	37120	30 40 5	- 4880	12 8/		Dale:	JULIS	o, 2023	,					Εľ		U Z	۷	
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		Τ.	<u> </u>			GROUND WATER CONDITIONS							00	PLASTI LIMIT	IC NAT	URAL	LIQUID LIMIT	ż	NATURAL UNIT WT (kN/m ³)	REMARK AND
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LEV EPTH	CLASSIFICATION	VTA F	BER		BLOWS 0.3 m	UND	ATI0	O UI	NCONF	INED	+	FIÉLD V & Sensiti	ANE vity					(CU)	\TURA (Kh	DISTRIBUT (%)
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PROJECT Geneterheidel Investigation - Ontatio Northaus Northau					L	UG	OF BO	JRE	IOL	E RH	23-1	11-2	U								2	OF 2
PROJECT LOCATION: Timmins, Ontain Dame: 20mm REF. 2007 REF. ND: 2002 BILDOATION: See Borehot Location Plan NST308-02 E 4887128 Bit 2007	PRO	JECT: Geotechnical Investigation - Onta	irio N	lorthl	and No	ortheas	stern Pa	ssenge	er Rail	Servic	e											
	CLIE	NT: Gannett Fleming							Metho	od: Hol	low St	em Au	ugers				TE	CHNI	CIAN	I: Т.	Ou	
BH LOCATION: see Borehole Location Plan N 5371380.42 E 48212.44 SOLL PROFILE SAMPLES Profile Stande PLOT Stand Code PLOT Stand	PRO	JECT LOCATION: Timmins, Ontario							Diam	eter: 2	00mm						R	EF. NC	D.: 23	3042	02	
SOLI PROFILE SAMPLES Provide Concernance Provide	DAT	UM: Geodetic							Date:	Jul 19	9, 202	3					E١		0.: 2	2		
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133 SILTY SAND TILL: trace to some clay, trace gravel, grey, wet, compact, to very dense. 10 274 274 0 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>275</td> <td></td>								275														
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GROUNDWATER ELEVATIONS GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity O ^{\$=3%} Strain at Failure				<u> </u>	I	1		l		<u> </u>	<u> </u>	<u> </u>	1	<u> </u>	I	I	<u> </u>	1	<u> </u>	<u> </u>		

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	ECT: Geotechnical Investigation - Ontai	rio No	orthla	and No	ortheas	stern Pa	asseng									T F			ь. т .	0	
	T: Gannett Fleming									low Ste	m Aug	jers									
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HLU	CATION: See Borehole Location Plan SOIL PROFILE	IN 53		SAMPL		39.75	<u> </u>	DYNA	MIC CC	NE PEN E PLOT	ETRAT	ION									
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m)		-OT			S	GROUND WATER CONDITIONS	z		Ĺ	0 60	80		0	LIMIT W _P	CON	TENT N	LIMIT W _L	OCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)		.ND IN SIZI
<u>EV</u> PTH	CLASSIFICATION	A PI	R		BLOWS 0.3 m		OF		AR STI NCONF		È FI	IÉLD VA	NE	<u>-</u>		>	<u> </u>	OCKE	URAL (kN/i	DISTR	
		STRATA PLOT	NUMBER	ТҮРЕ		D D D D D D D D D D D D D D D D D D D	ELEVATION	• Q	UICK T	RIAXIAL	хŤ	ORVA	NE		TER CO			9 0	NAT	(%)
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	dark grey, wet, loose to compact.	\bigotimes	1	SS	9			E													
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	contains wood pieces	\bigotimes	3	SS	5			Ł									Ψ				
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2.2	FILL:sandy silt, trace to some clay, dilatant, brown, wet, loose.	\bigotimes						ŧ													
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	and the strength of the strength of the	\bigotimes	5	SS	5	 :目:	284	-								0					
	contains clayey silt pockets	\bigotimes	5	33	3	ŀ∃÷		F								Γ					
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	sand, brownish grey, wet, soft. possible fill	FH7				[:目:	_00	ŧ													
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PROJ	ECT: Geotechnical Investigation - Onta	rio N	orthla	and No	ortheas	stern Pa	assenge	er Rail	Servio	e										
CLIEN	IT: Gannett Fleming							Meth	od: Hol	low S	tem A	ugers				TE	ECHNI	CIAN	N: T.	Ou
PROJ	ECT LOCATION: Timmins, Ontario							Diam	eter: 2	00mm	ı					R	EF. NO	D.: 23	3042	02
DATU	IM: Geodetic							Date:	Jul 1	9, 202	3					E١	NCL N	0.: 2	3	
BH LC	OCATION: See Borehole Location Plan	N 53	37138	35.94 I	E 4882	39.75														
	SOIL PROFILE		1	SAMPL				DYNA	MIC CO		NETR	ATION								DEMARKO
					1	GROUND WATER CONDITIONS							00	PLAST LIMIT	IC MOIS	URAL STURE ITENT	LIQUID LIMIT	z	NATURAL UNIT WT (kN/m ³)	REMARKS AND
(m)		2			SIE	WA ⁻	z		AR STI	L			I	W _P		W	$W_{\rm L}$	POCKET PEN. (Cu) (kPa)	(m ³)	GRAIN SIZE
ELEV DEPTH	CLASSIFICATION	TAF	ËR		BLOWS 0.3 m	I I I I I I I I I I I I I I I I I I I	ATIO		NCONF		ì	FIELD V & Sensit	ANE			o		Sock	(KN	DISTRIBUTION (%)
		STRATA PLOT	NUMBER	ТҮРЕ	ľ.	ONE ROL	ELEVATION		UICK TI 20 4		L X	TORV			TER CO		T (%) 30	–	¥	
	Continued SILTY CLAY: trace sand, contains	l on K.X		-	-	00	ш	-			1	+	1			1	1	-		GR SA SI C
-	silt seams, grey, wet, very	Hł.	1				277	-												
-	soft.(Continued)	W.	1					-												
-		K	1					-												
-		Hł.	1					-												
-	contains silt layers	W	10	SS	1		-Bento	- nite		×							0	0		
-		K	┣																	
-		ŔŻ	1					-												
275.5	SILT: some clay, contains clayey	ľ4	4					-												
- 11.7	silt seams, dilatant, grey, wet,							-												
	compact.						275	_												
_							215	-												
-			11	SS	11			-								0				
-								-												
13								-												
-							274	-										4		
-								-												
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-								-												
<u>14273.2</u> - 14.0	SILTY SAND TILL: trace to some	101	12	SS	12											0				
- 14.0	clay, trace gravel, grey, wet,	i ¦ i					273											-		
-	compact to dense.							-												
-								L												
-								-												
-		ļ ģ						-												
-		밥밥	<u> </u>				272	-										1		
-		ŀŀ	13	ss	38			-							0					
								E												
<u>1</u> 9271.2		₀						-												
16.1	END OF BOREHOLE																			
	Note: 1) 50mm diameter monitoring well																			
	was installed upon completion in the borehole.																			
	Water Level Readings:																			
	Date W. L. Depth (mBGS) 2023-08-30 1.28																			
			1		1									1			1			
			1		1									1			1			
			1		1									1			1			
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			1		1									1			1			
0001						GRAPH	₊ 3	×3.	Number	rs refer	~	8=3%	Strain	at Failu						
GRUUN	IDWATER ELEVATIONS					NOTES	• •		to Sens	itivity	<u> </u>	-	Cuant	arrait						

	IECT: Geotechnical Investigation - Onta	rio No	orthla	nd No	ortheas	tern Pa	ssenge															
	NT: Gannett Fleming									llow S		Aug	ers									
	IECT LOCATION: Timmins, Ontario									200mm								EF. NC		30420)2	
	IM: Geodetic							Date:	Jun '	11, 202	24						E١	NCL NO	D.: 1			
BHLC	CATION: See Borehole Location Plan	N 53	-			9.38		DYNA	MIC CC	DNE PE	NET	RATIC	NC		<u> </u>				<u> </u>			
	SOIL PROFILE		5	SAMPL	_ES	н				DNE PE E PLOT	_				PLAST	IC NAT MOIS CON	URAL			۲M.	REMARKS AND	
(m)		Lot			ଷ୍ଟ	GROUND WATER CONDITIONS	z		1	1 .		80		00	W _P	CON	ITENT W	LIMIT W _L	KPa)	NATURAL UNIT WT (kN/m ³)	GRAIN SIZE	:
ELEV DEPTH	CLASSIFICATION	TA PI	Щ		BLOWS 0.3 m			O U	AR ST NCONF		ін	(KPa + ^{FII} & 3	i) ELD V/ Sensiti	ANE	I		o		(Du)	rural (kn/	DISTRIBUTIC (%)	N
		STRATA PLOT	NUMBER	ТҮРЕ		ROU	ELEVATION				L 60	× Ľ/ 80	AB VA	NE		TER CO		T (%)	<u>۵</u>	, A		
	Ground Surface TOPSOIL: 100mm	0	z	-	f	00	ш	4	20 4	40 (0		10 2	20 :	30			GR SA SI	CL
28 9.0 0.1	FILL: clavev silt, trace sand, trace	\mathbb{X}	1	SS	8		288															
	gravel, trace organics, brown, wet, firm.	\otimes	'	00			200	-														
		\otimes	-					-														
		\otimes						-														
Ē		\otimes	2	SS	7			-										o				
E							287															
-								-														
-		\otimes	3	SS	5			-														
2		\otimes	Ĭ					-														
286.1	FILL: silty clay, trace sand, brown,	\mathbb{X}						-														
- 2.2	wet, firm.	\otimes					286	-														
-		\otimes	4	SS	5			-										42				
		\otimes						-														
<u>-285.3</u> 3.1	SILTY CLAY: trace sand, greyish	X	}			-		-														
-	brown, wet, soft to firm.		5	SS	4		285	-										0				
-		H.	Ĭ		.			-														
E						-		E														
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			6	SS	4			-										0				
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E	grey below 6.1m					-		[
	grey below 6.1m contains clayey silt layers		7	SS	7		282	-									0					
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540		R.	1		1		280					_										
- 270 6								ŀ														
<u>279.6</u> 8.7	SILTY SAND TILL: trace clay, trace							ŀ														
00 2034 1	gravel, grey, wet, dense.	間	1					ŀ														
						1	070	F														
PULIERS	contains silt layers	旧	8	SS	40		279	-								0						
GROUN	Continued Next Page IDWATER ELEVATIONS					<u>GRAPH</u> NOTES	+ 3.	×3:	Numbe	rs refer itivity		08	=3%	Strain	at Failu	re						
	1st 2nd 3rd 4th					NUTES	,		to Sens	ativity												
Measure																						

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	JECT: Geotechnical Investigation - Ontar	io No	orthla	and No	ortheas	tern Pa	ssenge														
	NT: Gannett Fleming								od: Ho			ugers									
	JECT LOCATION: Timmins, Ontario								eter: 2								EF. NC)2	
	JM: Geodetic OCATION: See Borehole Location Plan	N 53	7107	75 6 E	/0011	0.38		Date	Jun 1	1, 202	24					۲	NCL N	0.: 1			
DITE	SOIL PROFILE	14 33	1	SAMPL				DYNA	MIC CO STANCE			TION								DEM	DKO
(112)		F				GROUND WATER CONDITIONS							00	PLASTI LIMIT	C MOIS CON	URAL STURE TENT	LIQUID LIMIT	Ľ.	NATURAL UNIT WT (kN/m ³)	REMA AN	
(m) ELEV		STRATA PLOT	~		BLOWS 0.3 m	NNS ONS	N		AR ST	1	TH (kl	Pa)		W _P		N 0	WL	POCKET PEN. (Cu) (kPa)	KAL UN	GRAIN DISTRIE	
DEPTH	CLASSIFICATION	RATA	NUMBER	щ			ELEVATION		NCONF UICK TF		+ ×	FIELD V & Sensit	ANE ivity ANE	WA	ER CO	ONTEN	T (%)	0 Q Q	NATUF ((%	
	Continued		NN	ТҮРЕ	ż	GR(COI	E						00	1	0 2	20 3	30			GR SA	SI CL
-	SILTY SAND TILL: trace clay, trace gravel, grey, wet, dense.(Continued)	161 -						-													
10								-													
5		⁰ 																			
-							278	-													
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-						1		-												wet spo below	on
<u>11</u>			9	SS	35)					DCIOW	
-		_ _0					277	-													
-								-													
276.6	SANDY SILT TO SILTY SAND:							-													
- 11.7	trace clay, trace gravel, grey, wet to saturated, very dense.	말						-													
-	saturated, very dense.				50/			-													
-			10	SS	50/ 75mm	u l	276	-							-0						
-								-													
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<u>13</u> -								ŀ													
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-							274	-													
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<u>15</u> -								-													
-	contains sand layers		12	SS	50/		273								0			-			
<u>272.8</u> 15.5	END OF BOREHOLE	1.1		00	<u>100mn</u>										-						
	1) Water level was at 7.71mBGS upon completion of drilling.																				
	Borehole was open upon																				
	completion of drilling.																				
0																		1			
11-77-7- GAM																					
2 5 7 7 7																		1			
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0000	NDWATER ELEVATIONS					<u>GRAPH</u>	+ 3	×3.	Number	s refer		8=3%	Strain	at Failur	<u> </u>			•			

 $\begin{array}{c} 1 \text{ st} \\ \text{Measurement} \\ \underline{\nabla} \\ \underline{$

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	JECT: Geotechnical Investigation - Ontai	io No	orthla	nd No	rtheas	tern Pa	ssenge	r Rail ·	- Timn	nins 20)24										
	NT: Gannett Fleming									llow St		ugers									
	JECT LOCATION: Timmins, Ontario									:00mm							EF. NC)2	
	JM: Geodetic							Date:	Jun ′	12, 202	24					EN	ICL NO	D.: 2			
BH LO	OCATION: See Borehole Location Plan	N 53	-			60.8 I		DYNA				TION		1				-	1		
	SOIL PROFILE		s	AMPL	.ES	н		RESIS	TANCE	DNE PEI E PLOT	\geq			PLAST	C NATI MOIS CON		LIQUID		μ	REMA	
(m)		OT			ω l	GROUND WATER CONDITIONS	_		1	1		1	100	LIMIT W _P		TENT	LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	AN GRAIN	
ELEV DEPTH	CLASSIFICATION	STRATA PLOT	Ë		BLOWS 0.3 m		ELEVATION		AR ST NCONF		TH (kl +	Pa) FIELD \ & Sensi	ANE/		(OCKE (Cu)	URAL (kN/r	DISTRIB	UTION
		[RAT	NUMBER	ТҮРЕ	<u>ا</u> ه	IDNC	EVA.	• QI	UICK T	RIAXIAL	- ×	LAB V	ANE		TER CC			ē.		(%	
288.3 - 28 8.2	Ground Surface TOPSOIL: 150mm	S	ž	F	ŗ	ΰŭ	Ш	2	20 4	40 E	60 E	30 1	100	1	0 2	20 3	30 			GR SA	SI CL
0.2	FILL: clayey silt, trace sand, trace	$\overline{\mathbb{X}}$		SS	5		288	-													
E	gravel, trace organics, brown, moist, firm.	\bigotimes	1	33	5		200								0						
-		\bigotimes	-			-															
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E		\bigotimes				-		[
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2		\bigotimes	3	33	5																
- 286.0		\bigotimes						-													
2.3		ŔŶ					286	-													
-	brown, wet, very soft.	K	4	SS	3			-									41	•			
Ē								F													
3	grey below 3.1m																				
-	grey below 3. Th		_	00			285	_									46				
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- 281.1	SANDY SILT: trace to some clay,	KA																			
1.2	grey, wet to saturated, compact.						281														
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8			7	SS	11			-							0	Þ					
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000 1000								-													
- - 278.9		$\left[: \right] $					279	<u> </u>	-			-		<u> </u>							
210.9	Continued Next Page	<u>H. . </u>				L			<u> </u>												
GROUN	NDWATER ELEVATIONS					<u>GRAPH</u> NOTES	+ 3,	× ³ : 1	Numbe to Sens	rs refer itivity	С	8 =3%	° Strain	at Failur	e						
Measur	$\begin{array}{c c} & 1 \text{st} \\ \hline \end{array} & \mathbf{\underline{\nabla}} & \mathbf{\underline{\nabla}} & \mathbf{\underline{\nabla}} & \mathbf{\underline{4}} \\ \hline \end{array} & \mathbf{\underline{\nabla}} & \mathbf{\underline{\nabla}} & \mathbf{\underline{\nabla}} & \mathbf{\underline{V}} \end{array}$																				

1 OF 2

	IECT: Geotechnical Investigation - Ontar	rio No	orthla	ind No	rtheas	tern Pa	ssenge		- Timr Iod: Ho			uders								
	JECT LOCATION: Timmins, Ontario								neter: 2			lugero				R	EF. NC	D.: 2	3042)2
	JM: Geodetic								: Jun								NCL N			
BH LO	OCATION: See Borehole Location Plan	N 53	7129	97.74 E	E 4881	60.8														
	SOIL PROFILE		s	SAMPL	ES	~		DYN/ RESI	AMIC CO STANCI	DNE PE E PLOT		ATION -		PLASTI LIMIT			LIQUID		ŕ	REMARKS
(m)		Б			ol ا	GROUND WATER CONDITIONS	_		_	1	1		00	LIMIT W _P	CON	NTENT W	LIMIT W _L	POCKET PEN. (Cu) (KPa)	NATURAL UNIT WT (kN/m ³)	AND GRAIN SIZE
ELEV DEPTH	CLASSIFICATION	LA PL	Щ		BLOWS 0.3 m	ND V ITION	VIIO		AR ST		STH (k +	(Pa) FIELD \ & Sensi	ANE	ļ Ē		-o	`	OCKE (Cu)	(kN/r	DISTRIBUTION (%)
		STRATA PLOT	NUMBER	ТҮРЕ		SROU	ELEVATION		DUICK T		- ×	LAB V	ANE 00			ONTEN 20	T (%) 30	Ē	¥	
- 9.5	Continued SILTY SAND TILL: trace clay, trace	191	2	-	-	00	ш —	_								1	1			GR SA SI CL
-	gravel, grey, moist to wet, very dense to dense.(Continued)							-												
10	· · · · · ·	 						_												
							278	-												
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-	contains clayey silt layers						277	-												
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		臣]					-												
<u>13</u> -	saturated below 13m	(\$						-												
-			9	SS	17		275									0		-		
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- <u>272.5</u> 15.9	END OF BOREHOLE	<u>, i i i i i</u>						-												
	1) Water level was at 6.24mBGS upon completion of drilling.																			
	2. Borehole was open upon completion of drilling.																			
949																				
240809.09-1																				
TMMMS 20																				
106 2024																				
8 SOL - 20 18																				
3VTNd																				
GROUN	IDWATER ELEVATIONS					<u>GRAPH</u> <u>NOTES</u>	+ 3,	× ³ :	Numbe to Sens	rs refer sitivity	C	⊃ ^{8=3%}	Strain	at Failur	e					

2 OF 2

 $\begin{array}{c} \underline{\text{GROUNDWATER ELEVATIONS}} \\ \text{Measurement} \quad \underbrace{\stackrel{1 \text{st}}{\underline{\bigvee}} \quad \stackrel{2 \text{nd}}{\underline{\bigvee}} \quad \underbrace{\stackrel{3 \text{rd}}{\underline{\bigvee}} \quad \underbrace{\stackrel{4 \text{th}}{\underline{\bigvee}}} \end{array}$

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CLIEI PRO. DATU	JECT: Geotechnical Investigation - Ontar NT: Gannett Fleming JECT LOCATION: Timmins, Ontario JM: Geodetic OCATION: See Borehole Location Plan						ssenge	Metl Diar Date	hod mete e: J	: Hol er: 2(un 1	low \$ 00mr 2, 20	Ster n)24	m Aı	ugers						EF. NC NCL N			02	
	SOIL PROFILE		s	ampl	.ES	~		DYN RES	IAMI SISTA	C CO	NE PE PLO			TION		DI /	NSTIC	NAT	URAL	LIQUID		т	REM	ARKS
(m) <u>ELEV</u> DEPTH	CLASSIFICATION	STRATA PLOT	NUMBER	ТҮРЕ	" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	01	UNC QUIC	ONFI	REN REN RIAXIA	٩L	H (kl + ×	L Pa) FIELD & Sens LAB	ANE/	- w	^{'P} WATE	ER CO	URAL STURE ITENT W O		POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	GRAII DISTRI	ND N SIZE BUTION %)
287.2 - 28 0 .0	Ground Surface TOPSOIL: 125mm	LS 1/2	z	Ϋ́	ŗ	9 9 9	Щ		20	4	0	60	8	80	100	_	10) 2	20	30			GR SA	SI CL
- 0.1	FILL: silty sand, trace clay, trace gravel, contains cobbles, brown, moist, loose to very loose.		1	SS	5	-	287	-									c	>			-			
- - - - -			2	SS	8		286	- - - -													_			
 	some clay below 1.5m		3	SS	6			-										0						
- - - - -			4	SS	3	-	285	- - - - -											¢					
- <u>3284.2</u> - 3.1	SILTY CLAY: trace sand, brown,	K.				-		-																
 - -	moist, soft.		5	SS	3	-	284	- - - -											¢					
- - - - - - - - - - - - - - - - - - -			6	SS	3	-	283	- - - -													_			
_ 4.5 	SILTY CLAY: trace sand, grey, moist to wet, very soft.		7	SS	0		282	-											0					
- - - - - - -							202	-																
-				TW			281	- - - -		+									F	60.4	4			
- <u>7</u> - - - -							280	- - - - -													_			
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00. 201 THINKS 202300 073 215								-																
E R SOLL 20 18							278	-				+		-		+					1			
	Continued Next Page	ĽĽ	9	SS	0			<u> </u>												0	L			
<u>GROUN</u> Measur	$\begin{array}{c} \begin{array}{c} \text{NDWATER ELEVATIONS} \\ \text{ement} \stackrel{1\text{st}}{\underline{\nabla}} \stackrel{2\text{nd}}{\underline{\Psi}} \stackrel{3\text{rd}}{\underline{\Psi}} \stackrel{4\text{th}}{\underline{\Psi}} \end{array}$					<u>GRAPH</u> NOTES	+°,	׳:	to	Sensi	tivity	•	С) - -3`	[%] Strai	n at Fa	ailure							

1 OF 2

PRO	JECT: Geotechnical Investigation - Onta	ario No	orthla	and No	ortheas	tern Pa	ssenge	er Rail	- Timn	nins 2	024										
	NT: Gannett Fleming										tem A	ugers									
	JECT LOCATION: Timmins, Ontario								eter: 2								EF. NC			02	
	JM: Geodetic							Date:	Jun '	12, 20	24					E١	NCL N	O.: 3			
BHL	OCATION: See Borehole Location Plan SOIL PROFILE	N 53	-	and E Sampl		99.31		DYNA	MIC CC	NE PE		TION		1					1		
					.es 	Ë								PLAST	IC NAT MOIS CON	URAL STURE	LIQUID LIMIT	z	ΜŢ	REMAR AND	
(m)		LOT			SI ∈	GROUND WATER CONDITIONS	z		1	1	60 8 H GTH (k	1	00	W _P		NTENT W	WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	GRAIN S	IZE
ELEV DEPTH	CLASSIFICATION	TAP	ËR		BLOWS 0.3 m		ATIO	ου	NCONF	INED	+		ANE	<u> </u>		•		(CU)	TURA (kN	DISTRIBU (%)	TION
	O antinue d	STRATA PLOT	NUMBER	TYPE	z.	SROU	ELEVATION		UICK T 20 4		LΧ	LAB V	ANE 00			ONTEN 20 ;	T (%) 30	–	¥	GR SA S	
	Continued SILTY CLAY: trace sand, grey,	1/X			-			-	1		+		1		1	1	1			GR SA C	N CL
-	moist to wet, very soft.(Continued)		}					-													
10			1					-													
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,276.2								-													
11.0	CLAYEY SILT: trace to some		1					-													
-	gravel, trace sand, contains cobbles, grey, wet, very soft.		1				276	-													
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- 14.0	SILTY SAND TILL: trace clay. trace	<u> </u>	1				070	-												Auger gri	nding
-	gravel, grey, moist, very dense.						273	-													
E								E													
-								-													
- 15 -		ŀιφ						-													
-		臣					272											-			
-		ιφ.	11	SS .	82/			-							6						
271.6					250mr			-													
15.7	1) Water level was at 8.71mBGS																				
	upon completion of drilling. 2. Borehole was open upon																				
	completion of drilling.																				
																			1		
2 2 2																			1		
10.00																			1		
1777- SMIM																					
AL 16 17 1																			1		
																			1		
ALMEN SOL																			1		
	NDWATER ELEVATIONS		•			<u>GRAPH</u>	3	× ³ :	Numbe	rs refer	·	8=3%	Chusin	•		1		•			

20.GLB

501-1



Palmer.

LOG OF BOREHOLE BH24-NT103

PRO	JECT: Geotechnical Investigation - Ontar	rio No	orthla	and No	rtheas	tern Pa	ssenge	r Rail	- Timn	nins 2	024									
	NT: Gannett Fleming										tem A	ugers								
	JECT LOCATION: Timmins, Ontario								eter: 2							R	EF. NC	0.: 23	30420)2
	JM: Geodetic							Date:	Jun 1	13, 20	24					E١	NCL N	0.: 4		
BHL	OCATION: See Borehole Location Plan	N 53	-			75.7		DYNA	MIC CC	NE PE		TION		-				i i		
	SOIL PROFILE	1		SAMPL	.ES	н								PLAST	IC NAT MOIS CON	URAL	LIQUID LIMIT	-	TW -	REMARKS AND
(m)		LoT			& -	GROUND WATER CONDITIONS	z		1	1	60 		100	- W _P		ITENT W	WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	GRAIN SIZE
ELEV DEPTH	CLASSIFICATION	STRATA PLOT	ËR		BLOWS 0.3 m		ELEVATION	οu	NCONF	INED	+	FIELD & Sens	VANE			o		POCKI	TURA (kn	DISTRIBUTION (%)
007.4	Consumed Counter and	STRA	NUMBER	ТҮРЕ	ž	GROU	ELEV		UICK TI 20 4		L X	LAB \	/ANE 100		TER CO		T (%) 30	-	¥2	GR SA SI CL
- 0.0		<i>"</i>	2		-			-	1		1	1	+		1		1			GR SA SI CL
-	samples						0.07	-												
-							287	_												
-								-												
1								-												
-																				
-							286						_							
-								-												
-								-												
- 285.1																				
285.1	FILL: silty clay to clayey silt, trace	×				1	285		-				_	_						
-	sand, greyish brown, moist to wet, very soft.	\otimes	1	SS	1			-								0				
-		\bigotimes						_												
-3284.4	SILTY CLAY: trace sand, contains	K				-		-												
-	clayey silt layers, greyish brown, wet, very soft.		2	SS	1		204	-								6				
-	wet, very solt.	H	1				284	-												
-								-												
4	grey below 3.8m	R						-									4	4		
Ē		H2	3	SS	0													Î		
-			├──			-	283							_						
-					İ			-												
5				тw				-												
-		H.						-												
-		K]				282	_					_							
-		K	1					-												
[1																	
<u>6</u> -			1					-												
-			1	-			004	-												
-			1	TW			281													
-		R						-												
7		R						-												
-		H2																		
-							280						-	-						
-								t -												
-		H.	}					F												
-		H]					ŀ												
0 MM W		H	1			-	279	-												
2024030				SS	0			t -									0			
A ROOM W		H	1	33				E												
80 100 X						1		-												
ERSOL-X		H.	1				070	-												
1764 200	Continued Next Page	ĽĽ.	1				278		Nices-1					I				L		
<u>GROUN</u>	NDWATER ELEVATIONS					<u>GRAPH</u> <u>NOTES</u>	+ 3,	X 3:	Numbei to Sens	s reter itivity	C	S ≈ =35	^o Strain	ı at Failu	re					

Measurement $\underline{\nabla}$ $\underline{\nabla}$ $\underline{\nabla}$ $\underline{\nabla}$

1 OF 2

LOG OF BOREHOLE BH24-NT104

	IECT: Geotechnical Investigation - Ontar	io No	orthla	nd No	rtheast	tern Pa	ssenge	r Rail	- Timn	nins 20)24										
CLIENT: Gannett Fleming									Method: Hollow Stem Augers												
PROJECT LOCATION: Timmins, Ontario									eter: 2								EF. NC)2	
	JM: Geodetic							Date:	Jun 1	3, 202	24					E١	NCL N	O.: 4			
BH LO	OCATION: See Borehole Location Plan	75.7	-	DYNA	MIC CO	NF PFI		TION						-	<u> </u>						
	SOIL PROFILE	_	S	AMPL	ES	к		RESIS	MIC CO STANCE	PLOT	\geq			PLAST	C NAT		LIQUID LIMIT		μ	REMAR	
(m)		-oT			<u></u> ଜା –	GROUND WATER CONDITIONS	7		1	1		1	00	LIMIT W _P	CON	TENT N		T PEN KPa)	NATURAL UNIT WT (kN/m ³)	AND GRAIN S	
ELEV DEPTH	CLASSIFICATION	STRATA PLOT	Ж		BLOWS 0.3 m		ELEVATION		AR STI NCONF		Η (k	Pa) FIELD V & Sensit	ANE			0		OCKE (Cu)	(kn/	DISTRIBU	
	Continued		NUMBER	ТҮРЕ	"N	ROU OND	LEV	• Q	UICK TR	RIAXIAL	- ×	LAB V/	ANE		TER CC		T (%)	۵.		(%)	
	Continued SILTY CLAY: trace sand, contains	s XX	z	F	-	00	ш	4	20 4	ιο e	30 03	50 1	00		0 2	20 3	30			GR SA S	SI CL
-	clayey silt layers, greyish brown, wet, very soft.(Continued)							-													
10	wet, very solt.(Continued)							-													
-								-													
-							277														
-																					
-		H.						-													
<u>11</u> -								-													
-							276	-													
275.8							270	-													
- 11.6	SILTY SAND TILL: trace clay, trace gravel, contains cobbles, grey, wet	Ι¢Ι Ι	5	SS	22			-								0					
<u>12</u>	to saturated, compact to very dense.							-													
-								Ē													
E							275														
-								-													
-								-													
-								-													
E	moist to wet						274	Ē													
-								-													
-								-													
14			6	ss	89/			-							0						
-					275mm	ו		-													
-							273														
272.7		ا ا						ŀ													
- 14.7	SAND: trace clay, trace silt, grey, moist to wet, dense.							-													
-								-													
E							272														
-			7	SS	38		212	ŀ							0						
- - 271.6								-													
15.9	END OF BOREHOLE 1) Water level was at 7.74mBGS																				
	upon completion of drilling. 2. Borehole was open upon																				
	completion of drilling.																				
2 2 2																					
0.000																					
7777- SMINU																					
1. 2.3.1																					
PADAR NO.																					
						GRAPH	. 3	×3.	Number	s refer		8=3%		at Eailur							

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2 OF 2

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PROJECT	annett Fleming																		
	OCATION: Timming Ontario							Method: Ho	llow Ste	em Aug	jers								
	LOCATION. TITIIIIIIS, Olitano		PROJECT LOCATION: Timmins, Ontario											R	EF. NC).: 23	0420	2	
DATUM: Ge	eodetic							Date: Jun 1	4, 202	4				E	NCL NO	D.: 5			
BH LOCAT	ION: See Borehole Location Plan	N 53	7137	'3.28 E	4881	84.6						<u>,</u>				,			
	SOIL PROFILE	.ES	~		DYNAMIC CC RESISTANCE	NE PEN PLOT		ON	ы	STIC NA	TURAL	LIQUID		F	REMAR	₹KS			
(m) <u>ELEV</u> DEPTH	CLASSIFICATION	STRATA PLOT	NUMBER	щ	BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	20 4 SHEAR ST O UNCONF O QUICK TI	IE W				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	AND GRAIN S DISTRIBL (%)	size Jtioi			
286.9 Grou	nd Surface	STF	NN	түре	ż	GR C	ELE		0 60				10	20	30			GR SA S	31 C
0.0 Aug sar	ger directed to 3.1m without nples						286	-											
1																			
2							285	-											
283.9							284	-											
3.1 SIL gra	TY CLAY: trace sand, trace vel, grey, wet, soft to very soft.		1	SS	3			-						0					
<u>4</u>					-		283	-											
<u>5</u>				TW			282	- - - - - - - - - -						I	43				
<u>6</u>							281	-											
	contains silty sand layers		2	SS	1			-							46				
							280												
3							279												
9							278	- - - - -											
			3	SS	1										46				

1 OF 2

	IECT: Geotechnical Investigation - Ontar	io No	orthla	and No	rtheas	tern Pa	ssenge														
	NT: Gannett Fleming	Method: Hollow Stem Augers																			
	JECT LOCATION: Timmins, Ontario					eter: 2								EF. NC)2				
	JM: Geodetic OCATION: See Borehole Location Plan	N 52	7407	70 00 F	- 1001	94.6		Date	: Jun 1	4, 202	24					EI	NCL NO	0.: 5			
	SOIL PROFILE		DYNA	MIC CC		NETR	ATION						1								
				SAMPL		Ë					\geq	> 80	100	PLAST	IC NAT MOIS CON	URAL	LIQUID LIMIT	z	NATURAL UNIT WT (kN/m ³)	REMARKS AND	
(m)		STRATA PLOT			Sε	GROUND WATER CONDITIONS	z		20 4 AR ST	1	TU (1	WP	CON	W	WL	(KPa)	AL UNI V/m ³)	GRAI	N SIZE
ELEV DEPTH	CLASSIFICATION	ATA F	BER		BLOWS 0.3 m	UND	ATIC	οu	NCONF	INED	+	- FIELD & Ser			TER CO		T (0/)	POC (CU)	ATUR/ (Kh	REMA AN GRAIN DISTRIE	BUTION %)
	Continued	STR/	NUMBER	ТҮРЕ	z	GRO	ELEVATION		UICK TI 20 4		- × 50	CLAB 80	VANE 100				1 (%) 30		ž		
	SILTY CLAY: trace sand, trace	K.	-		-			-	+								+				01 02
-	gravel, grey, wet, soft to very soft.(Continued)		-					-													
10	(1				277	-													
-			1					-													
-		K						-													
-								-													
-			1				276	-													
<u>11</u> -			1					-													
-		R	1					-													
-								-													
-								-													
12			1				275	-													
E								-													
-								-													
-			4	SS	0			-									0				
-			1					-													
13			1				274	-													
-			ł					-													
-								-													
-			1					-													
- 273.0						1	273	-													
13.9 -	SILTY SAND TILL: trace to some clay, trace gravel, contains cobbles,		5	SS	15		213	-							0						
-	grey, moist to wet, compact to dense.							-													
-	dense.							-													
-								-													
-							272	-													
- -		臣						-													
-	contains 330mm sand and gravel		<u> </u>					-													
-	pockets, trace silt, grey, wet		6	SS	47			-						0	>						
- 271.1		q						-													
15.8	END OF BOREHOLE 1) Water level was at 4.04mBGS																				
	upon completion of drilling. 2. Borehole was open upon																				
	completion of drilling.																				
																		1			
2 2 2																		1			
240800-0																		1			
107-55MWW														1							
1 100 200																		1			
- 29 8 9														1							
MUNEN S			L			L	L											L			
GROUN	IDWATER ELEVATIONS					<u>GRAPH</u> NOTES	+ 3,	× ³ :	Number to Sens	s refer		○ ⁸⁼³	[%] Strain	at Failu	re						

200.GLB

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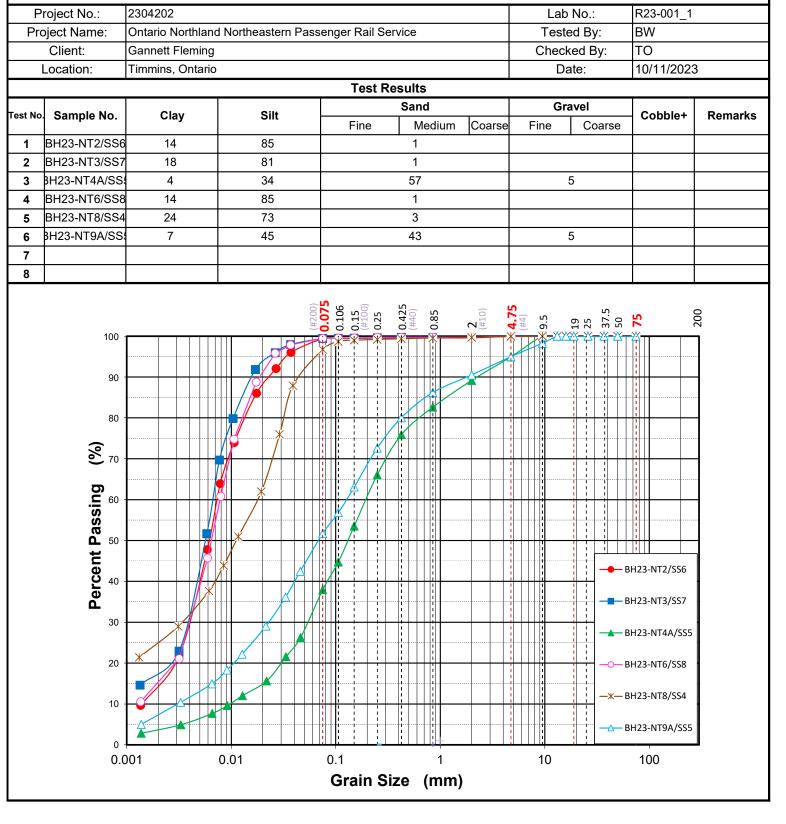


Palmer Environmental Consulting Group Inc.

871 Equestrain Ct, Unit 1

Oakville, ON L6L 6L7

Particle Size Distribution Report





Palmer Environmental Consulting Group Inc.

30

20

10

0

0.001

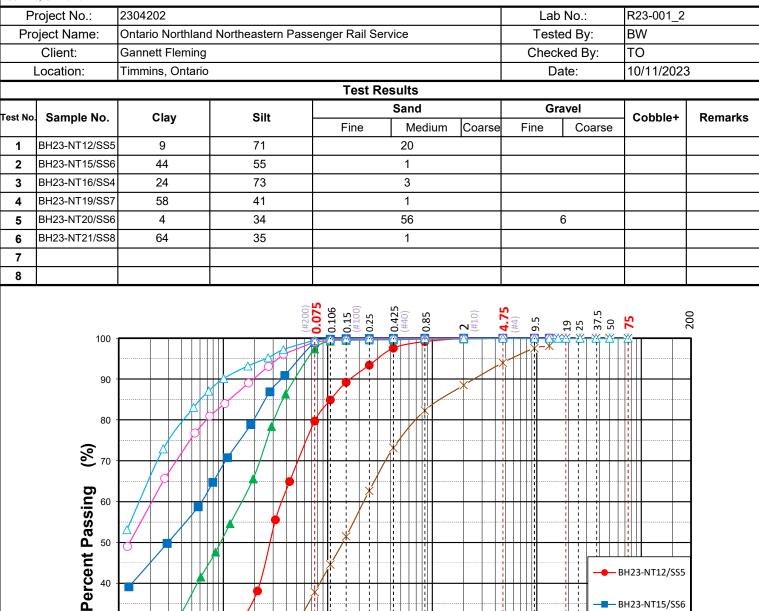
Ж

0.01

871 Equestrain Ct, Unit 1

Oakville, ON L6L 6L7

Particle Size Distribution Report



0.1

1

Grain Size (mm)

10

-x— BH23-NT20/SS6

100

BH23-NT19/SS7

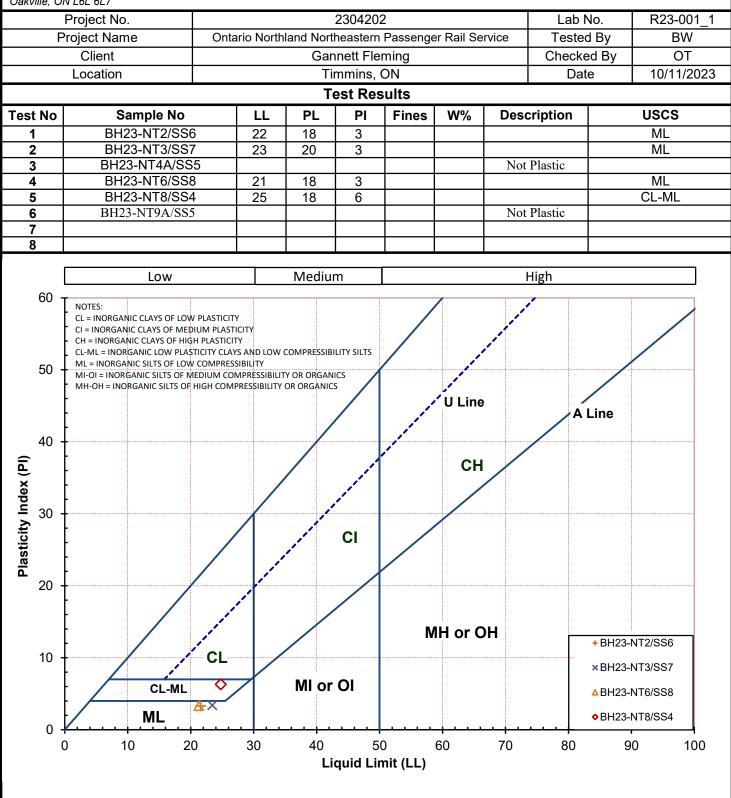
BH23-NT21/SS8



Plasticity Chart

871 Equestrain Ct, Unit 1

Oakville, ON L6L 6L7

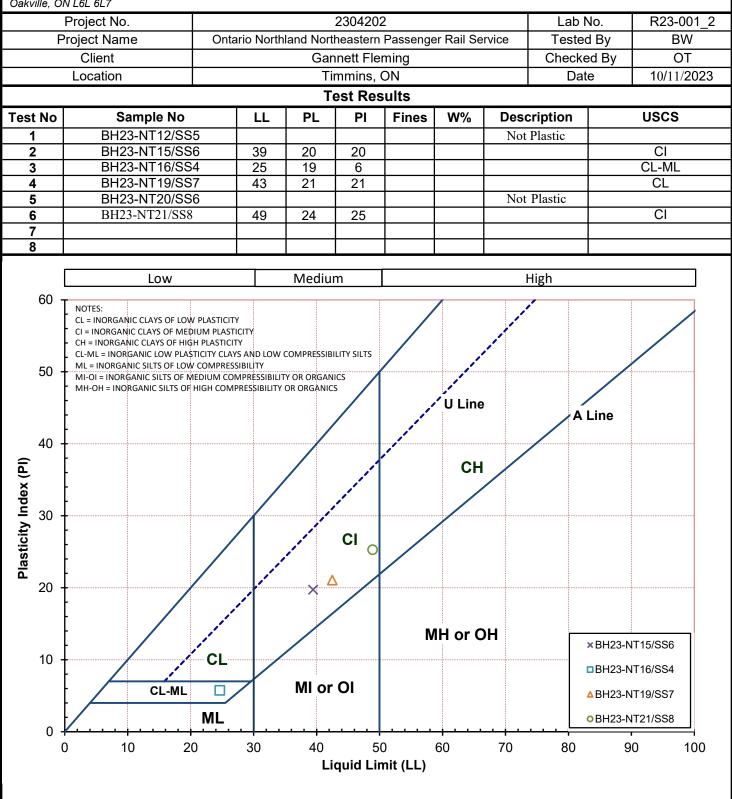


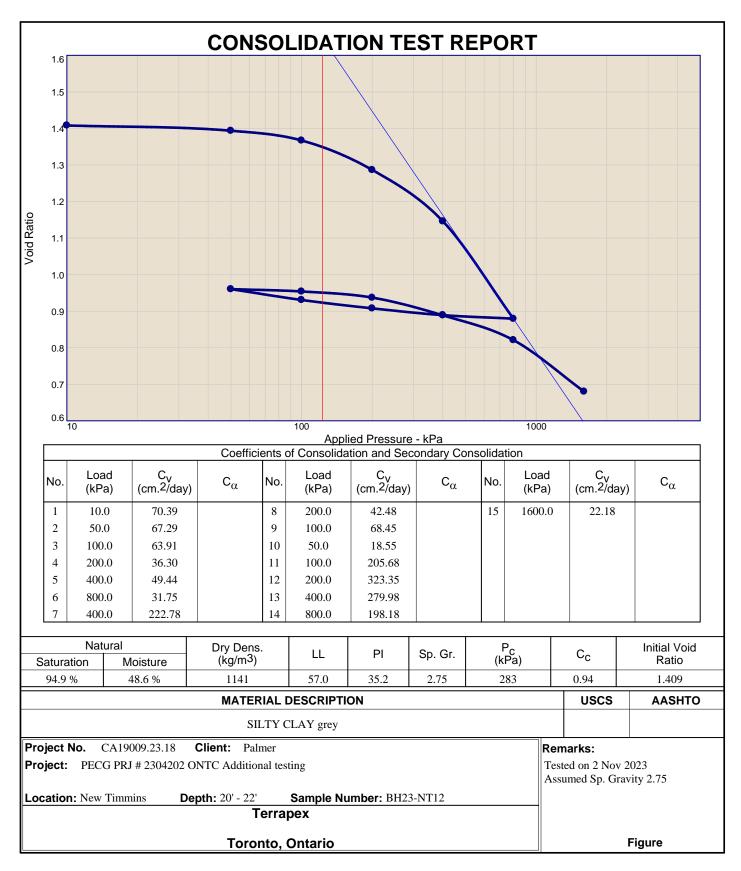


Plasticity Chart

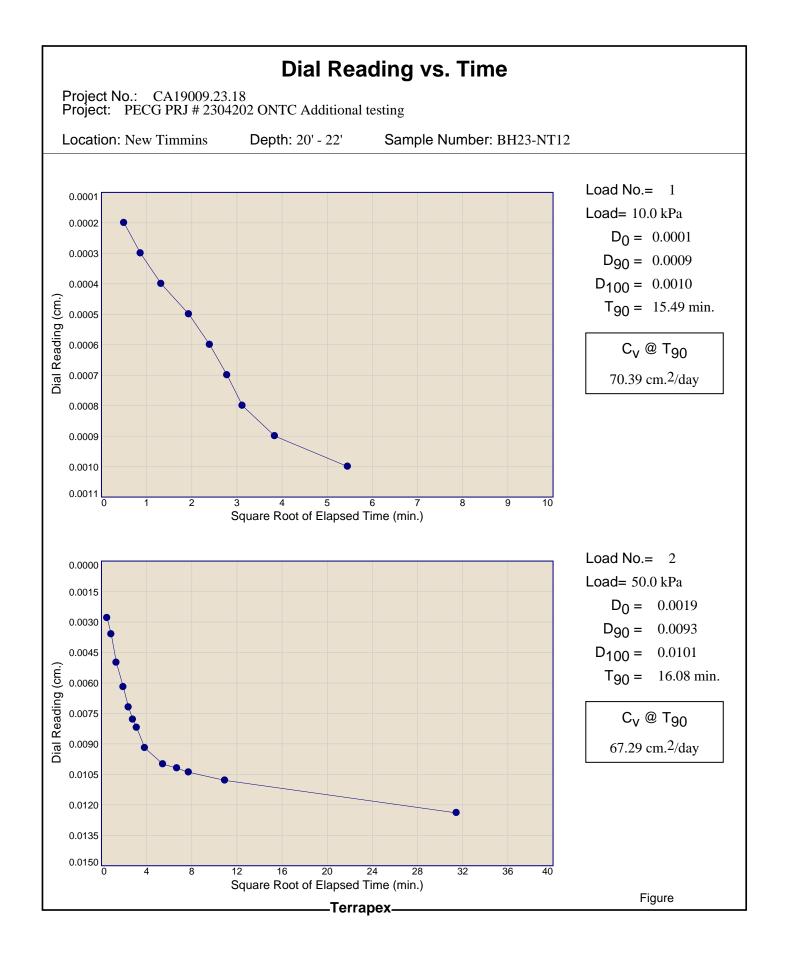
871 Equestrain Ct, Unit 1

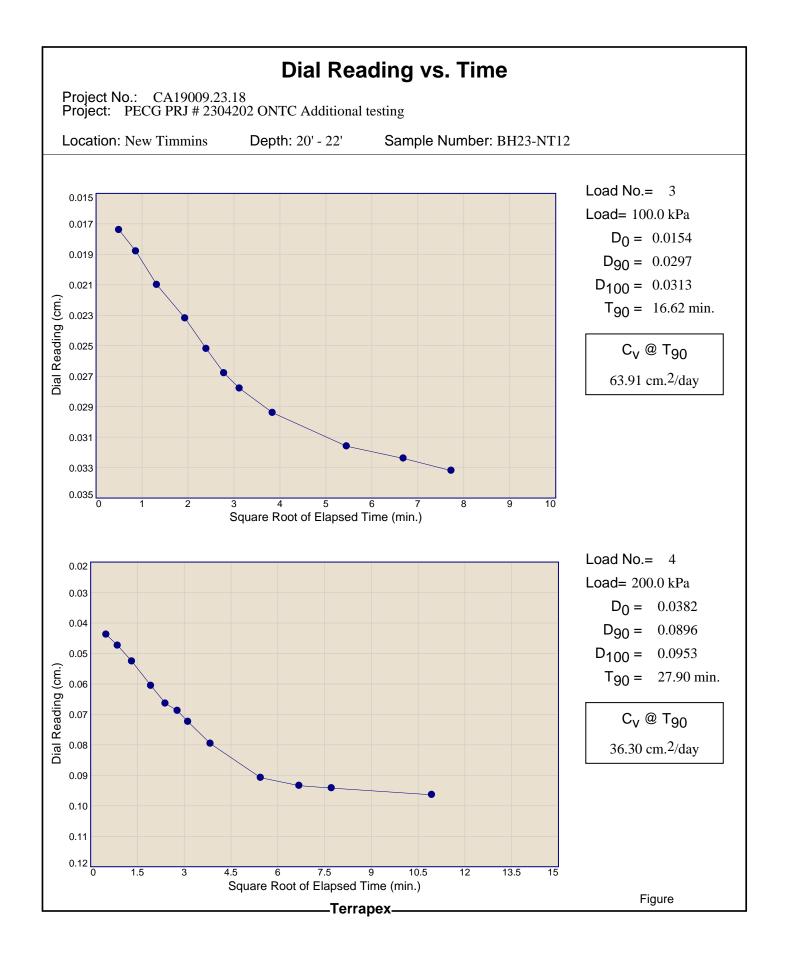
Oakville, ON L6L 6L7

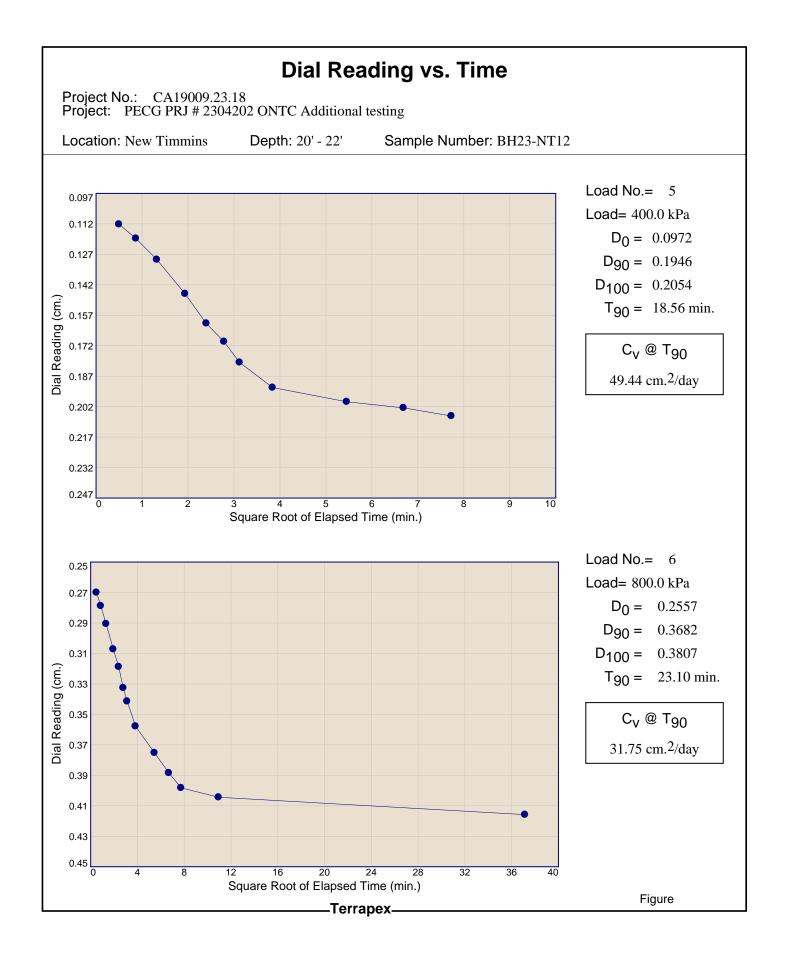


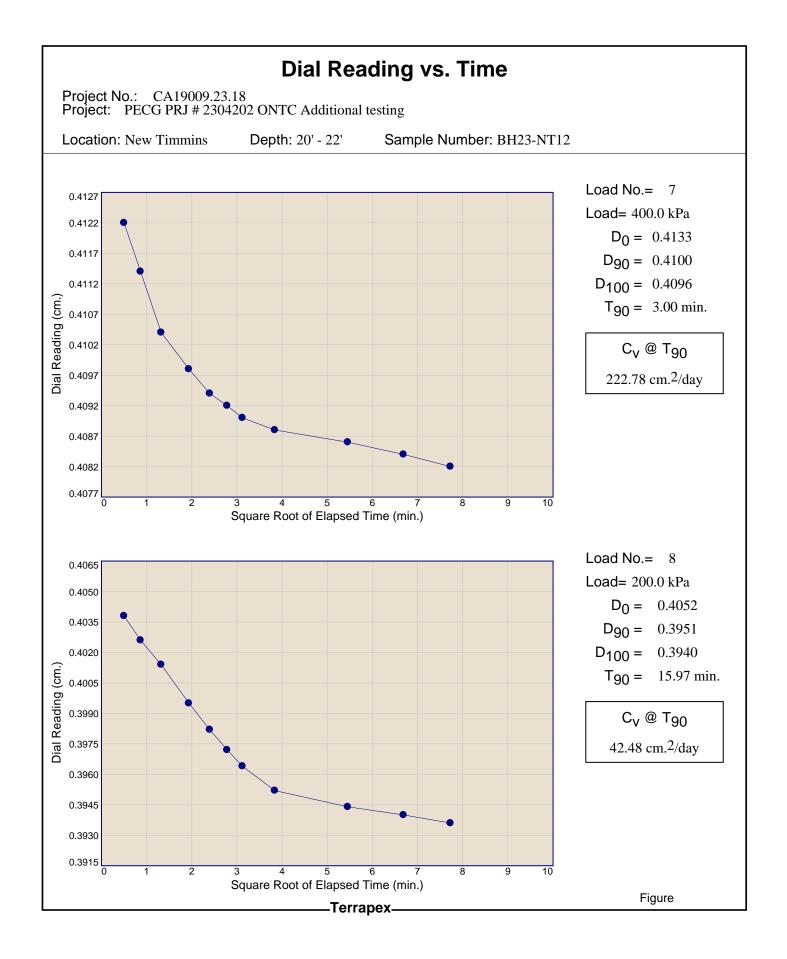


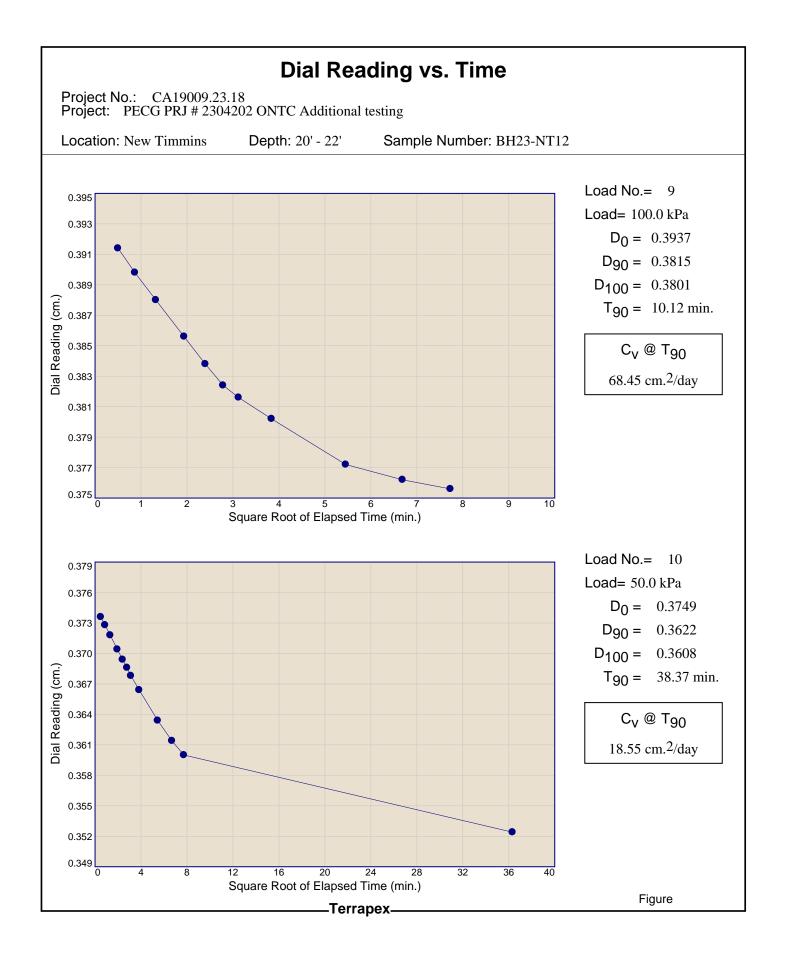
Tested By: RJ

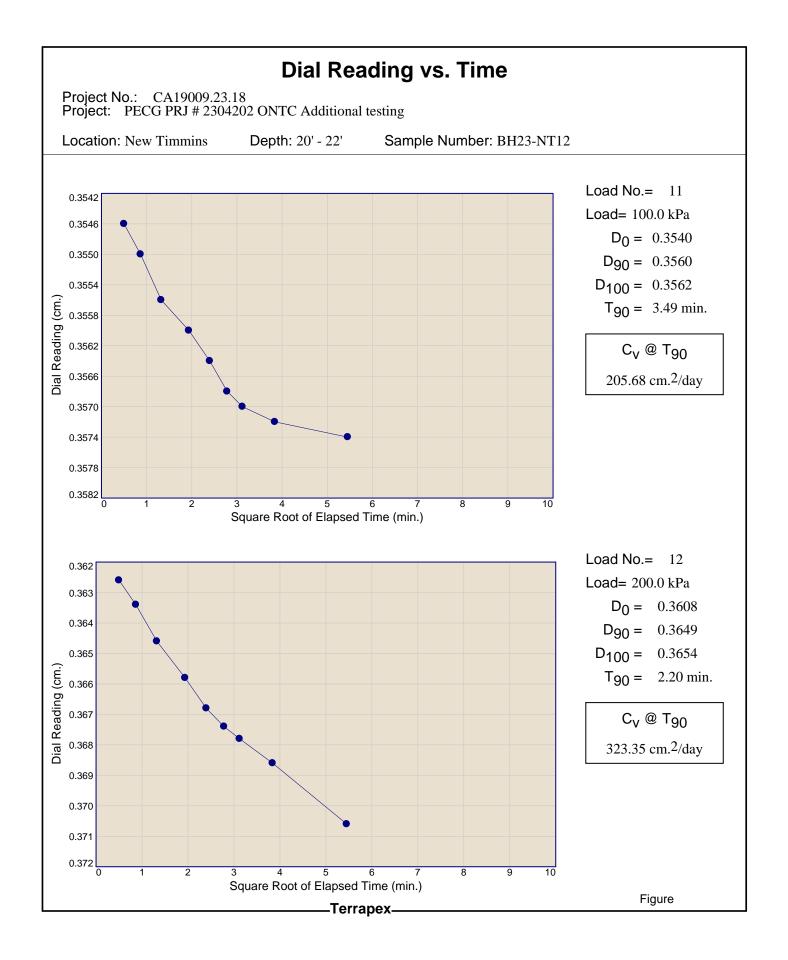


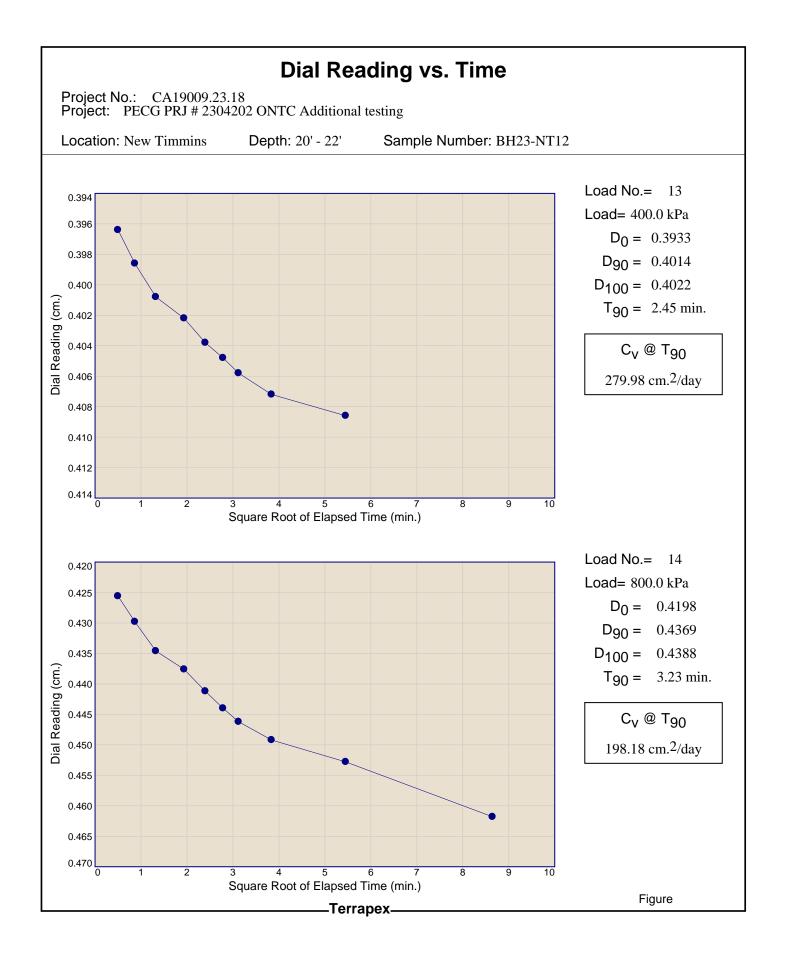


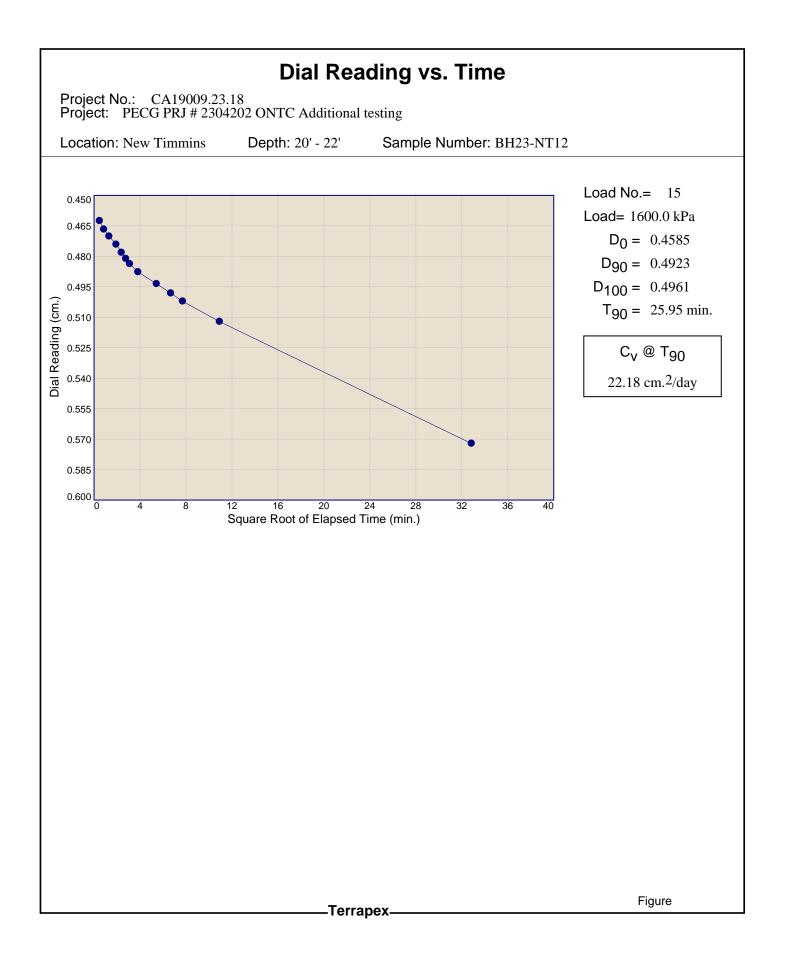












CONSOLIDATION TEST DATA

Client: Palmer Project: PECG PRJ # 2304202 ONTC Additional testing Project Number: CA19009.23.18 Location: New Timmins Depth: 20' - 22' S Material Description: SILTY CLAY grey Liquid Limit: 57.0 F Testing Remarks: Tested on 2 Nov 2023 Assumed Sp. Gravity 2.75

Sample Number: BH23-NT12

Plasticity Index: 35.2

Tested by: RJ

	Test Specimen Data	
NATURAL MOISTURE	VOID RATIO	AFTER TEST
Wet w+t = 130.88 g.	Spec. Gr. = 2.75	Wet w+t = 88.64 g.
Dry w+t = 101.90 g.	Est. Ht. Solids = 0.784 cm.	Dry w+t = 77.13 g.
Tare Wt. = 42.32 g.	Init. V.R. = 1.409	Tare Wt. = 42.32 g.
Moisture = 48.6 %	Init. Sat. = 94.9 %	Moisture = 33.1 %
UNIT WEIGHT	TEST START	Dry Wt. = 34.81 g.
Height = 1.890 cm.	Height = 1.890 cm.	
Diameter = 5.010 cm.	Diameter = 5.010 cm.	
Weight = 63.21 g.		

Weight = 63.21 g. Dry Dens. = 1141 kg/m³

	-		End-Of	-Load S	Summary		
Pressure (kPa)	Final Dial (cm.)	Deformation (cm.)	C _V (cm.²/day)	c_{lpha}	Void Ratio	% Strain	
start	0.00010	0.00000			1.409		
10.0	0.00100	0.00090	70.39		1.408	0.0 Comprs.	
50.0	0.01240	0.01230	67.29		1.394	0.7 Comprs.	
100.0	0.03320	0.03310	63.91		1.367	1.8 Comprs.	
200.0	0.09640	0.09630	36.30		1.287	5.1 Comprs.	
400.0	0.20660	0.20650	49.44		1.146	10.9 Comprs.	
800.0	0.41580	0.41570	31.75		0.879	22.0 Comprs.	
400.0	0.40820	0.40810	222.78		0.889	21.6 Comprs.	
200.0	0.39360	0.39350	42.48		0.908	20.8 Comprs.	
100.0	0.37560	0.37550	68.45		0.931	19.9 Comprs.	
50.0	0.35240	0.35230	18.55		0.960	18.6 Comprs.	
100.0	0.35740	0.35730	205.68		0.954	18.9 Comprs.	
200.0	0.37060	0.37050	323.35		0.937	19.6 Comprs.	
400.0	0.40860	0.40850	279.98		0.889	21.6 Comprs.	
800.0	0.46180	0.46170	198.18		0.821	24.4 Comprs.	
1600.0	0.57220	0.57210	22.18		0.680	30.3 Comprs.	
Compression	index (C _c), kl	Pa = 0.94 Pre	consolidation p	oressure	e (P _p), kPa = 1	283 Void ratio at $P_p(e_m) = 1.231$	
Overburden (σ vo), kPa = 20		at σ _{vo} (e _o) = 1.2			ion index (C_r) = 0.14	

2023-11-06

	re: 10.0 kPa			TE	ST READINGS		Load No.
	_	Cloc		Dial		0.0001	
	No.	Tim		Reading		0.0002	
	1	+0 00:0		0.00010		0.0003	
	2	+0 00:0		0.00020		0.0004	
	3	+0.00:0		0.00030		0.0005	
	4	+0.00:0		0.00040		0.0006	
	5	+0.00:0		0.00050		0.0007	
	6	+0.00:0	6:00	0.00060		0.0008	
	7	+0.00:0	8:00	0.00070		0.0009	
	8	+0.00:1	0:00	0.00080		0.0011	
	9	+0.00:1	5:00	0.00090		0 1 2 3 4 5	6 7 8 9 1
	10	+0 00:3	0:00	0.00100			
/oid F	Ratio = 1.408 C	ompression	= 0.0%				
D₀ = 0	0.0001 D ₉₀ = 0	-	00 = 0.0	010 C _v at 15	.49 min. = 70.39	9 cm. ² /day	
essu	re: 50.0 kPa			TE	ST READINGS		Load No.
No.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading	0.0000	
1	+0 00:30:15	0.00180	11	+0 01:15:00	0.01020	0.0015	
2	+0.00:30:13 +0.00:30:30	0.00180	11	+0.01:30:00	0.01020	0.0030	
3	+0 00:30:30	0.00280	12	+0 02:30:00	0.01040	0.0045	
4	+0 00:31:00	0.00500	13	+0 17:00:00	0.01080	0.0060	
5	+0 00:32:00	0.00500	14	+017.00.00	0.01240	0.0075	
	+0.00.34.00 +0.00:36:00	0.00720				0.0090	
6 7	+0.00:38:00 +0.00:38:00	0.00720				0.0105	
8	+0.00:38:00 +0.00:40:00	0.00780				0.0135	
9	+0.00.40.00 +0.00:45:00	0.00920				0.0150 0 4 8 12 16 20	24 28 32 36 4
10	+0 00:45:00	0.01000				0 4 0 12 10 20	24 20 32 30 4
	Ratio = 1.394 C).0019 D ₉₀ = (•		101 C _v at 16	.08 min. = 67.29	9 cm. ² /day	

Clock TimeDial ReadingNo.Clock TimeDial Reading1 $+0$ 18:00:15 0.04120 11 $+0$ 18:45:00 0.09340 2 $+0$ 18:00:30 0.04380 12 $+0$ 19:00:00 0.09420 3 $+0$ 18:01:00 0.04740 13 $+0$ 20:00:00 0.09640 4 $+0$ 18:02:00 0.05260 5 $+0$ 18:06:00 0.06660 6 $+0$ 18:06:00 0.06640 7 $+0$ 18:08:00 0.06880 8 $+0$ 18:10:00 0.07240	No. Time Reading No. Time Reading 1 +0 17:00:15 0.01620 11 +0 17:45:00 0.03240 2 +0 17:00:30 0.01740 12 +0 18:00:00 0.03320 3 +0 17:01:00 0.01880 4 +0 17:02:00 0.02100 5 +0 17:06:00 0.02520 7 +0 17:06:00 0.02520 9 +0 17:15:00 0.02580 8 +0 17:10:00 0.02780 9 +0 17:15:00 0.02940 10 +0 17:30:00 0.03160 Void Ratio = 1.367 Compression = 1.8% Do = 0.0154 Dgo = 0.0297 D100 = 0.0313 C _v at 16.62 min. = 63.91 cm. ² /day ressure: 200.0 kPa Load No. No. Clock Dial Reading No. Clock Time Reading 1 +0 18:00:15 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:01:00 0.04740 13 +0 20:00:00 0.09420 3 +0 18:01:00 0.06640 7 +0 18:02:00 0.05260 5 +0 18:04:00 0.06640 7 +0 18:06:00 0.06640		ıre: 100.0 kPa			TE		S Load No.
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	No.			No.			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1	+0 17:00:15	0.01620	11	+0 17:45:00	0.03240	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 +0 17:01:00 0.01880 4 +0 17:02:00 0.02100 5 +0 17:06:00 0.02320 6 +0 17:06:00 0.02520 7 +0 17:08:00 0.02680 8 +0 17:10:00 0.02780 9 +0 17:15:00 0.02940 10 +0 17:30:00 0.03160 Void Ratio = 1.367 Compression = 1.8% D ₀ = 0.0154 D ₉₀ = 0.0297 D ₁₀₀ = 0.0313 C _v at 16.62 min. = 63.91 cm. ² /day ressure: 200.0 kPa TEST READINGS Load No. No. Clock Dial Reading 1 +0 18:00:15 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:01:00 0.04740 13 +0 20:00:00 0.09420 4 +0 18:00:00 0.05260 5 +0 18:04:00 0.05260 5 +0 18:04:00 0.05660 6 +0 18:00:00 0.06640 7 +0 18:00:00 0.06640 7 +0 18:00:00 0.06680 8 +0 18:10:00 0.07240 9 +0 18:15:00 0.07960 10 +0 18:30:00 0.0980 Void Ratio = 1.287 Compression = 5.1%	2	+0 17:00:30	0.01740	12	+0 18:00:00	0.03320	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	3	+0 17:01:00	0.01880				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4	+0 17:02:00	0.02100				
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 +0 17:08:00 0.02680 8 +0 17:10:00 0.02780 9 +0 17:15:00 0.02940 10 +0 17:30:00 0.03160 Void Ratio = 1.367 Compression = 1.8% Do = 0.0154 Dg = 0.0297 D ₁₀₀ = 0.0313 C _v at 16.62 min. = 63.91 cm.2/day ressure: 200.0 kPa TEST READINGS Load No. No. Time Reading No. Clock Dial Reading No. Clock Dial Reading No. Clock Dial 1 +0 18:00:10 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:00:00 0.05260 5 +0 18:00:00 0.06660 6 +0 18:00:00 0.07240 9 +0 18:15:00 0.07960 10 +0 18:30:00 0.09080 Void Ratio = 1.287 Compression = 5.1%	5	+0 17:04:00	0.02320				0.027
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 +0 17:08:00 0.02680 8 +0 17:10:00 0.02780 9 +0 17:15:00 0.02940 10 +0 17:30:00 0.03160 Void Ratio = 1.367 Compression = 1.8% Po = 0.0154 Pog = 0.0297 P ₁₀₀ = 0.0313 C _v at 16.62 min. = 63.91 cm.2/day ressure: 200.0 kPa TEST READINGS Load No. No. Time Reading No. Clock Dial 1 +0 18:00:15 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:00:00 0.05260 5 +0 18:06:00 0.06640 7 +0 18:08:00 0.06640 -0 18:06:00 0.06640 7 +0 18:09:00 0.07240 -0 18:06:00 0.07960 9 +0 18:15:00 0.07960 -10 +0 18:30:00 0.09080 Void Ratio = 1.287 Compression = 5.1%							0.029
9 +0 17:15:00 0.02940 10 +0 17:30:00 0.03160 Void Ratio = 1.367 Compression = 1.8% D_0 = 0.0154 D_{30} = 0.0297 D_{100} = 0.0313 C _v at 16.62 min. = 63.91 cm. ² /day ressure: 200.0 kPa TEST READINGS Load No. Clock Dial Reading No. Clock Time Reading 1 +0 18:00:15 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:01:00 0.04740 13 +0 20:00:00 0.09640 4 +0 18:02:00 0.05260 5 +0 18:00:00 0.06640 7 +0 18:06:00 0.06640 7 +0 18:06:00 0.06680 8 +0 18:10:00 0.07240 9 +0 18:15:00 0.07960 10 +0 18:30:00 0.09080	9 +0 17:15:00 0.02940 10 +0 17:30:00 0.03160 Void Ratio = 1.367 Compression = 1.8% D ₀ = 0.0154 D ₉₀ = 0.0297 D ₁₀₀ = 0.0313 C _v at 16.62 min. = 63.91 cm. ² /day ressure: 200.0 kPa TEST READINGS Load No. Clock Dial Reading 1 +0 18:00:15 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:01:00 0.04740 13 +0 20:00:00 0.09640 4 +0 18:02:00 0.05260 5 +0 18:00:00 0.06640 7 +0 18:08:00 0.06640 8 +0 18:10:00 0.07240 9 +0 18:15:00 0.07960 10 +0 18:30:00 0.09080 Void Ratio = 1.287 Compression = 5.1%	7	+0 17:08:00	0.02680				0.031
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	8	+0 17:10:00	0.02780				0.033
Void Ratio = 1.367 Compression = 1.8% $D_0 = 0.0154$ $D_{90} = 0.0297$ $D_{100} = 0.0313$ C_v at 16.62 min. = 63.91 cm.2/dayressure: 200.0 kPaTEST READINGSLoadNo.Clock Time Reading 2 +0 18:00:15Dial 0.04120 Clock 11 +0 18:45:00Dial 0.09340 1+0 18:00:150.0412011+0 18:45:000.093402+0 18:00:300.0438012+0 19:00:000.094203+0 18:01:000.0474013+0 20:00:000.096404+0 18:02:000.052600.096405+0 18:06:000.066407+0 18:08:000.068808+0 18:10:000.072409+0 18:15:000.0796010+0 18:30:000.09080	Void Ratio = 1.367 Compression = 1.8% $D_{00} = 0.0297$ $D_{100} = 0.0313$ C_v at 16.62 min. = 63.91 cm. ² /day ressure: 200.0 kPa Load No. Clock Time Reading No. Clock Time Reading Reading 0.09340 1 +0 18:00:15 0.04120 11 +0 18:45:00 0.09340 2 +0 18:00:30 0.04380 12 +0 19:00:00 0.09420 3 +0 18:01:00 0.04740 13 +0 20:00:00 0.09640 4 +0 18:02:00 0.05260 5 +0 18:06:00 0.06640 7 +0 18:06:00 0.06640 -0.0740 -0.0740 -0.0740 9 +0 18:15:00 0.07960 -0.07240 -0.0760 -0.0760 -0.0760 10 +0 18:30:00 0.09080 -0.0760 <	9	+0 17:15:00	0.02940				0.035 0 1 2 3 4 5 6 7 8 9 1
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 + 0 18:00:15 0.04120 11 + 0 18:45:00 0.09340 $2 + 0 18:00:30 0.04380 12 + 0 19:00:00 0.09420$ $3 + 0 18:01:00 0.04740 13 + 0 20:00:00 0.09640$ $4 + 0 18:02:00 0.05260$ $5 + 0 18:04:00 0.06660$ $6 + 0 18:06:00 0.06640$ $7 + 0 18:08:00 0.06880$ $8 + 0 18:10:00 0.07240$ $9 + 0 18:15:00 0.07960$ $10 + 0 18:30:00 0.09080$ Void Ratio = 1.287 Compression = 5.1%		Clock	Reading	No.	Clock	Dial	0.02
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$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 6 & +0 \ 18:06:00 & 0.06640 \\ 7 & +0 \ 18:08:00 & 0.06880 \\ 8 & +0 \ 18:10:00 & 0.07240 \\ 9 & +0 \ 18:15:00 & 0.07960 \\ 10 & +0 \ 18:30:00 & 0.09080 \end{array}$	4	+0 18:02:00	0.05260				0.07
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8 +0 18:10:00 0.07240 9 +0 18:15:00 0.07960 10 +0 18:30:00 0.09080	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		+0 18:06:00	0.06640				0.09
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9 +0 18:15:00 0.07960 10 +0 18:30:00 0.09080 /oid Ratio = 1.287 Compression = 5.1%		+0.18:08:00	0.06880				0.10
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	/oid Ratio = 1.287 Compression = 5.1%		+0 18:15:00	0.07960				0.12 0 1.5 3 4.5 6 7.5 9 10.5 12 13.5
Void Ratio = 1.287 Compression = 5.1%		10	+0 18:30:00	0.09080				
$D_0 = 0.0382$ $D_{90} = 0.0896$ $D_{100} = 0.0953$ C_v at 27.90 min. = 36.30 cm. ² /day				-			'.90 min. = 36.	30 cm. ² /day

10 +0 20:30:00 0.19200 10 +0 20:30:00 0.19960 Void Ratio = 1.146 Compression = 10.9% D ₀ = 0.0972 D ₉₀ = 0.1946 D ₁₀₀ = 0.2054 C _v at 18.56 min. = 49.44 cm. ² /day Pressure: 800.0 kPa EST READINGS Load No. No. Time Reading No. Clock Dial 1 +0 21:00:15 0.26440 11 +0 21:45:00 0.38840 2 +0 21:00:30 0.27000 12 +0 22:00:00 0.39820 3 +0 21:00:00 0.27880 13 +0 23:00:00 0.40440 4 +0 21:02:00 0.29060 14 +1 20:00:00 0.41580 5 +0 21:06:00 0.31880		ıre: 400.0 kPa			TE	ST READINGS	Load No. 4
1 +0 20:00:15 0.10640 11 +0 20:45:00 0.20260 2 +0 20:00:30 0.11220 12 +0 21:00:00 0.20660 3 +0 20:01:00 0.11920 12 +0 21:00:00 0.20660 5 +0 20:06:00 0.16464 0 0.1600 0.17000 8 +0 20:16:00 0.18020 0.19260 0.19260 0.19260 10 +0 20:30:00 0.19960 11 +0 21:45 min. = 49.44 cm.2/day Void Ratio = 1.146 Compression = 10.9% Dg = 0.0972 Dg = 0.1946 D100 = 0.2054 Cy at 18.56 min. = 49.44 cm.2/day Yessure: 800.0 KPa Load No. Clock Dial 1 +0 21:00:15 0.26440 11 +0 21:45:00 0.38840 2 +0 21:00:00 0.37880 13 +0 23:00:00 0.414580 5 +0 21:00:00 0.331880 13 +0 23:00:00 0.41580 5 +0 21:00:00 0.331840 -10 -10 -10 -10 -10 -10 -10 -10 -	No.			No.			0.097
$\begin{array}{cccccccccccccccccccccccccccccccccccc$							
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4 +0 20:02:00 0.12960 5 +0 20:04:00 0.14640 6 +0 20:05:00 0.16100 7 +0 20:08:00 0.17000 8 +0 20:10:00 0.18020 9 +0 20:15:00 0.19260 10 +0 20:30:00 0.19960 Void Ratio = 1.146 Compression = 10.9% D ₀ = 0.0972 D ₉₀ = 0.1946 D ₁₀₀ = 0.2054 C _v at 18.56 min. = 49.44 cm. ² /day Pressure: 800.0 kPa TEST READINGS Load No. No. Clock Dial Reading No. Clock Time Reading 1 +0 21:00:15 0.26440 11 +0 21:45:00 0.38840 2 +0 21:00:30 0.27000 12 +0 22:00:00 0.39820 3 +0 21:01:00 0.27880 13 +0 23:00:00 0.41580 5 +0 21:00:00 0.30720 6 +0 21:00:00 0.331880 7 +0 21:00:00 0.33260 8 +0 21:10:00 0.33780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%					10 21100100	0.20000	
$ \begin{array}{c} 5 & +0 \ 20:04:00 & 0.14640 \\ 6 & +0 \ 20:06:00 & 0.16100 \\ 7 & +0 \ 20:08:00 & 0.17000 \\ 8 & +0 \ 20:15:00 & 0.18020 \\ 9 & +0 \ 20:15:00 & 0.19260 \\ 10 & +0 \ 20:30:00 & 0.19960 \end{array} $							
6 +0 20:06:00 0.16100 7 +0 20:08:00 0.17000 8 +0 20:10:00 0.18020 9 +0 20:15:00 0.19260 10 +0 20:30:00 0.19960 Void Ratio = 1.146 Compression = 10.9% D ₀ = 0.0972 D ₉₀ = 0.1946 D ₁₀₀ = 0.2054 C _v at 18.56 min. = 49.44 cm. ² /day ressure: 800.0 kPa TEST READINGS Load No. No. Clock Dial Reading No. Clock Dial Reading 1 +0 21:00:15 0.26440 11 +0 21:45:00 0.38840 2 +0 21:00:30 0.27000 12 +0 22:00:00 0.39820 3 +0 21:01:00 0.27880 13 +0 23:00:00 0.40440 4 +0 21:02:00 0.29060 14 +1 20:00:00 0.41580 5 +0 21:06:00 0.31880 7 +0 21:06:00 0.331880 7 +0 21:06:00 0.33260 8 +0 21:11:00 0.35780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%							
7 $+0 20:08:00$ 0.17000 8 $+0 20:10:00$ 0.18020 9 $+0 20:15:00$ 0.19260 10 $+0 20:30:00$ 0.19960 Void Ratio = 1.146 Compression = 10.9% D ₀ = 0.0972 D ₉₀ = 0.1946 D ₁₀₀ = 0.2054 C _v at 18.56 min. = 49.44 cm.2/day ressure: 800.0 kPa No. Time Reading 1 $+0 21:00:15$ 0.26440 11 $+0 21:45:00$ 0.38840 2 $+0 21:00:15$ 0.26440 11 $+0 21:00:00$ 0.39820 3 $+0 21:00:00$ 0.27880 13 $+0 23:00:00$ 0.41580 5 $+0 21:06:00$ 0.31880 7 $+0 21:08:00$ 0.33260 8 $+0 21:10:00$ 0.37520 0.37520 0.37520 Void Ratio = 0.879 Compression = 22.0%							
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9 +0 20:15:00 0.19260 10 +0 20:30:00 0.19960 Void Ratio = 1.146 Compression = 10.9% D ₀ = 0.0972 D ₉₀ = 0.1946 D ₁₀₀ = 0.2054 C _v at 18.56 min. = 49.44 cm. ² /day ressure: 800.0 kPa TEST READINGS Load No. Clock Dial Reading 1 +0 21:00:15 0.26440 11 +0 21:45:00 0.38840 2 +0 21:00:30 0.27000 12 +0 22:00:00 0.39820 3 +0 21:01:00 0.27880 13 +0 23:00:00 0.40440 4 +0 21:02:00 0.29060 14 +1 20:00:00 0.41580 5 +0 21:00:00 0.31880 7 +0 21:08:00 0.33260 8 +0 21:10:00 0.34140 9 +0 21:15:00 0.35780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%							0.232
10 +0 20:30:00 0.19960 Void Ratio = 1.146 Compression = 10.9% D ₀ = 0.0972 D ₉₀ = 0.1946 D ₁₀₀ = 0.2054 C _v at 18.56 min. = 49.44 cm. ² /day ressure: 800.0 kPa TEST READINGS Load No. No. Clock Dial Reading No. Clock Time Reading 1 +0 21:00:15 0.26440 11 +0 21:45:00 0.38840 2 +0 21:00:30 0.27000 12 +0 22:00:00 0.39820 3 +0 21:01:00 0.27880 13 +0 23:00:00 0.40440 4 +0 21:02:00 0.29060 14 +1 20:00:00 0.41580 5 +0 21:06:00 0.31880 7 +0 21:06:00 0.31880 7 +0 21:06:00 0.33260 8 +0 21:10:00 0.34140 9 +0 21:15:00 0.35780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%							0.247 0 1 2 3 4 5 6 7 8 9 10
D0 = 0.0972D90 = 0.1946D100 = 0.2054Cv at 18.56 min. = 49.44 cm.2/dayressure:800.0 kPaTEST READINGSLoad No.Clock TimeDial Reading + 0 21:00:15Dial + 0 21:45:000.388402+ 0 21:00:300.2700012+ 0 22:00:000.398203+ 0 21:01:000.2788013+ 0 23:00:000.404404+ 0 21:02:000.2906014+ 1 20:00:000.415805+ 0 21:00:000.318807+ 0 21:00:000.332608+ 0 21:10:000.37578010+ 0 21:30:000.37520		+0 20:30:00					
No.TimeReadingNo.TimeReading1+0 21:00:150.2644011+0 21:45:000.388402+0 21:00:300.2700012+0 22:00:000.398203+0 21:01:000.2788013+0 23:00:000.404404+0 21:02:000.2906014+1 20:00:000.415805+0 21:06:000.318800.332606+0 21:06:000.318807+0 21:08:000.332608+0 21:10:000.3578010+0 21:30:000.37520	D ₀ = (0.0972 D ₉₀ = ire: 800.0 kPa	0.1946 D		2054 C_v at 18 TE	ST READINGS	4 cm.2/day Load No.
1 + 0 21:00:15 0.26440 11 + 0 21:45:00 0.38840 $2 + 0 21:00:30 0.27000 12 + 0 22:00:00 0.39820$ $3 + 0 21:01:00 0.27880 13 + 0 23:00:00 0.40440$ $4 + 0 21:02:00 0.29060 14 + 1 20:00:00 0.41580$ $5 + 0 21:04:00 0.30720$ $6 + 0 21:06:00 0.31880$ $7 + 0 21:08:00 0.33260$ $8 + 0 21:10:00 0.34140$ $9 + 0 21:15:00 0.35780$ $10 + 0 21:30:00 0.37520$ Void Ratio = 0.879 Compression = 22.0%	No.			No.			
2 +0 21:00:30 0.27000 12 +0 22:00:00 0.39820 3 +0 21:01:00 0.27880 13 +0 23:00:00 0.40440 4 +0 21:02:00 0.29060 14 +1 20:00:00 0.41580 5 +0 21:04:00 0.30720 6 +0 21:06:00 0.31880 7 +0 21:08:00 0.33260 8 +0 21:10:00 0.34140 9 +0 21:15:00 0.35780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%	1	+0 21:00:15	0.26440	11	+0 21:45:00	0.38840	
3 +0 21:01:00 0.27880 13 +0 23:00:00 0.40440 4 +0 21:02:00 0.29060 14 +1 20:00:00 0.41580 5 +0 21:04:00 0.30720 6 +0 21:06:00 0.31880 7 +0 21:08:00 0.33260 8 +0 21:10:00 0.34140 9 +0 21:15:00 0.35780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%	2	+0 21:00:30	0.27000	12	+0 22:00:00	0.39820	
5 +0 21:04:00 0.30720 $6 +0 21:06:00 0.31880$ $7 +0 21:08:00 0.33260$ $8 +0 21:10:00 0.34140$ $9 +0 21:15:00 0.35780$ $10 +0 21:30:00 0.37520$ Wold Ratio = 0.879 Compression = 22.0%	3	+0 21:01:00	0.27880	13	+0 23:00:00	0.40440	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		+0 21:02:00	0.29060	14	+1 20:00:00	0.41580	0.35
7 +021:08:00 0.33260 $8 +021:10:00 0.34140$ $9 +021:15:00 0.35780$ $10 +021:30:00 0.37520$ Void Ratio = 0.879 Compression = 22.0%							0.37
$\begin{array}{cccccccccccccccccccccccccccccccccccc$							0.39
9 +0 21:15:00 0.35780 10 +0 21:30:00 0.37520 Void Ratio = 0.879 Compression = 22.0%							
$\begin{array}{cccccccccccccccccccccccccccccccccccc$							0.45
Void Ratio = 0.879 Compression = 22.0%							0 4 8 12 16 20 24 28 32 36 40
	10	+0 21:30:00	0.37520				
			-			.10 min. = 31.7:	5 cm.2/day

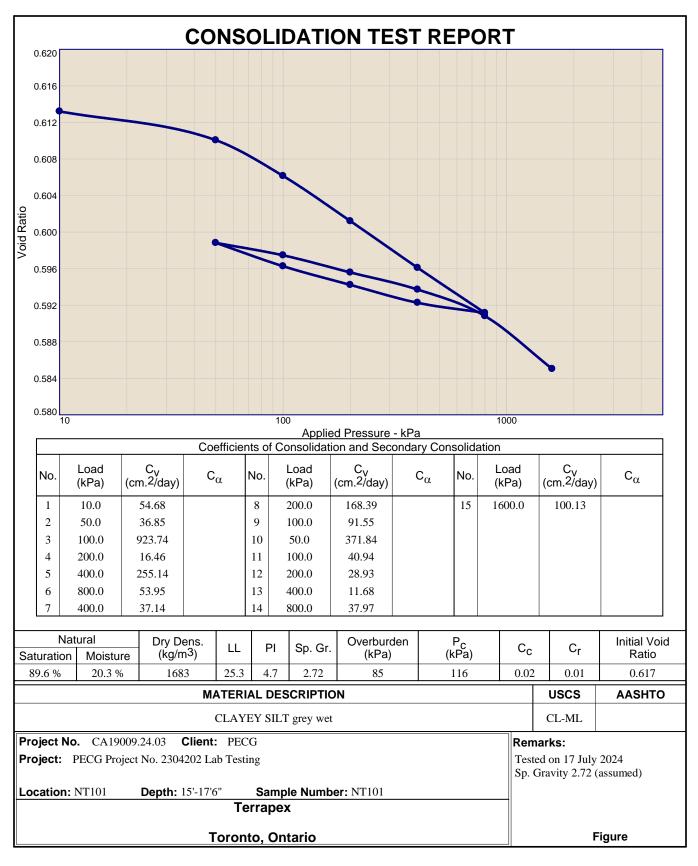
	ure: 400.0 kPa			TE		S Load No.
No.	Clock Time	Dial		Clock Time	Dial	0.4127
	+1 20:00:15	Reading	No.		Reading	0.4122
1 2	$+1\ 20:00:13$ $+1\ 20:00:30$	0.41280 0.41220	11 12	+1 20:45:00 +1 21:00:00	0.40840 0.40820	0.4117
2 3	$+1\ 20:00:30$ $+1\ 20:01:00$	0.41220	12	+1 21:00:00	0.40820	0.4112
3 4	$+1\ 20:01:00$ $+1\ 20:02:00$	0.41140				0.4107
4 5	$+1\ 20:02:00$ $+1\ 20:04:00$	0.41040				0.4102
5 6	$+1\ 20:04:00$ $+1\ 20:06:00$	0.40980				0.4097
7	$+1\ 20.00.00$ $+1\ 20:08:00$	0.40940				0.4092
8	+1 20:08:00	0.40920				0.4082
9	+1 20:15:00	0.40900				
10	+1 20:13:00	0.40860				
ressu No.	ure: 200.0 kPa Clock Time	Dial Reading	No.	Clock Time	ST READINGS Dial Reading	0.4065
1	+1 21:00:15	0.40500	11	+1 21:45:00	0.39400	0.4050
2	+1 21:00:30	0.40380	12	+1 22:00:00	0.39360	0.4035
3	+1 21:01:00	0.40260				0.4005
4	+1 21:02:00	0.40140				0.3990
5	+1 21:04:00	0.39950				0.3975
6	+1 21:06:00	0.39820				0.3960
7	+1 21:08:00	0.39720				0.3945
8	+1 21:10:00	0.39640				0.3930
9	+1 21:15:00	0.39520				0.3915 0 1 2 3 4 5 6 7 8 9 10
10	+1 21:30:00	0.39440				
	Ratio = 0.908 C 0.4052 D ₉₀ =	-			5 .97 min. = 42	48 cm. ² /day

No.Clock TimeDial Reading No.Clock TimeDial Reading $Reading$ 1+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.37180	No. Time Reading No. Time Reading 0.385 1 +1 22:00:15 0.39180 11 +1 22:45:00 0.37620 2 +1 22:00:10 0.38980 +1 22:00:10 0.38980 4 +1 22:00:00 0.3850	No. Time Reading No. Time Reading 1 +1 22:00:15 0.39180 11 +1 22:45:00 0.37620 2 +1 22:00:30 0.39140 12 +1 23:00:00 0.37560 4 +1 22:00:00 0.38980 5 +1 22:00:00 0.38980 5 +1 22:00:00 0.38380 7 +1 22:06:00 0.38380 9 +1 22:15:00 0.38240 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% Dg = 0.3937 Dg = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day ressure: 50.0 kPa TEST READINGS Load No. 1 No. Clock Dial Reading No. Clock Dial Time Reading 1 +1 23:00:15 0.37360 12 +2 00:000 0.35240 3 +1 23:00:10 0.37360 12 +2 00:000 0.35240 4 +1 23:00:10 0.37360 12 +2 00:000 0.35240 4 +1 23:00:00 0.37180 5 +1 23:00:00 0.37180 5 +1 23:00:00 0.36640 10 +1 23:30:00 0.36780 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36780 10 +1 23:30:00 0.36780 10 +1 23:30:00 0.36640 10 +1 2		ure: 100.0 kPa			TE		S Load No.
No.N	No.Time t = 123:00:15No.Time t = 122:03:00Reading 0.376203+1 22:00:300.3914012+1 23:00:000.375603+1 22:01:000.3898012+1 23:00:000.375604+1 22:02:000.388000.388005+1 22:06:000.388006+1 22:06:000.382408+1 22:10:000.381609+1 22:15:000.3802010+1 22:30:000.37720Void Ratio = 0.931 Compression = 19.9%Dg = 0.3937Dg = 0.3815D10g = 0.3801Cy at 10.12 min. = 68.45 cm.2/dayPressure: 50.0 kPaLoad No.No.Clock Time Reading 4Dial Time Time 81+1 23:00:100.3728013+2 21:00:000.352403+1 23:00:000.3728013+2 21:00:000.35240No.Clock Time 8Dial 7Dial 7Dial 71+1 23:00:000.3728013+2 21:00:000.352403+1 23:00:000.366400.366400.366409+1 23:15:000.366400.366400.3664010+1 23:30:000.366400.366409+1 23:15:000.366400.366409+1 23:15:000.366409+1 23:15:000.366409+1 23:15:000.3664010+1 23:30:000.3664010+1 23:30:000.36640	No. Time Reading No. Time Reading 33760 1 +1 22:00:15 0.39180 11 +1 22:45:00 0.37620 3 +1 22:00:00 0.38980 4 +1 22:00:00 0.38800 5 +1 22:00:00 0.38560 6 +1 22:06:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38160 9 +1 22:15:00 0.38160 9 +1 22:15:00 0.38160 9 +1 22:00:00 0.37720 Void Ratio = 0.931 Compression = 19.9% Do = 0.3937 Dgo = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm.2/day ressure: 50.0 kPa Load No. 1 No. Clock Dial No. Clock Dial 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 3 +1 23:00:10 0.37720 13 +2 21:00:00 0.35240 3 +1 23:00:00 0.37720 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.37720 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.37780 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.37780 13 +2 21:00:00 0.35240 5 +1 23:00:00 0.36640 7 +1 23:00:00 0.36640 8 +1 23:10:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36640 10	NI -			N.			0.395
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2 +1 22:00:30 0.39140 12 +1 23:00:00 0.37560 3 +1 22:01:00 0.38980 4 +122:02:00 0.38980 5 +1 22:06:00 0.38560 6 +1 22:06:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day Pressure: 50.0 kPa Log	$\begin{array}{cccccccccccccccccccccccccccccccccccc$						-	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	3 +1 22:01:00 0.38980 4 +1 22:02:00 0.38800 5 +1 22:06:00 0.38360 7 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm.2/day Pessure: 50.0 kPa No. Time Reading No. TEST READINGS Load No. No. Clock Dial Reading No. Clock Time Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:10 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37780 12 +2 00:00:00 0.35240 4 +1 23:00:00 0.37780 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.36640 5 +1 23:06:00 0.36640 7 +1 23:06:00 0.36640 9 +1 23:15:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36640 10 +1 2	3 +1 22:01:00 0.38980 4 +1 22:02:00 0.38800 5 +1 22:06:00 0.38380 7 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm.2/day ressure: 50.0 kPa TEST READINGS Load No. 1 No. Clock Dial Reading No. Time Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37260 12 +2 00:00:00 0.35240 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37040 6 +1 23:00:00 0.36640 7 +1 23:06:00 0.36640 9 +1 23:15:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36640 10 +1 2							0.391
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	4 +1 22:02:00 0.38800 5 +1 22:04:00 0.38560 6 +1 22:06:00 0.38380 7 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38120 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day Pressure: 50. kPa TEST READINGS Load No. Clock Dial Reading No. Clock Dial Reading No. Clock Dial Reading No. 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:15 0.37740 11 +1 23:45:00 0.36140 2 +1 23:00:00 0.37786 12 +2 00:00:00 0.36000 3 +1 23:00:00 0.37780 13 +2 21:00:00 0.35240 4 +1 23:06:00 0.37040 6 +1 23:06:00 0.36640 7 +1 23:06:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36640 1	4 +1 22:02:00 0.38800 5 +1 22:06:00 0.38260 6 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% Dog = 0.3937 Dog = 0.3815 D100 = 0.3801 Cy at 10.12 min. = 68.45 cm.2/day ressure: 50.0 KPa TEST READINGS No. Clock Time Reading No. Time Reading No. 1 +1 23:00:30 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37420 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.36860 3 +1 23:01:00 0.36640 9 +1 23:01:00 0.36640 0.36640 0.36640 0.36640 10 +1 23:00:00 0.36640 0.36640 0.36640 0.3664				12	+1 23:00:00	0.37560	0.389
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 5 \\ +1 \\ 22:06:00 \\ 6 \\ +1 \\ 22:06:00 \\ 7 \\ +1 \\ 22:08:00 \\ 9 \\ +1 \\ 22:15:00 \\ 0.38160 \\ 9 \\ +1 \\ 22:15:00 \\ 0.38020 \\ 10 \\ +1 \\ 22:30:00 \\ 0.37720 \\ \end{array} $	$\begin{array}{cccccccccccccccccccccccccccccccccccc$							0.387
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6 +1 22:06:00 0.38380 7 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm.2/day ressure: 500 kPa TEST READINGS Load No. No. Clock Dial Reading No. Clock Dial Reading No. Clock Dial 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.37180 5 +1 23:06:00 0.36940 7 +1 23:06:00 0.36940 7 +1 23:06:00 0.36940 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$							0.385
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% Dg = 0.3937 Dgg = 0.3815 D100 = 0.3801 C _v at 10.12 min. = 68.45 cm.2/day ressure: 50.0 kPa Load No. Clock Dial Reading No. Clock Time Reading Reading 1.4 +1 23:45:00 0.36140 2 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 3 +1 23:00:10 0.37280 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.36640 0.36640 0.36640 9 +1 23:10:00 0.36640 0.36640 10 +1 23:00:00 0.36340	7 +1 22:08:00 0.38240 8 +1 22:10:00 0.38160 9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm.2/day ressure: 50.0 kPa TEST READINGS Load No. 1 No. Clock Dial Reading No. Clock Time Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.36940 7 +1 23:06:00 0.36940 7 +1 23:06:00 0.36940 9 +1 23:15:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%							0.383
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c} 8 \\ 8 \\ +1 \\ 22:10:00 \\ 0.38160 \\ 9 \\ +1 \\ 22:15:00 \\ 0.38020 \\ 10 \\ +1 \\ 22:30:00 \\ 0.37720 \\ \end{array} $ Void Ratio = 0.931 Compression = 19.9% D_0 = 0.3815 D_{100} = 0.3801 C_v at 10.12 min. = 68.45 cm. ² /day ressure: 50.0 kPa	$ \begin{array}{c} 8 \\ +1 \\ 22:10:00 \\ 0 \\ +1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 \\ 0 \\ -1 \\ 22:30:00 $							0.381
9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day ressure: 50.0 kPa TEST READINGS Load No No. Clock Dial Reading No. Clock Time Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.37040 6 +1 23:06:00 0.36640 7 +1 23:08:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340	9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day ressure: 50.0 kPa	9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day ressure: 50.0 kPa TEST READINGS Load No. 1 No. Clock Dial Reading No. Clock Dial Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:00:00 0.36940 7 +1 23:08:00 0.36660 8 +1 23:10:00 0.36780 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%							
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	9 +1 22:15:00 0.38020 10 +1 22:30:00 0.37720 Void Ratio = 0.931 Compression = 19.9% D ₀ = 0.3937 D ₉₀ = 0.3815 D ₁₀₀ = 0.3801 C _v at 10.12 min. = 68.45 cm. ² /day ressure: 50.0 kPa TEST READINGS Load No. Clock Dial Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.36640 7 +1 23:08:00 0.36860 8 +1 23:10:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			0.38160				
Void Ratio = 0.931 Compression = 19.9% $D_0 = 0.3937$ $D_{90} = 0.3815$ $D_{100} = 0.3801$ C_v at 10.12 min. = 68.45 cm.2/dayressure: 50.0 kPaLoad NoNo. $Clock$ Time $Dial$ Reading $No.$ $Clock$ Time $Dial$ Reading1+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 20:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.371805+1 23:06:000.369407+1 23:06:000.366408+1 23:10:000.367809+1 23:15:000.3664010+1 23:30:000.36340	Void Ratio = 0.931 Compression = 19.9% $D_{00} = 0.3815$ $D_{100} = 0.3801$ C_{v} at 10.12 min. = 68.45 cm. $2/day$ ressure: 50.0 kPaTEST READINGSLoad No.No. $Clock$ Time Reading 2 + 1 23:00:15 $Dial$ Reading 1 + 1 23:45:00 $Dial$ Reading 0.361401+1 23:00:15 0.37420 11 +1 23:45:00+1 23:45:00 0.36140 0.36140 2+1 23:00:10 0.37280 13 +2 21:00:00+2 21:00:00 0.35240 0.36000 3+1 23:00:00 0.36600 0.36940 7+1 23:06:00 0.36640 9+1 23:10:00 0.36640 10+1 23:30:00 0.36340	Void Ratio = 0.931 Compression = 19.9% $D_{00} = 0.3815$ $D_{100} = 0.3801$ C_{v} at 10.12 min. = 68.45 cm. $2/day$ ressure: 50.0 kPaTest ReadingNo.ClockDial ReadingLoad No. 1No.Clock TimeDial ReadingNo.Clock TimeDial Reading 0.361401+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.37180							0.3/5 0 1 2 3 4 5 6 7 8 9 10
D0 = 0.3937D90 = 0.3815D100 = 0.3801Cv at 10.12 min. = 68.45 cm.2/dayTEST READINGSNo.Clock TimeDial Reading 1No.Clock TimeDial Reading 0.361401+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.3718013+2 21:00:000.352405+1 23:06:000.368608+1 23:10:000.366409+1 23:15:000.3664010+1 23:30:000.36340	D0 = 0.3937D90 = 0.3815D100 = 0.3801Cv at 10.12 min. = 68.45 cm.2/dayressure: 50.0 kPaTEST READINGSLoad No.Clock TimeDial Reading +1 23:00:15Dial 0.37420Dial +1 2 +2 00:00:00Dial Reading 0.361401+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.37180-2 21:00:000.352405+1 23:06:000.36940-3567+1 23:08:000.366608+1 23:10:000.366409+1 23:15:000.3664010+1 23:30:000.36340	D0 = 0.3937D90 = 0.3815D100 = 0.3801Cv at 10.12 min. = 68.45 cm.2/dayressure:50.0 kPaTest READINGsLoad No. 1No.Clock TimeDial ReadingNo.Clock TimeDial Reading1+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.371400.370406+1 23:06:000.368608+1 23:10:000.366409+1 23:15:000.3664010+1 23:30:000.36340				10.0	o/		
No.Clock TimeDial ReadingNo.Clock TimeDial Reading1 $+1 23:00:15$ 0.37420 11 $+1 23:45:00$ 0.36140 2 $+1 23:00:30$ 0.37360 12 $+2 00:00:00$ 0.36000 3 $+1 23:01:00$ 0.37280 13 $+2 21:00:00$ 0.35240 4 $+1 23:02:00$ 0.37180 5 $+1 23:06:00$ 0.36940 7 $+1 23:08:00$ 0.36860 8 $+1 23:10:00$ 0.36860 8 $+1 23:10:00$ 0.36640 9 $+1 23:15:00$ 0.36640 10 $+1 23:30:00$ 0.36340	No.Clock TimeDial Reading No.Clock TimeDial Reading Reading1+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.371400.370406+1 23:06:000.369400.368608+1 23:10:000.366409+1 23:15:000.3664010+1 23:30:000.36340	No.Clock TimeDial Reading No.Clock TimeDial Reading Reading1+1 23:00:150.3742011+1 23:45:000.361402+1 23:00:300.3736012+2 00:00:000.360003+1 23:01:000.3728013+2 21:00:000.352404+1 23:02:000.37180+2 21:00:000.352405+1 23:06:000.36940	D ₀ =	0.3937 D ₉₀ =	-		3801 C _v at 10		· · ·
No. Time Reading No. Time Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.36940 7 +1 23:06:00 0.36640 8 +1 23:10:00 0.36640 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340	No.TimeReadingNo.TimeReading1 $+1 23:00:15$ 0.37420 11 $+1 23:45:00$ 0.36140 2 $+1 23:00:30$ 0.37360 12 $+2 00:00:00$ 0.36000 3 $+1 23:01:00$ 0.37280 13 $+2 21:00:00$ 0.35240 4 $+1 23:02:00$ 0.37040 0.37040 5 $+1 23:06:00$ 0.36940 0.36860 7 $+1 23:08:00$ 0.36860 8 $+1 23:10:00$ 0.36640 9 $+1 23:15:00$ 0.36640 10 $+1 23:30:00$ 0.36340	No. Time Reading No. Time Reading 1 +1 23:00:15 0.37420 11 +1 23:45:00 0.36140 2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.36940 7 +1 23:08:00 0.36860 8 +1 23:10:00 0.36780 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	ressu						S Load No. 1
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1 + 1 23:00:15 0.37420 11 + 1 23:45:00 0.36140 $2 + 1 23:00:30 0.37360 12 + 2 00:00:00 0.36000$ $3 + 1 23:01:00 0.37280 13 + 2 21:00:00 0.35240$ $4 + 1 23:02:00 0.37180$ $5 + 1 23:04:00 0.37040$ $6 + 1 23:06:00 0.36940$ $7 + 1 23:06:00 0.36640$ $8 + 1 23:10:00 0.36640$ $9 + 1 23:15:00 0.36640$ $10 + 1 23:30:00 0.36340$ Void Ratio = 0.960 Compression = 18.6%	1 + 1 23:00:15 0.37420 11 + 1 23:45:00 0.36140 $2 + 1 23:00:30 0.37360 12 + 2 00:00:00 0.36000$ $3 + 1 23:01:00 0.37280 13 + 2 21:00:00 0.35240$ $4 + 1 23:02:00 0.37180$ $5 + 1 23:04:00 0.37040$ $6 + 1 23:06:00 0.36940$ $7 + 1 23:06:00 0.36940$ $7 + 1 23:08:00 0.36860$ $8 + 1 23:10:00 0.36780$ $9 + 1 23:15:00 0.36640$ $10 + 1 23:30:00 0.36340$ Void Ratio = 0.960 Compression = 18.6%	No.			No.			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.37040 6 +1 23:06:00 0.36940 7 +1 23:08:00 0.36860 8 +1 23:10:00 0.36780 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	2 +1 23:00:30 0.37360 12 +2 00:00:00 0.36000 3 +1 23:01:00 0.37280 13 +2 21:00:00 0.35240 4 +1 23:02:00 0.37180 5 +1 23:04:00 0.37040 6 +1 23:06:00 0.36940 7 +1 23:08:00 0.36860 8 +1 23:10:00 0.36780 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	1	+1 23:00:15	0.37420	11	+1 23:45:00	0.36140	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$							
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 4 & +1\ 23:02:00 & 0.37180 \\ 5 & +1\ 23:04:00 & 0.37040 \\ 6 & +1\ 23:06:00 & 0.36940 \\ 7 & +1\ 23:08:00 & 0.36860 \\ 8 & +1\ 23:10:00 & 0.36780 \\ 9 & +1\ 23:15:00 & 0.36640 \\ 10 & +1\ 23:30:00 & 0.36640 \end{array}$	$\begin{array}{c} 4 & +1\ 23:02:00 & 0.37180 \\ 5 & +1\ 23:04:00 & 0.37040 \\ 6 & +1\ 23:06:00 & 0.36940 \\ 7 & +1\ 23:08:00 & 0.36860 \\ 8 & +1\ 23:10:00 & 0.36780 \\ 9 & +1\ 23:15:00 & 0.36640 \\ 10 & +1\ 23:30:00 & 0.36340 \end{array}$							
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	5 + 1 23:04:00 0.37040 6 + 1 23:06:00 0.36940 7 + 1 23:08:00 0.36860 8 + 1 23:10:00 0.36780 9 + 1 23:15:00 0.36640 10 + 1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	5 + 1 23:04:00 0.37040 6 + 1 23:06:00 0.36940 7 + 1 23:08:00 0.36860 8 + 1 23:10:00 0.36780 9 + 1 23:15:00 0.36640 10 + 1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%							
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} 6 & +1\ 23:06:00 & 0.36940 \\ 7 & +1\ 23:08:00 & 0.36860 \\ 8 & +1\ 23:10:00 & 0.36780 \\ 9 & +1\ 23:15:00 & 0.36640 \\ 10 & +1\ 23:30:00 & 0.36340 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$							
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7 + 1 23:08:00 0.36860 $8 + 1 23:10:00 0.36780$ $9 + 1 23:15:00 0.36640$ $10 + 1 23:30:00 0.36340$ Void Ratio = 0.960 Compression = 18.6%	7 + 1 23:08:00 0.36860 $8 + 1 23:10:00 0.36780$ $9 + 1 23:15:00 0.36640$ $10 + 1 23:30:00 0.36340Void Ratio = 0.960 Compression = 18.6%$							
8 +1 23:10:00 0.36780 9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 0 4 8 12 16 20 24 28 32 36	8 + 1 23:10:00 0.36780 0.36640 0.36640 0.36640 0.36340	$\begin{array}{cccccccccccccccccccccccccccccccccccc$							0.355
9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340	9 +1 23:15:00 0.36640 10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	9 + 1 23:15:00 0.36640 0.349 0 4 8 12 16 20 24 28 32 36 40 0 10 +1 23:30:00 0.36340 0.36340 0.36340 0.36340 0.36640 0.36640 0.36640 0.36640 0.36640 0.36640							0.352
10 +1 23:30:00 0.36340	10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%	10 +1 23:30:00 0.36340 Void Ratio = 0.960 Compression = 18.6%							0.349 0 4 8 12 16 20 24 28 32 36 40
	Void Ratio = 0.960 Compression = 18.6%	Void Ratio = 0.960 Compression = 18.6%	9						
			10 /oid	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.:	55 cm.2/day
			10 /oid	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.:	55 cm. ² /day
			10 /oid	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.3	55 cm. ² /day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.:	55 cm.2/day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.:	55 cm.2/day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.3	55 cm.2/day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.3	55 cm.2/day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.3	55 cm.2/day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.3	55 cm.2/day
			10 Void	+1 23:30:00 Ratio = 0.960	Compressior			3.37 min. = 18.3	55 cm.2/day

Pressure: 100.0 kPa			TEST READINGS	Load No. 11
	Clock	Dial	0.3542	
No.	Time	Reading	0.3546	
1	+2 21:00:15	0.35420	0.3550	
2	+2 21:00:30	0.35460	0.3554	
3	+2 21:01:00	0.35500	0.3558	
4	+2 21:02:00	0.35560	0.3562	
5	+2 21:04:00	0.35600	0.3566	
6	+2 21:06:00	0.35640	0.3574	
7	+2 21:08:00	0.35680	0.3578	
8	+2 21:10:00	0.35700	0.3582 0 1 2 3 4	5 6 7 8 9 10
9 10	+2 21:15:00 +2 21:30:00	0.35720 0.35740		
Void Ratio = 0.954 Co D ₀ = 0.3540 D ₉₀ = $0.$			at 3.49 min. = 205.68 cm. ² /day	
Pressure: 200.0 kPa			TEST READINGS	Load No. 12
	Clock	Dial		
No.	Time	Reading	0.362	
1	+2 21:30:15	0.35880	0.363	
2	+2 21:30:30	0.36260	0.365	
3	+2 21:31:00	0.36340	0.366	
4	+2 21:32:00	0.36460	0.367	
5	+2 21:34:00	0.36580	0.368	
6	+2 21:36:00	0.36680	0.369	
7	+2 21:38:00	0.36740	0.370	
8	+2 21:40:00	0.36780	0.371	
9	+2 21:45:00	0.36860	0.372	5 6 7 8 9 10
10	+2 22:00:00	0.37060		
Void Ratio = 0.937 Co D ₀ = 0.3608 D ₉₀ = 0.	•		at 2.20 min. = 323.35 cm. ² /day	

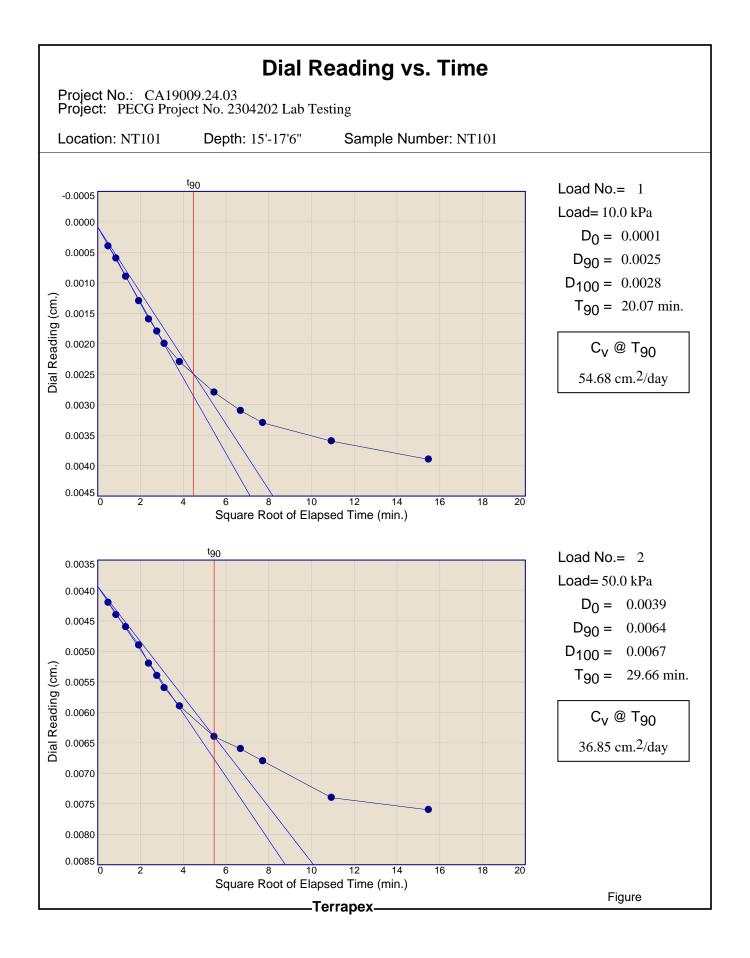
No. 1 2 3 4	Clock Time		ST READINGS		Load No. 1
1 2 3	ime	Dial		0.394	
2 3	0 00 00 15	Reading		0.396	
3		0.37060		0.398	
		0.39640		0.400	
4		0.39860		0.402	
-		0.40080		0.404	
5		0.40220		0.406	
6		0.40380		0.410	
7		0.40480		0.412	
8		0.40580		0.414 0 1 2 3 4 5 6 7	8 9 1
9		0.40720			
10	+2 22:30:00	0.40860			
/oid Ratio = 0.889 C	ompression = 21.6	5%			
D ₀ = 0.3933 D ₉₀ = 0	$D.4014 D_{100} = 0.4014$.4022 C _v at 2.4	45 min. = 279.9	-	
ressure: 800.0 kPa		TE	ST READINGS		Load No. 1
Clock No. Time	Dial Reading No.	Clock Time	Dial Reading	0.420	
1 +2 22:30:15	0.42080 11	+2 23:45:00	0.46180	0.425	
2 +222:30:30	0.42560	+2 25.45.00	0.40100	0.430	
3 +2 22:30:30 3	0.42980			0.435	
4 +2 22:32:00	0.43460			0.440	
5 +2 22:34:00	0.43760			0.443	
6 +2 22:36:00	0.44120			0.455	
7 +2 22:38:00	0.44400			0.460	
8 +2 22:40:00	0.44620			0.465	•
9 +2 22:45:00	0.44920			0.470 0 1 2 3 4 5 6 7	8 9 1
10 +2 23:00:00	0.45280				
	0.45280 compression = 24.4		23 min. = 198.1	0 1 2 3 4 5 6 7	89

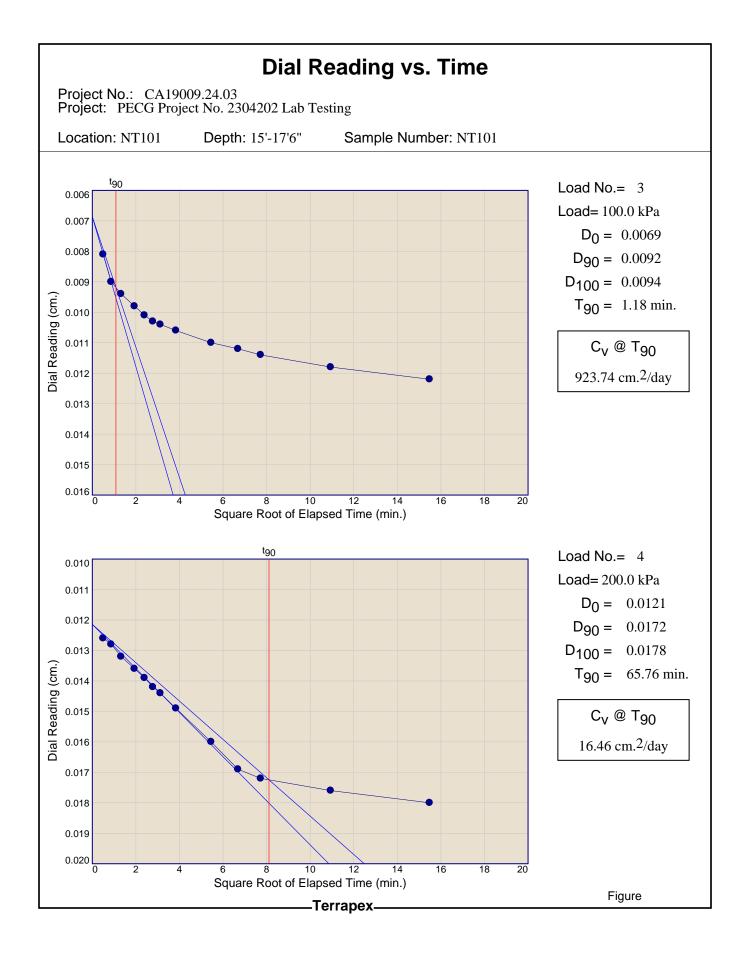
	re: 1600.0 kPa				ST READING	<u> </u>							oad No	
o.	Clock Time	Dial Reading	No.	Clock Time	Dial Reading	0.450								_
1	+3 00:00:15	0.46180	11	+3 00:45:00	0.49820	0.465								
2	+3 00:00:30	0.46260	12	+3 01:00:00	0.50220	0.480								
3	+3 00:01:00	0.46680	13	+3 02:00:00	0.51220	0.495								
4	+3 00:02:00	0.47020	14	+3 18:00:00	0.57220	0.525								
5	+3 00:04:00	0.47420				0.540								
6	+3 00:06:00	0.47820				0.555								
7	+3 00:08:00	0.48120				0.570							•	
8	+3 00:10:00	0.48380				0.585								
9	$+3\ 00:15:00$	0.48780				0.600	4 8	12	16	20	24	28 32	2 36	40
10	+3 00:30:00	0.49360												
	Ratio = 0.680 C).4585 D ₉₀ =	-		% 4961 C _v at 25	5.95 min. = 22.	18 cm.2/day								
		-			5 .95 min. = 22.	18 cm.2/day								
		-			.95 min. = 22.	18 cm.2/day								
		-			.95 min. = 22.	18 cm.2/day								
		-			. 95 min. = 22.	18 cm.2/day								
		-			.95 min. = 22.	18 cm.2/day								
		-			. 95 min. = 22.	18 cm.2/day								
		-			5.95 min. = 22.	18 cm.2/day								
		-			.95 min. = 22.	18 cm.2/day								
		-			6 .95 min. = 22.	18 cm.2/day								
		-			3 .95 min. = 22.	18 cm.2/day								

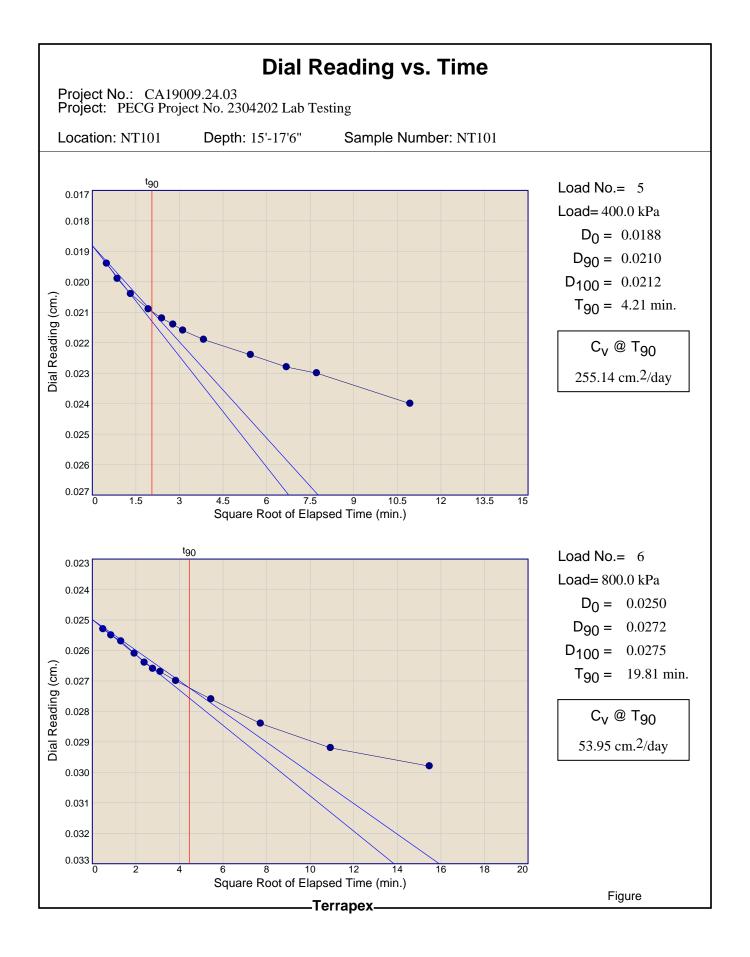


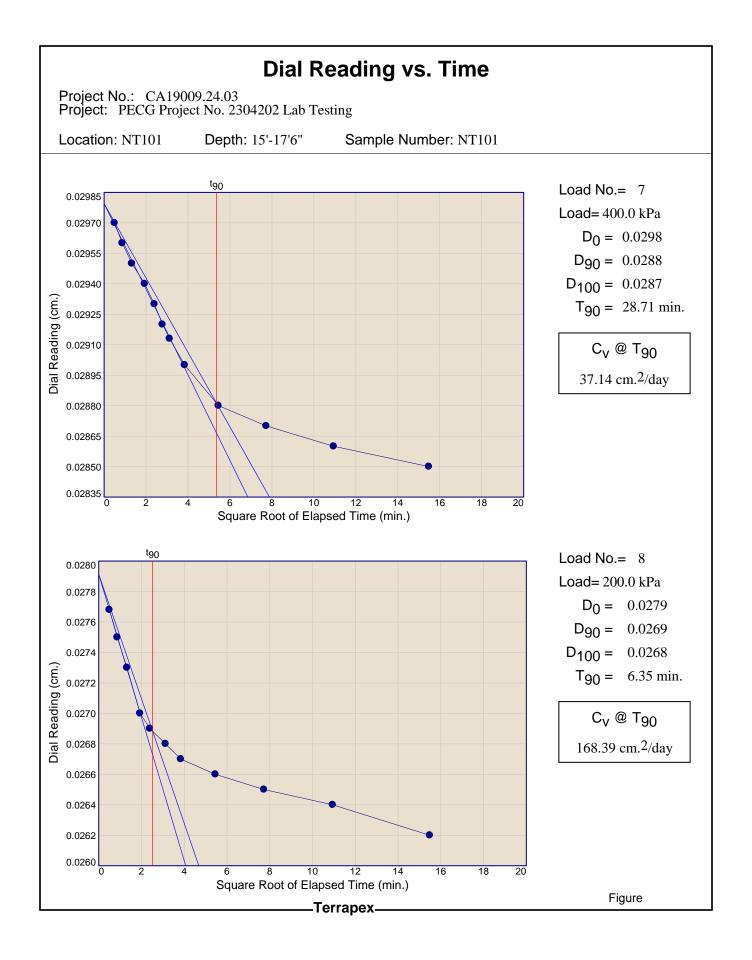
Tested By: John Ramachandran

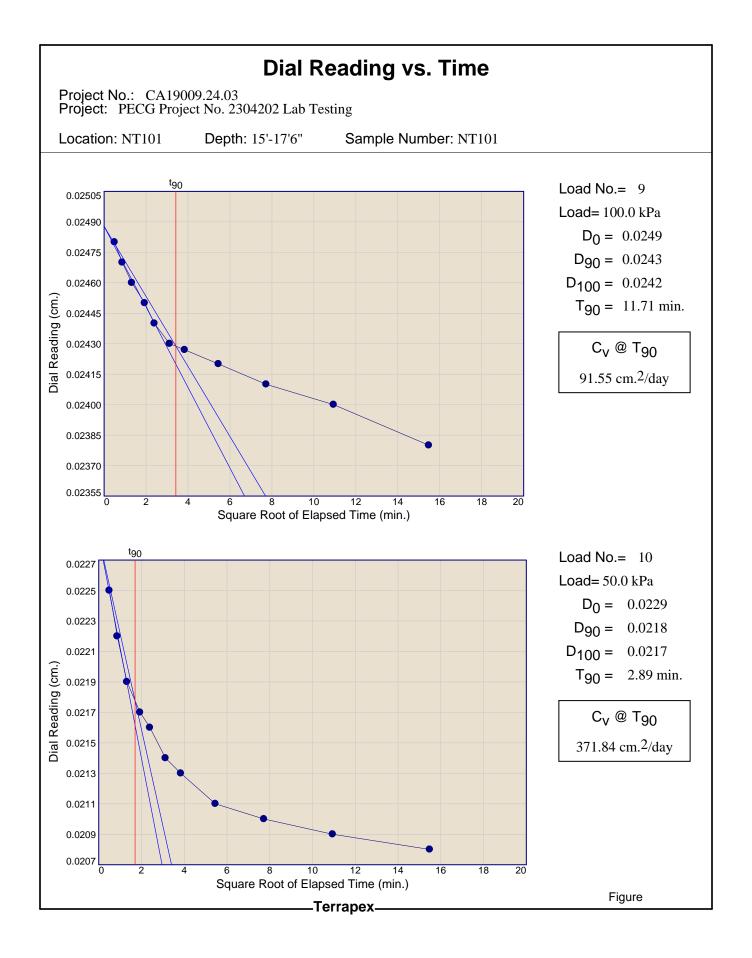
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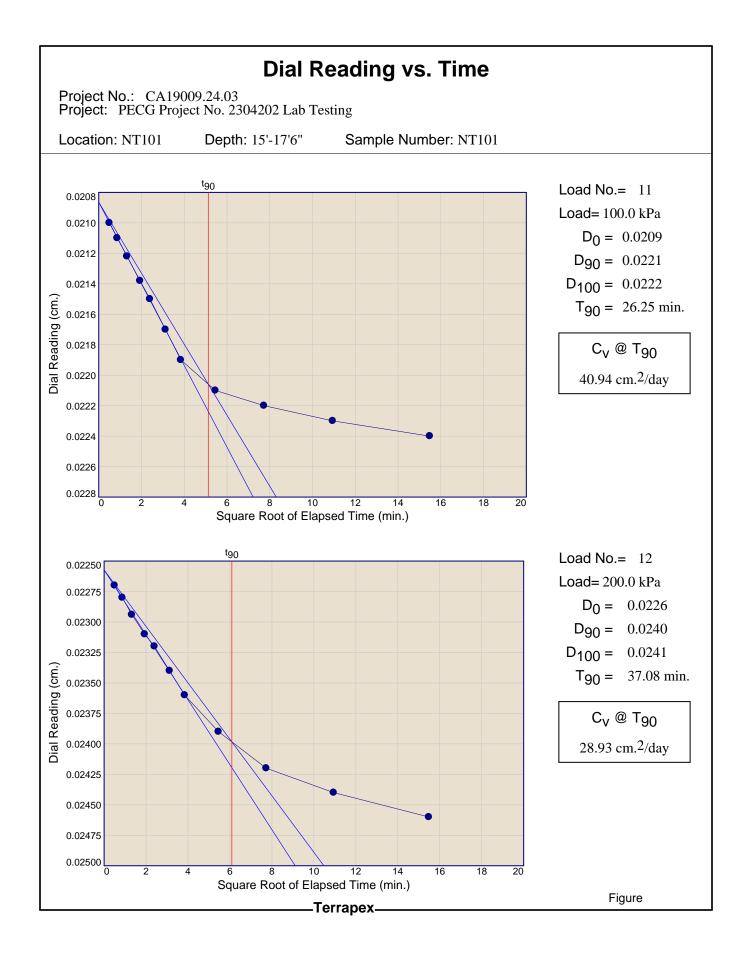


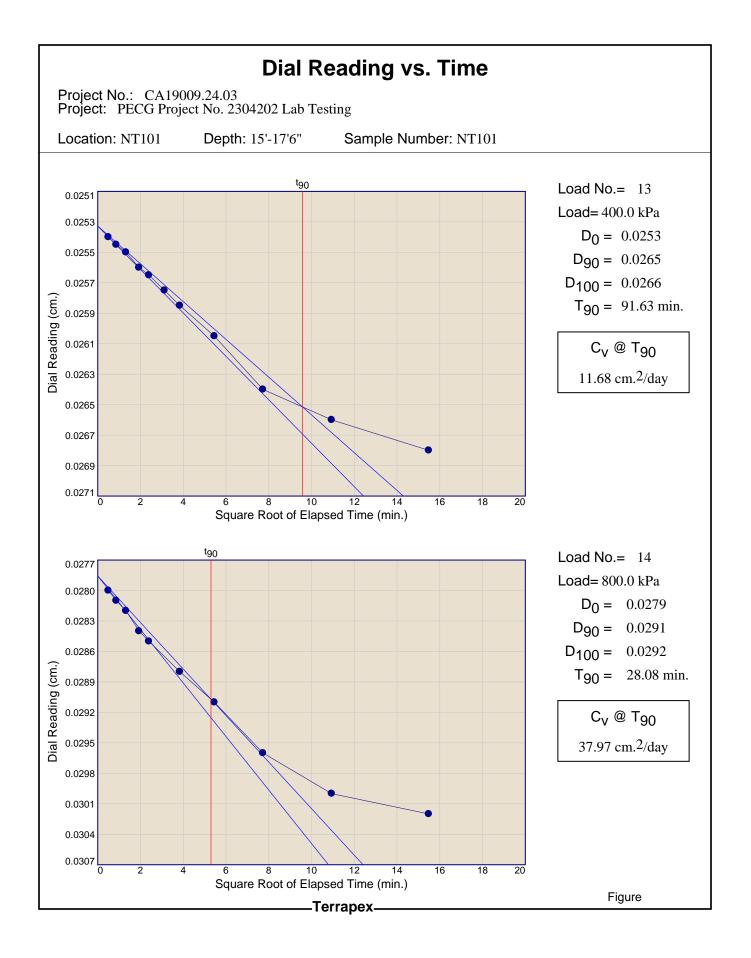


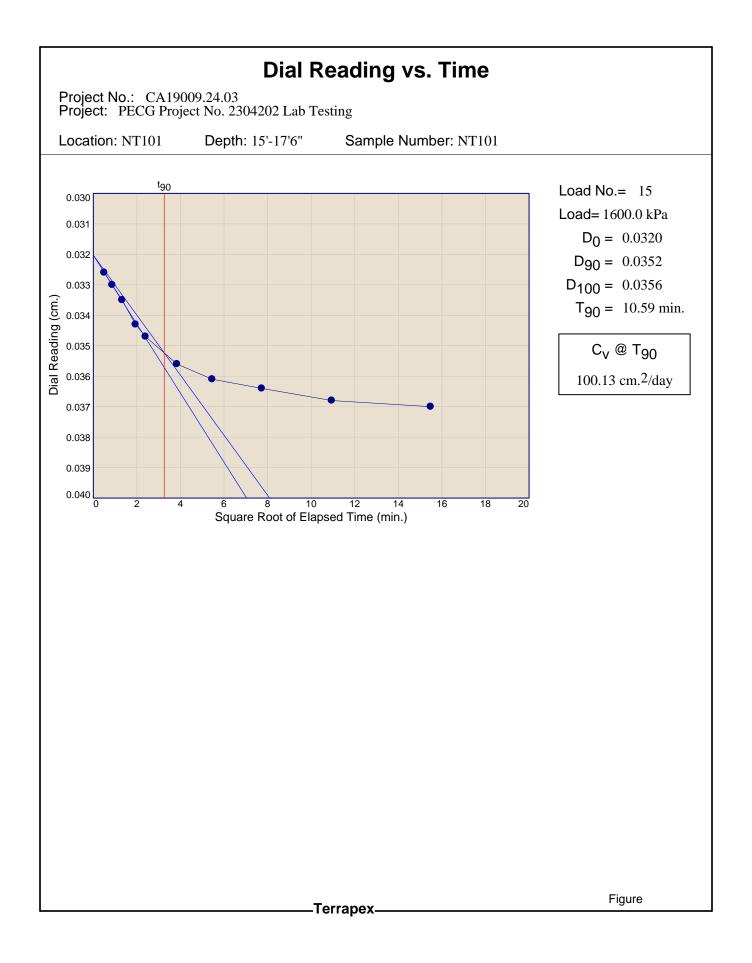


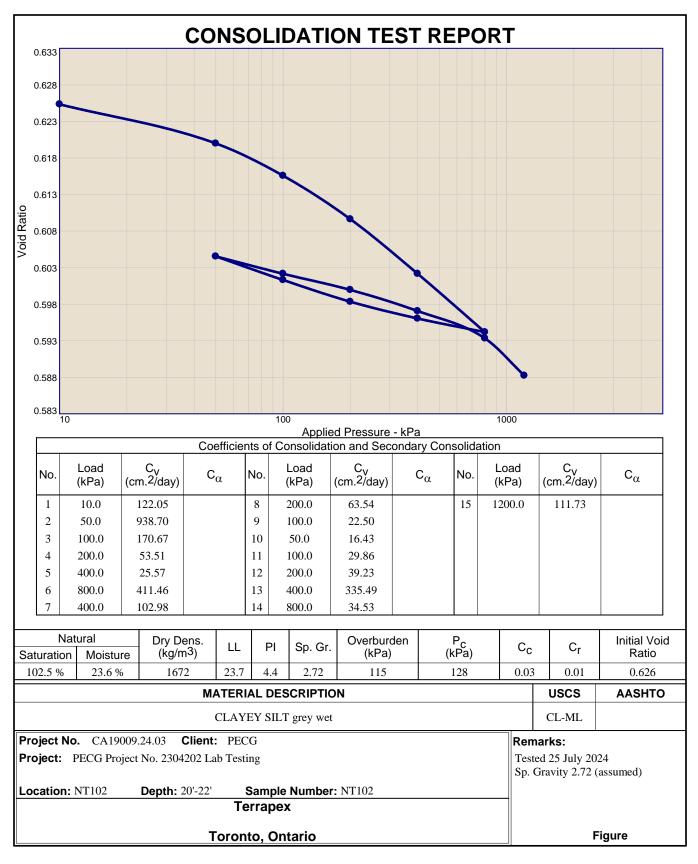






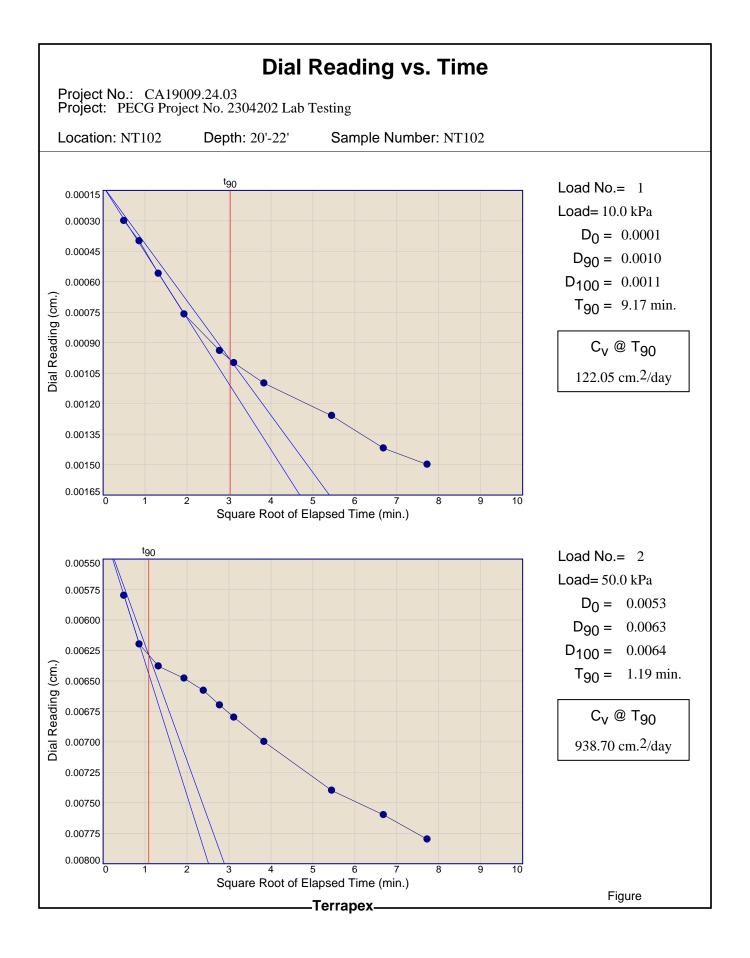


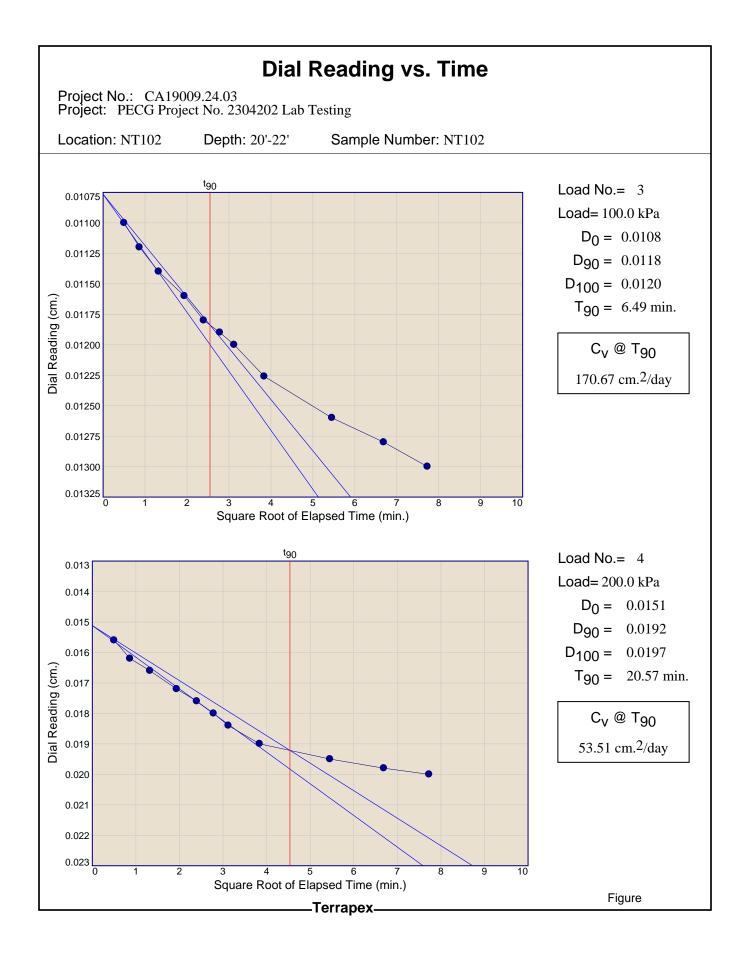


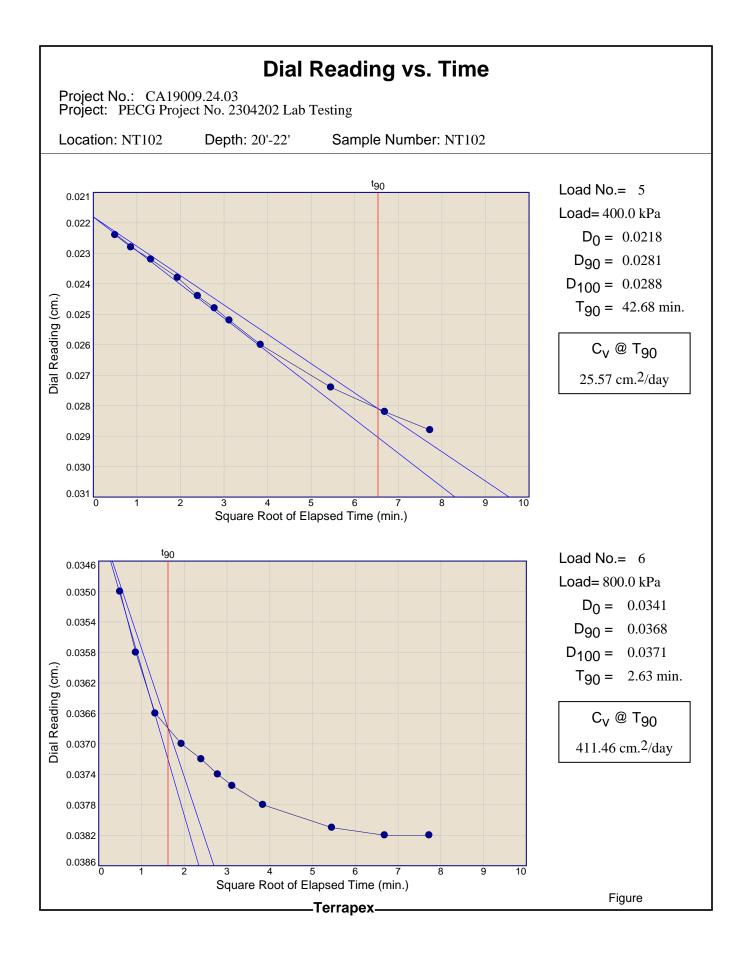


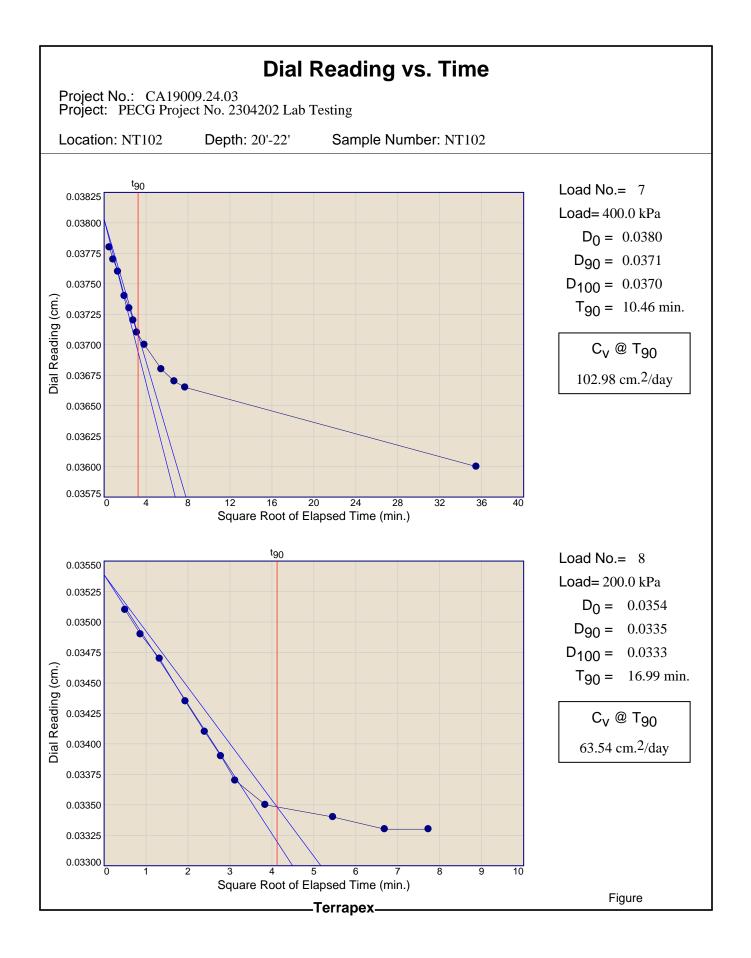
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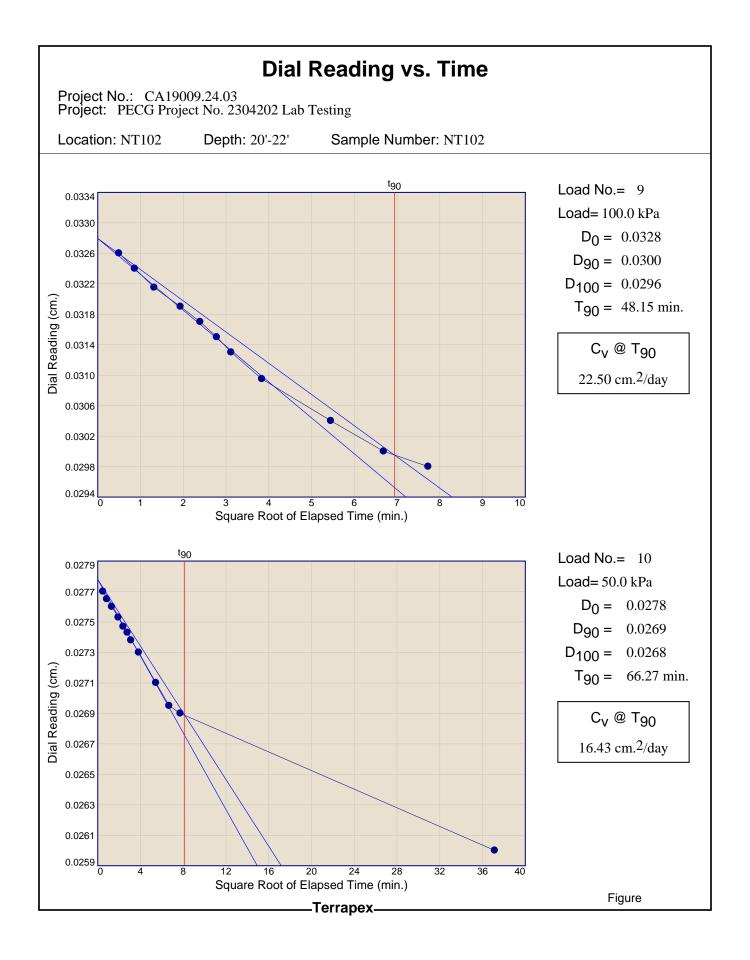
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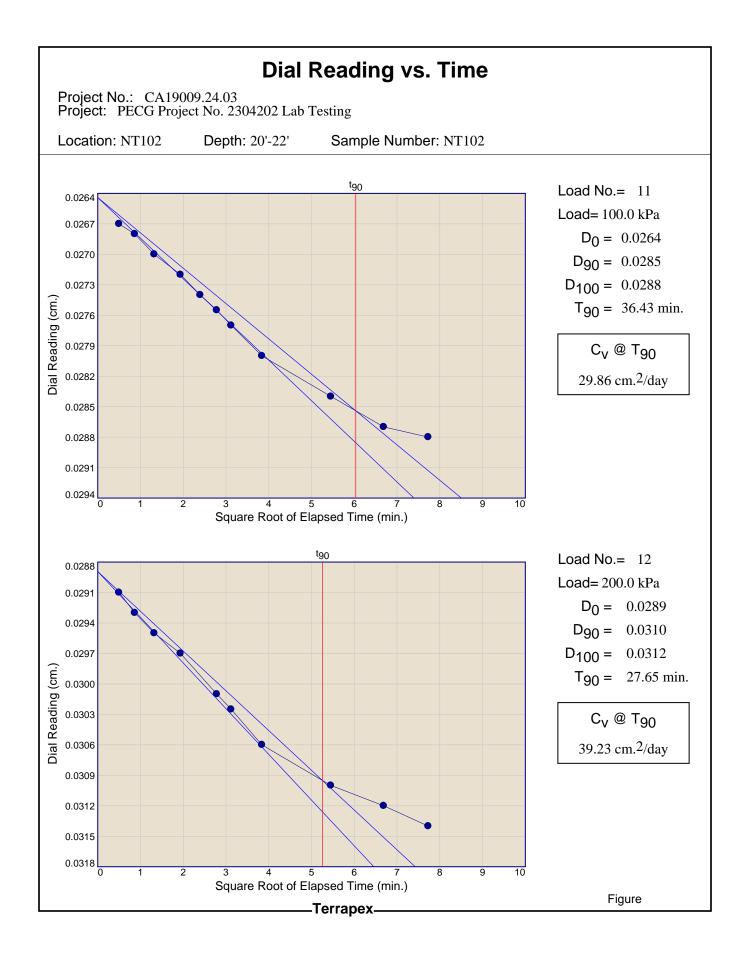


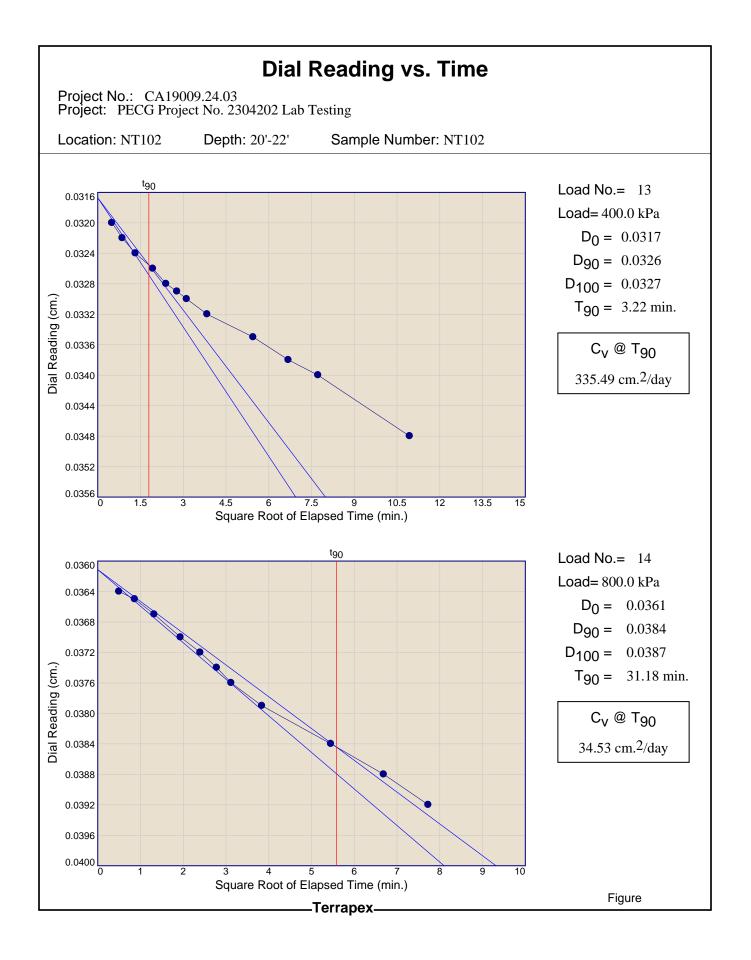


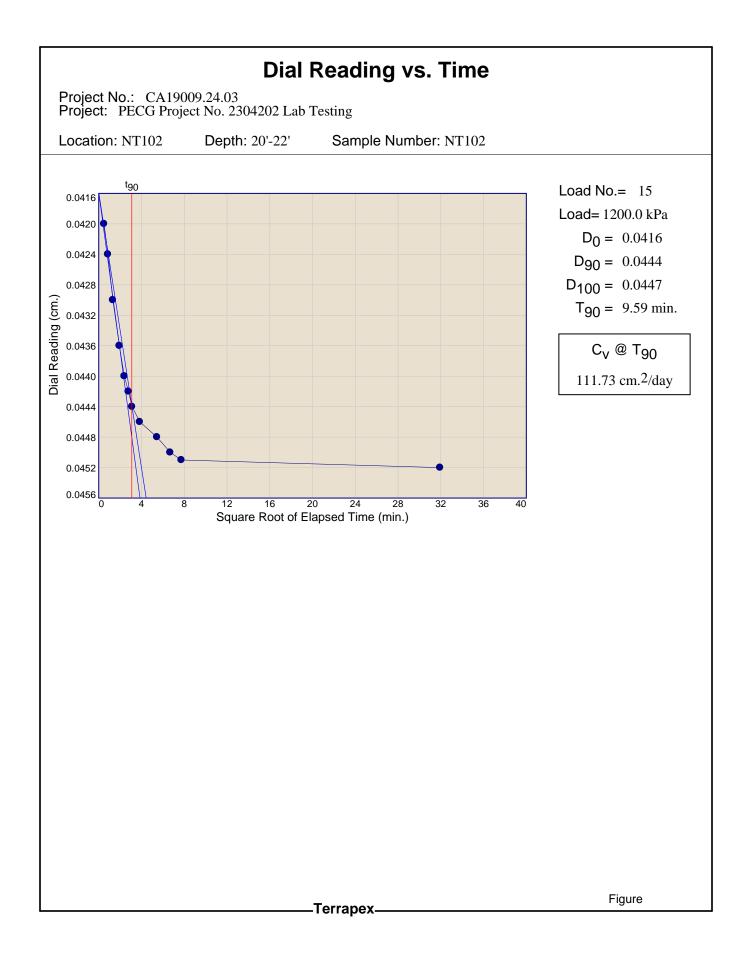


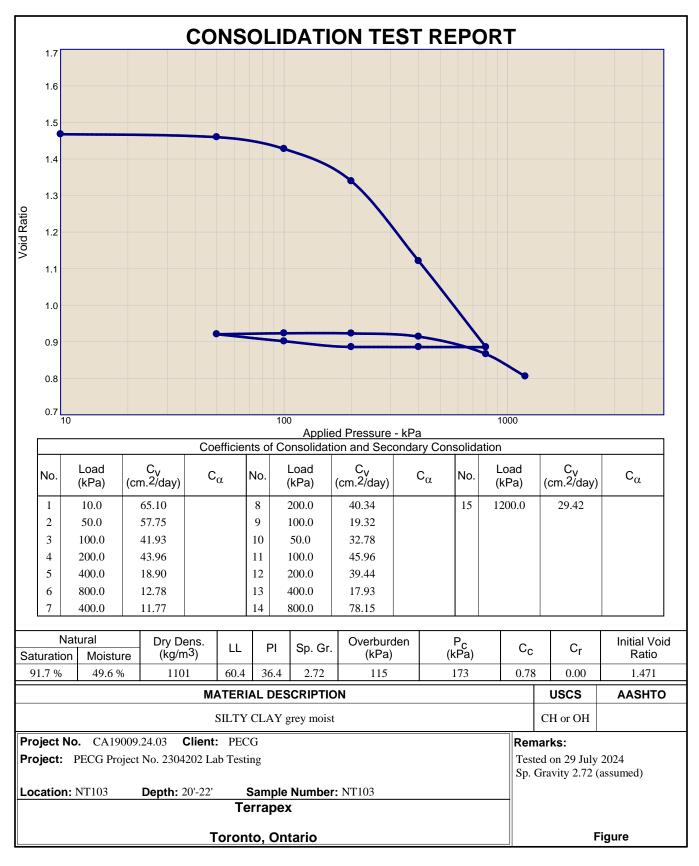






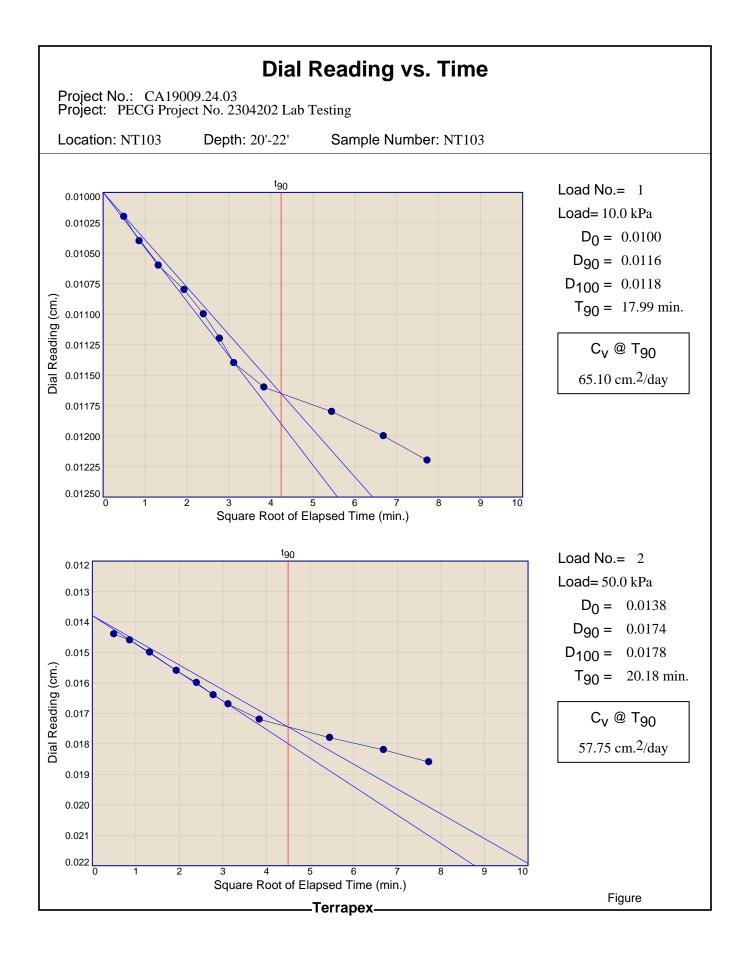


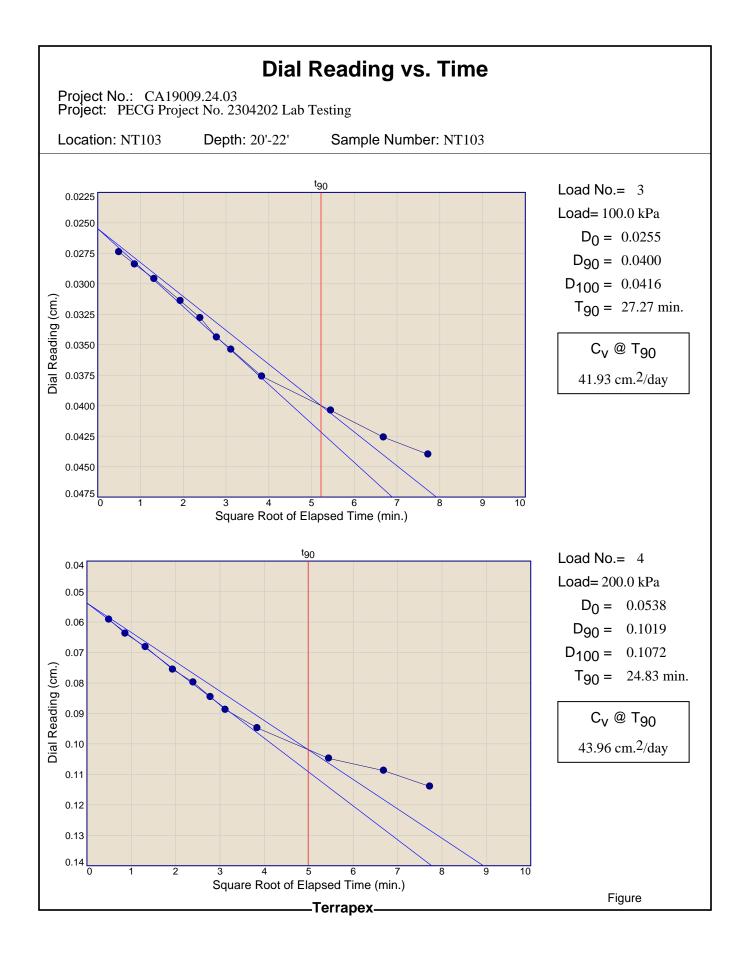


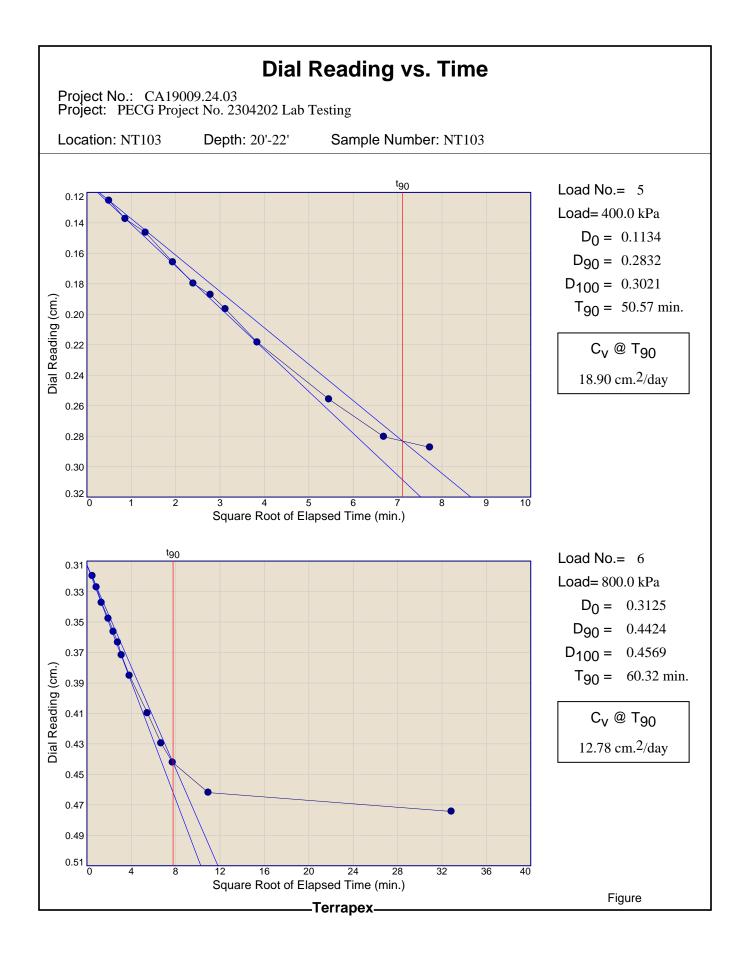


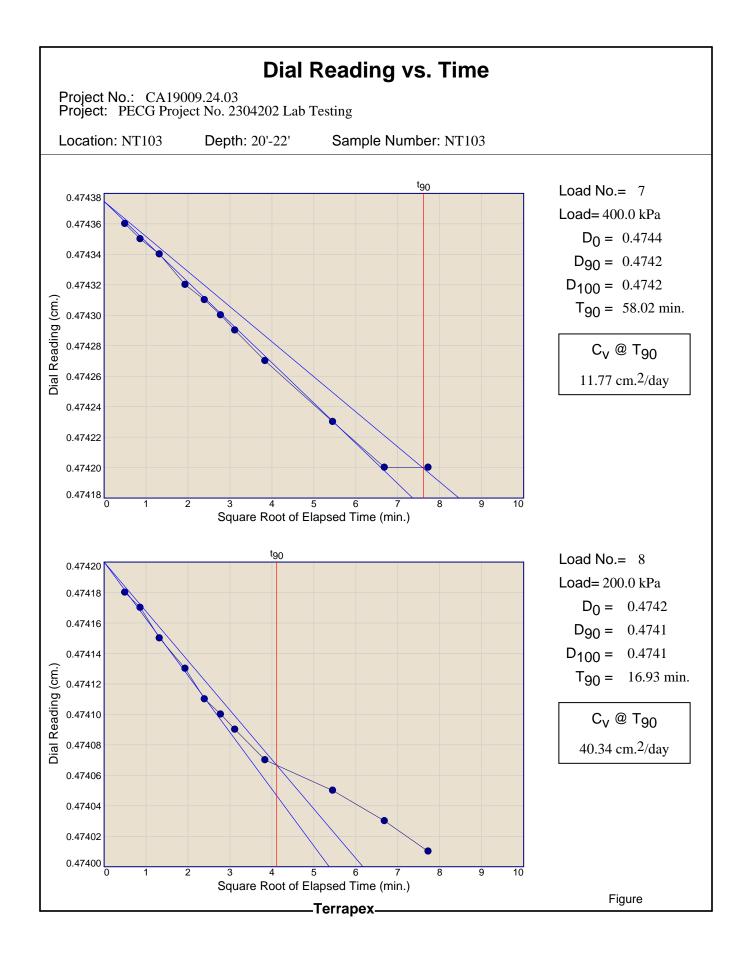
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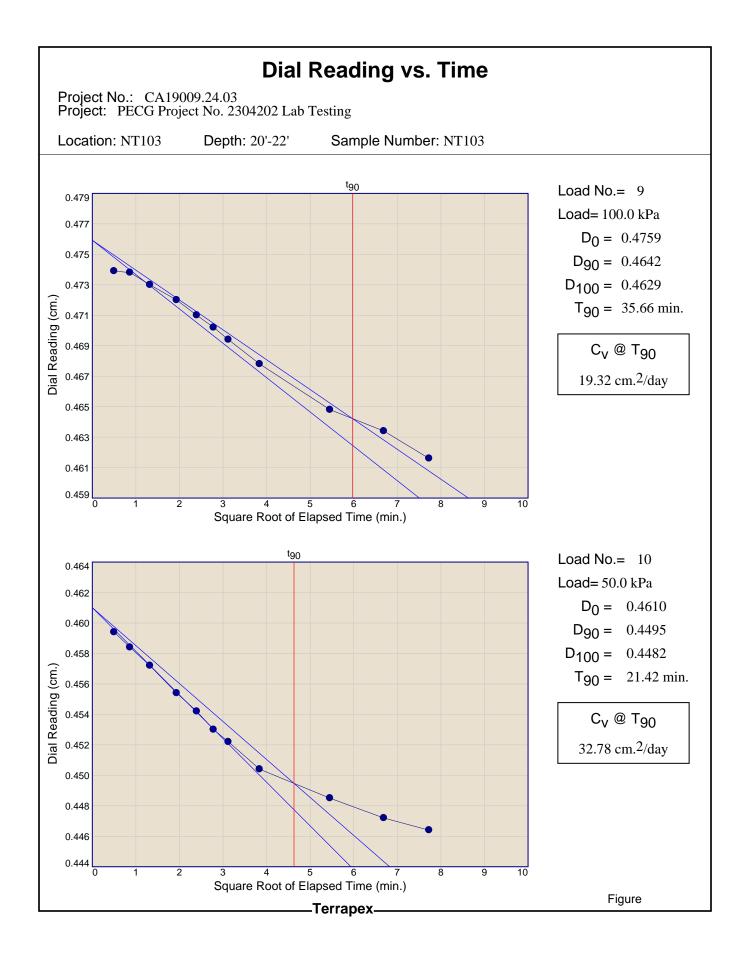
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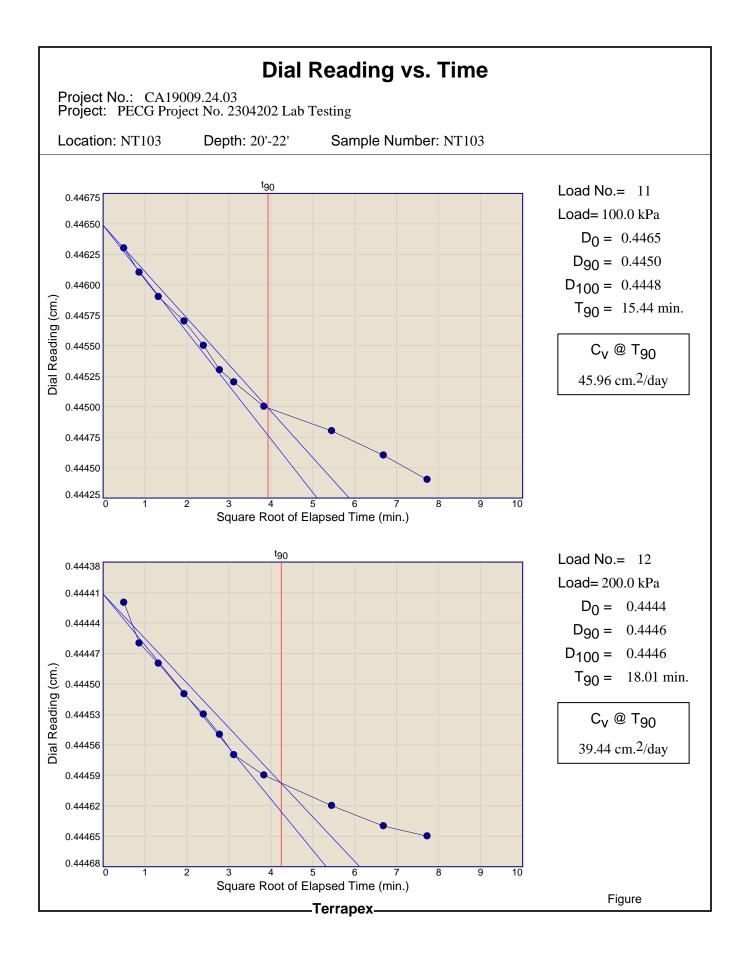


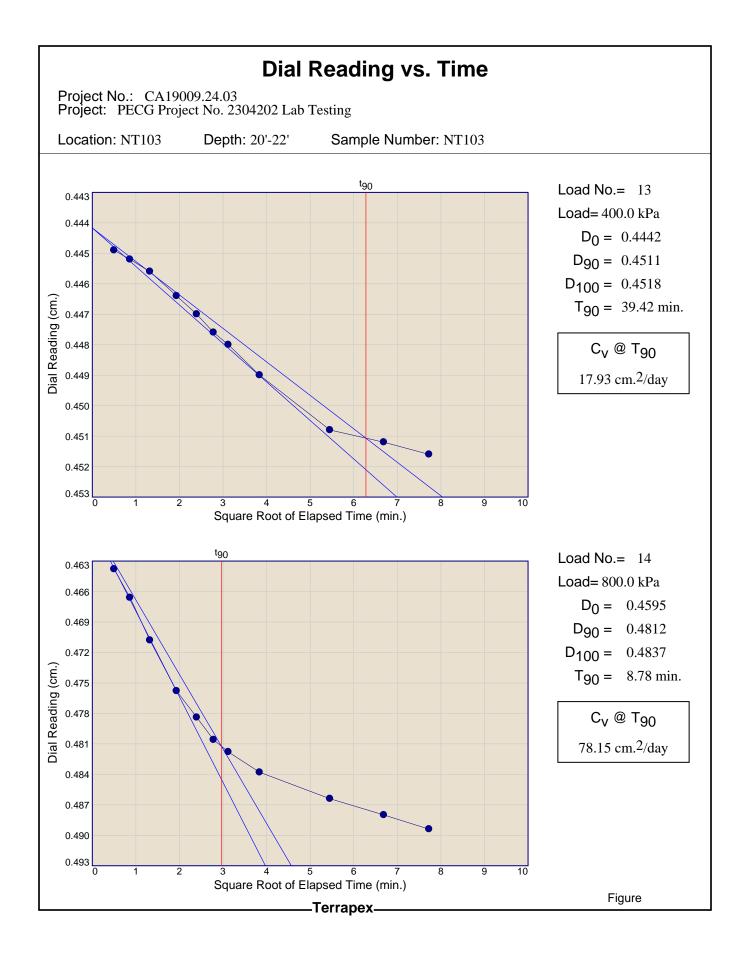


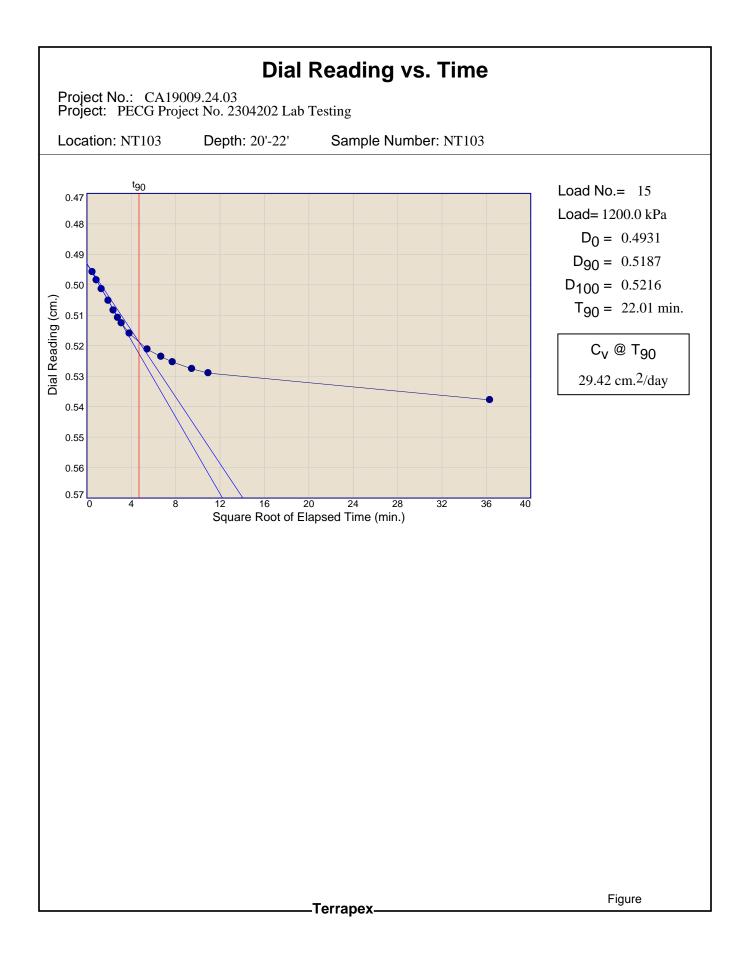


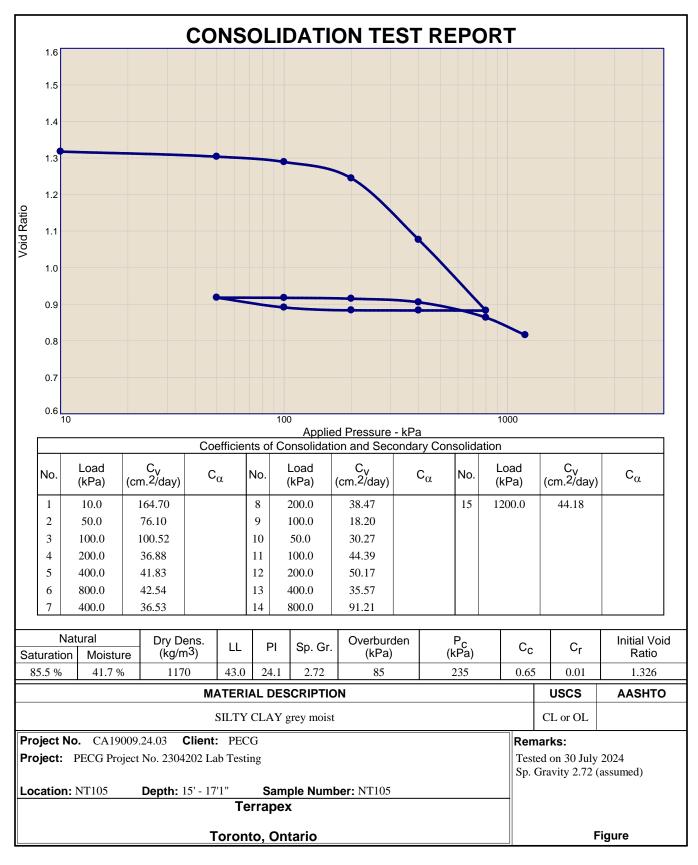




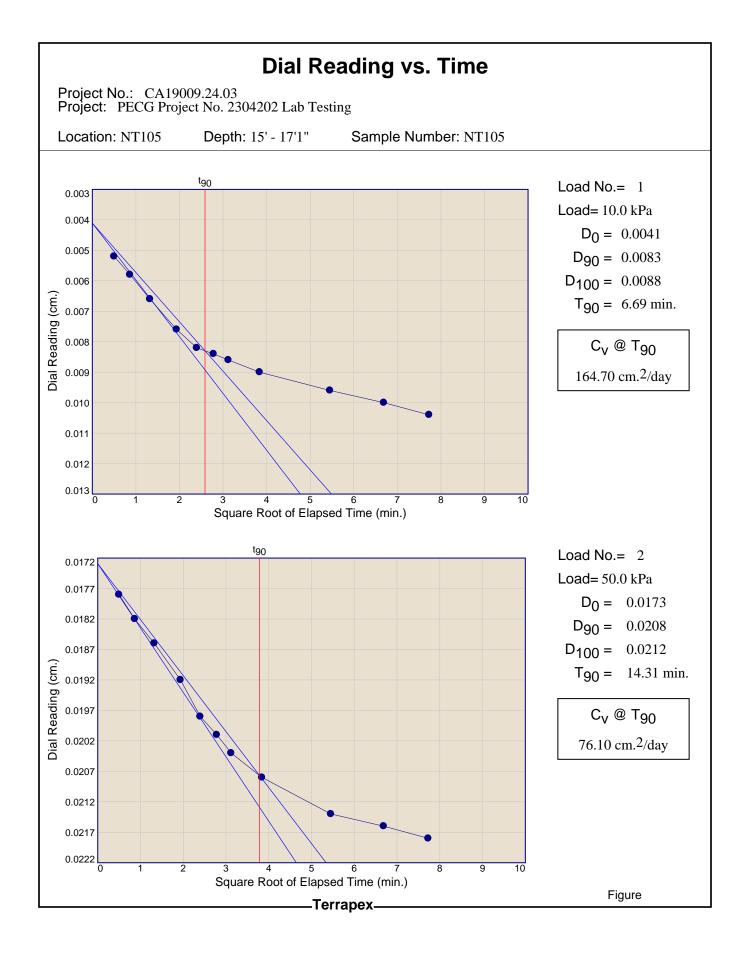


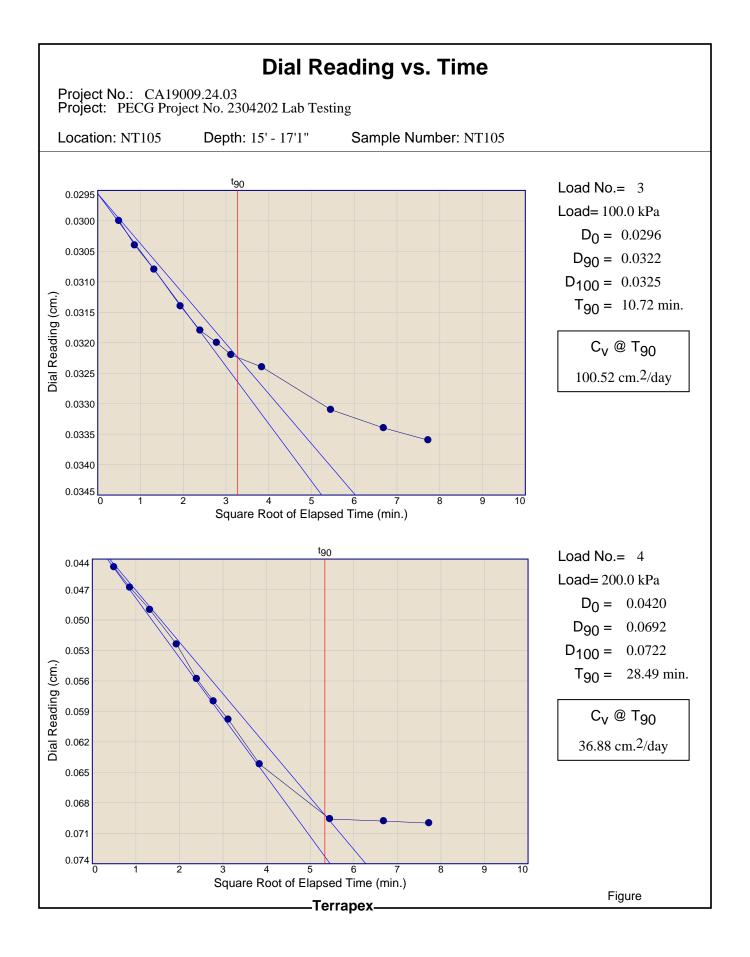


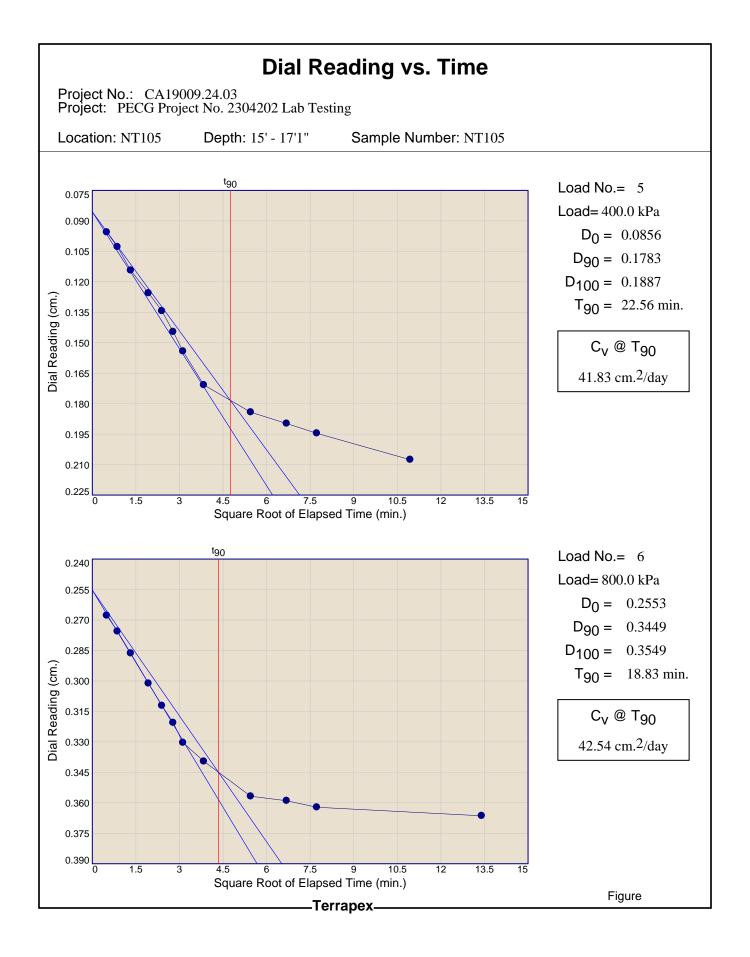


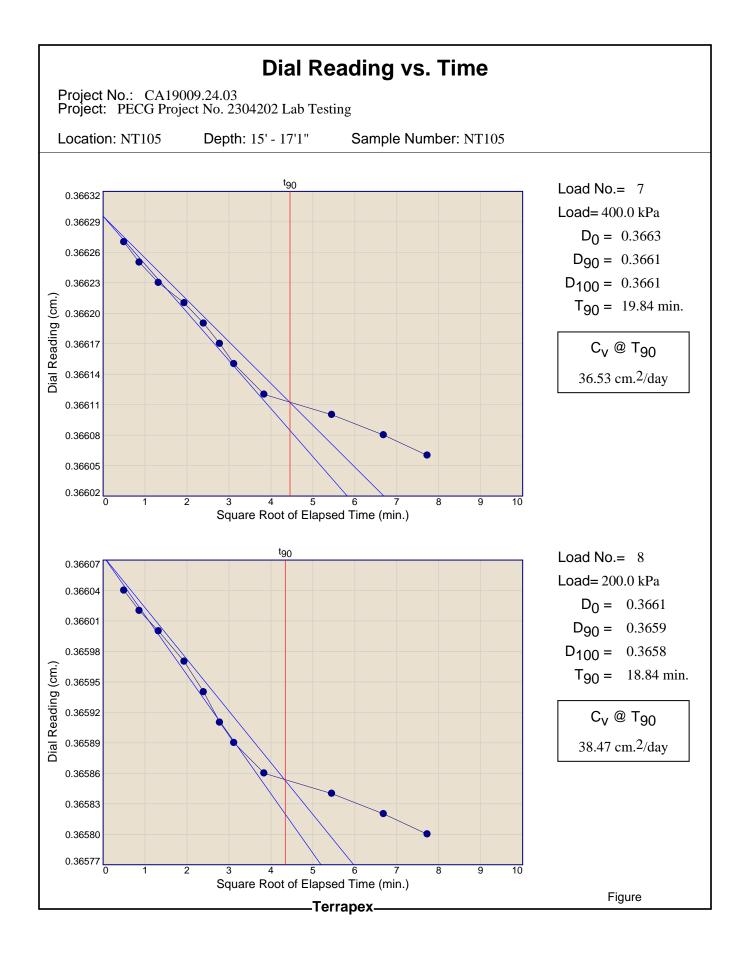


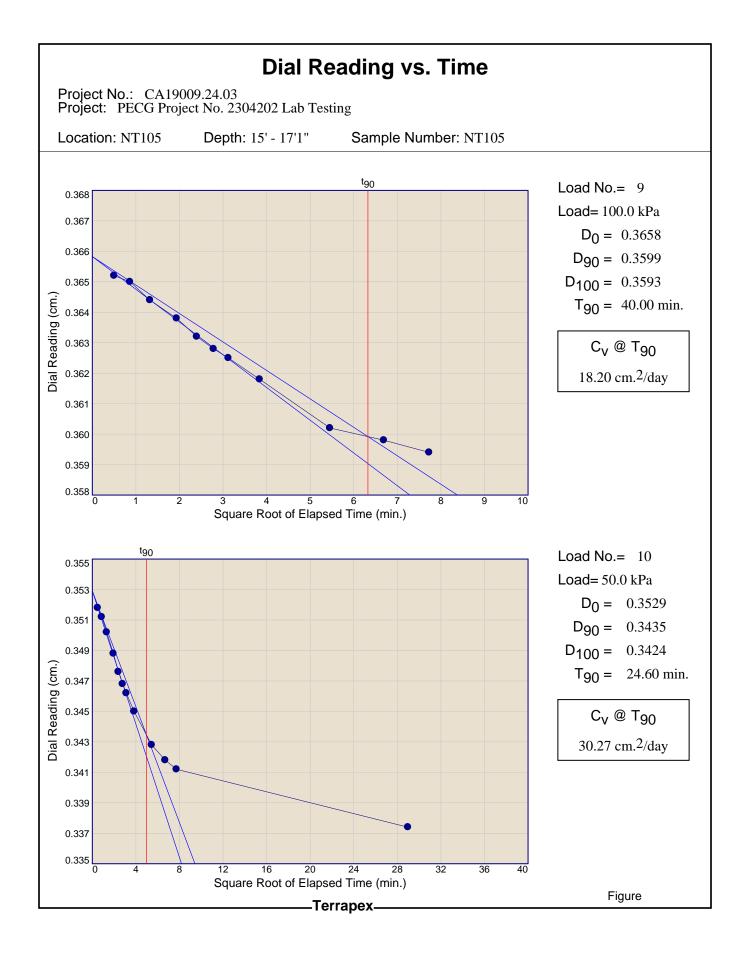
 Tested By: John Ramachandran
 Checked By: Demetra Matthews

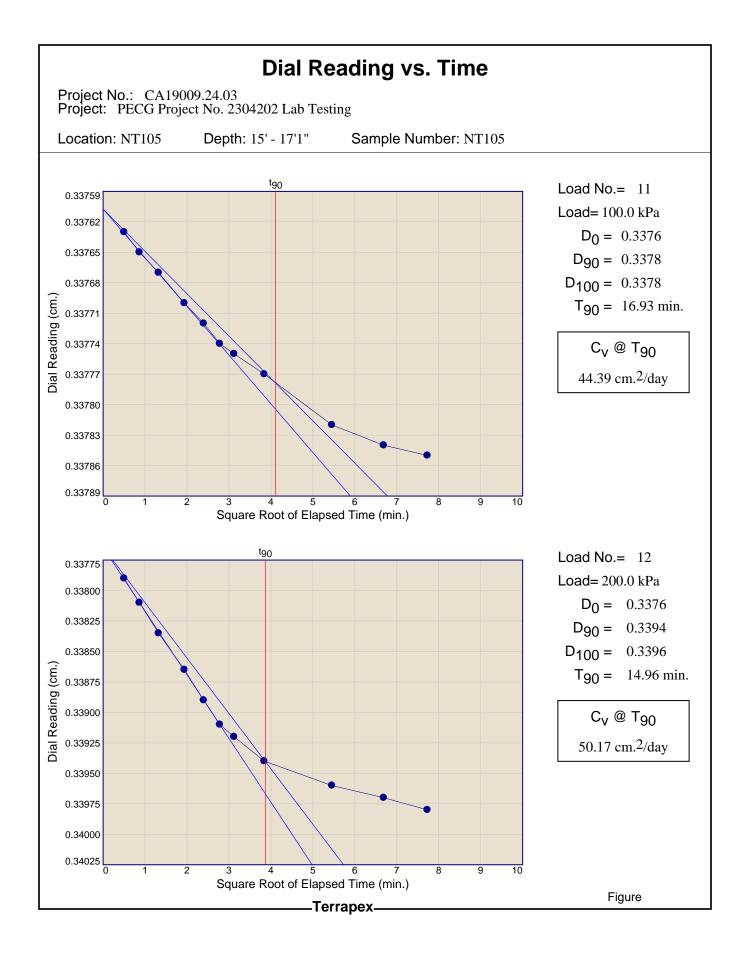


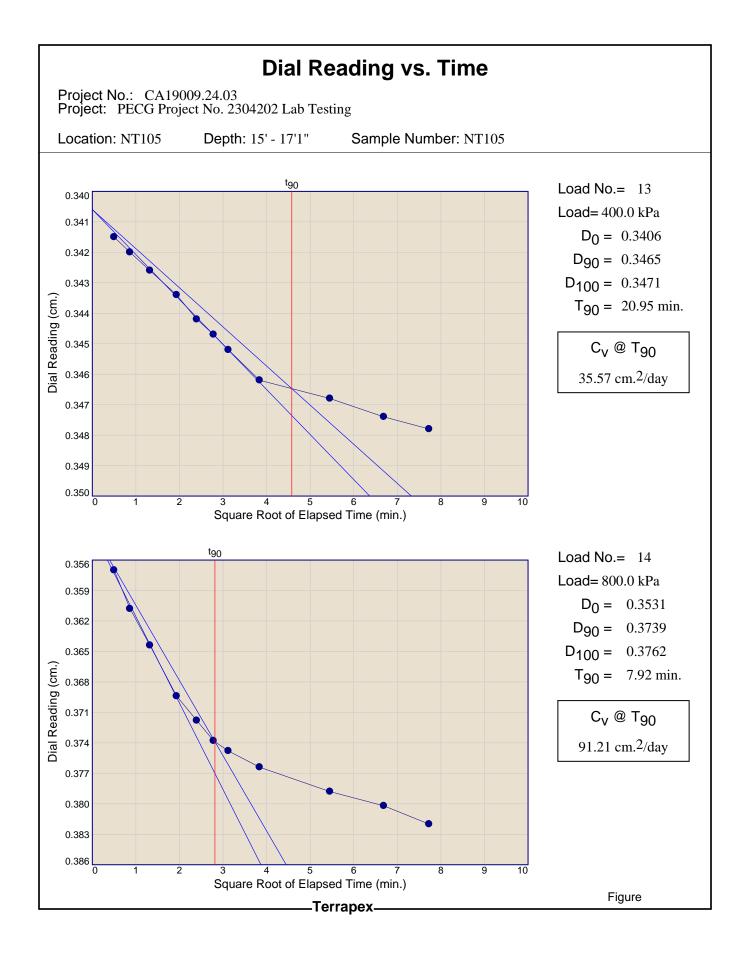


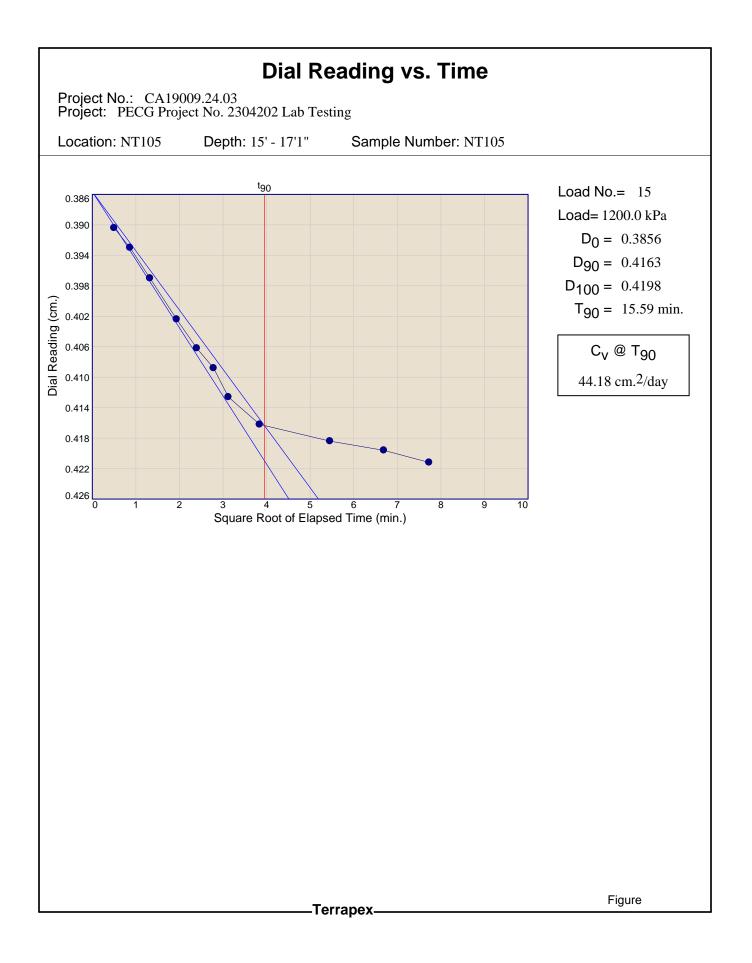












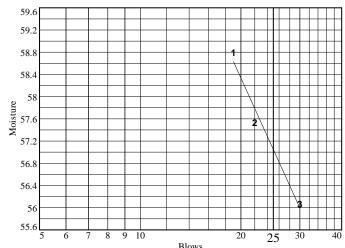
LIQUID AND PLASTIC LIMIT TEST DATA

Client: Palmer Project: PECG PRJ # 2304202 ONTC Additional testing Project Number: CA19009.23.18 Location: New Timmins Depth: 20' - 22' Material Description: SILTY CLAY grey Testing Remarks: Test Date: October 23, 2023 Tested by: AM

Liquid Limit Data

Sample Number: BH23-NT12

Run No.	1	2	3	4	5	6
Wet+Tare	20.97	20.83	20.01			
Dry+Tare	18.43	18.35	17.84			
Tare	14.11	14.04	13.97			
# Blows	19	22	30			
Moisture	58.8	57.5	56.1			



1 2 3 26.96 27.54 25.87 25.87 26.40 25.87	
25.87 26.40	
20.80 21.22	
21.5 22.0	
21.5 22.0	

2023-10-30

57.0

21.8 35.2

Liquid Limit= _

Plastic Limit= ____

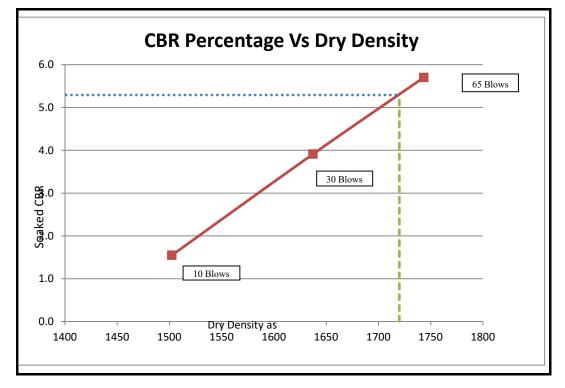
Plasticity Index=



Tel: 905 597 8383 • Fax: 90

<u>CBR (California Bearing Ratio) Testing of Subsoils</u> <u>ASTM D 1883-14</u>

		Date:	October 6, 2023
Proejct:	23-1060-08	Client: :	Palmer
PNJ Lab:	9932	Location:	Timmins
Sample Type:	Native	Date Sammpled:	N/A



Reported CBR Value @ penetration of 2.54mm (%) Dry Unit Weight of Soil (KG/m³) Soaking Duration (Hour) Maximum Swell (%) Surcharge Weights used (g)

Reviewed By

Tested By KR

Prabhdeep Lubana, P.Eng.

5.29

1720

24.5

96



Tel: 905 597 8383 • Fax: 9(

CBR (California Bearing Ratio) Testing of Subsoils ASTM D 1883-14

Project:	23-1060-08	Client: :	Palmer	
PNJ Lab:	9932	Location:	Timmins	
Sample Type:	Native	Date Sammpled:	N/A	

10 Blows

Penetration,	Standard Stress,	Observed		Moistur	e Content, %	Dry Density
,	,	Stress, Mpa	CBR, %	Molded	11.8	(kg/m ³)
mm	Мра	Stress, Mpa		After Soaki	ng 27.1	1502
2.54	6.89	0.107	1.5			
5.08	10.34	0.143	1.4	Sv	vell %	87.3%
7.62	13.10	0.167	1.3		7.1	

30 Blows

ľ	Penetration,	Standard Stress,	Observed		Moisture Content, %		Dry Density
I	,	,	Observed Stress, Mpa	CBR, %	Molded	12.1	(kg/m ³)
	mm	Мра	Stress, Mpa		After Soakin	ng 22.9	1637
ľ	2.54	6.89	0.270	3.9			
ľ	5.08	10.34	0.398	3.9	Swell %		95.2%
I	7.62	13.10	0.471	3.6	2	24.6	

65 Blows

ľ	Penetration,	Standard Stress,	Observed		Moisture Content, %		Dry Density
	,	Mpa	Stress, Mpa	CBR, %	Molded	10.8	(kg/m³)
	mm	Ivipa	Stress, Mpa		After Soaki	ng 22.1	1743
ſ	2.54	6.89	0.393	5.7			
ľ	5.08	10.34	0.612	5.9	Swell %		101.4%
ĺ	7.62	13.10	0.756	5.8		21.2	

Tested By

KR

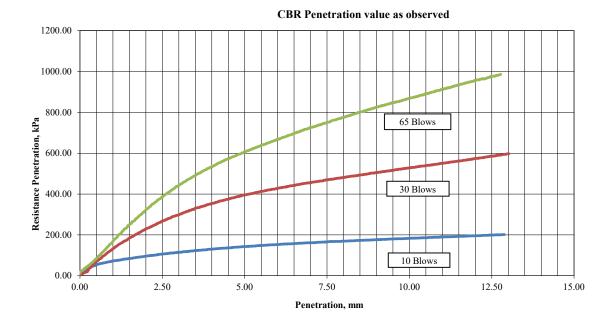
Reviewed By Prabhdeep Lubana, P.Eng.



Tel: 905 597 8383 • Fax: 90

CBR (California Bearing Ratio) Testing of Subsoils ASTM D 1883-14

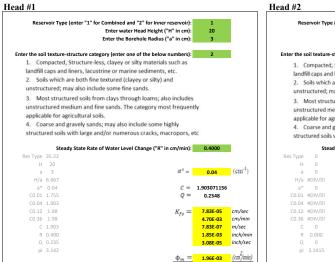
Project:	23-1060-08	Client: :	Palmer	
PNJ Lab:	9932	Location:	Timmins	_
Sample Type:	Native	Date Sammpled:	N/A	

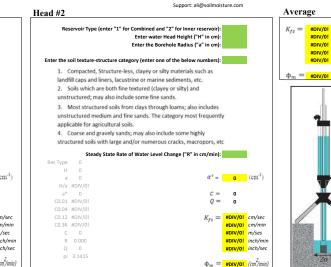






sourcesture Guelph Permeameter Calculations - GP1





Input

Result

K_{fs} = #DIV/0! cm/sec #DIV/0! cm/min #DIV/0! m/s #DIV/0! inch/min #DIV/0! inch/sec $\phi_m = \frac{\# DIV/0!}{(cm/min)}$

Cabrill has been as a balance of the particular part where Her Bar has been been been been been been as a construction been being the fensjelle (andra mine fanjanske i načenanja i 1990) logi bina unita (advoitel andrika minera) naturativa odvjag Berna unitanisti a do a socio v in altanisti milo intere destanari, (a unitanisti (2019) nit 1993.

Soil Texture-Structure Category	α*(cm-1)	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$\begin{split} C_1 &= \left(\frac{H_1/_a}{2.102 + 0.118(H_1/_a)}\right)^{0.655} \\ C_2 &= \left(\frac{H_2/_a}{2.102 + 0.118(H_2/_a)}\right)^{0.655} \end{split}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$\begin{split} C_1 &= \left(\frac{H_1/_a}{1.992 + 0.091(H_1/_a)} \right)^{0.683} \\ C_2 &= \left(\frac{H_2/_a}{1.992 + 0.091(H_2/_a)} \right)^{0.683} \end{split}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$\begin{split} C_1 &= \left(\frac{H_1/_a}{2.074 + 0.093 (H_1/_a)}\right)^{0.754} \\ C_2 &= \left(\frac{H_2/_a}{2.074 + 0.093 (H_2/_a)}\right)^{0.754} \end{split}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$\begin{split} C_1 &= \left(\frac{H_{1/a}}{2.074 + 0.093 (H_{1/a})}\right)^{0.754} \\ C_2 &= \left(\frac{H_{2/a}}{2.074 + 0.093 (H_{2/a})}\right)^{0.754} \end{split}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fg} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), a^* is Macroscopic capillary length parameter (from Table 2), α is Borchele radius (cm), H_2 is the first head of water established in borchele (cm), H_2 is the second head of water established in borchele (cm) and Cis Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \tilde{R}_1 \times 35.22$	$K_{fx} = \frac{C_1 \times Q_1}{2\pi H_x^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_x}{a^+}\right)}$
One Head, Inner Reservoir	$Q_1 = \tilde{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
Two Head. Combined Reservoir	$Q_1 = \overline{R}_1 \times 35.22$ $Q_2 = \overline{R}_2 \times 35.22$	$\begin{split} G_1 &= \frac{H_2C_1}{\pi(2H_1H_2(H_2-H_2)+\pi^2(H_1C_2-H_2C_1))}\\ G_2 &= \frac{H_1C_2}{\pi(2H_1H_2(H_2-H_2)+\pi^2(H_1C_2-H_2C_1))}\\ K_{f_4} &= G_2Q_2 - G_3Q_1\\ G_3 &= \frac{(2H_2^2+\pi^2C_2)C_2}{2\pi(2H_1H_2(H_2-H_1)+\pi^2(H_1C_2-H_2C_1))} \end{split}$
Two Hearl, Inner Reservoir	$Q_1 = \overline{R}_1 \times 2.16$ $Q_2 = \overline{R}_2 \times 2.16$	$\begin{split} G_4 &= \frac{(2H_1^2 + a^2C_1)C_2}{2\pi \big(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1)\big)}\\ \Phi_m &= G_3Q_1 - G_4Q_2 \end{split}$

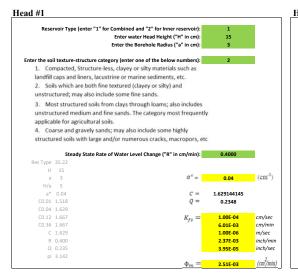
Two Head Met Reservoi Enter the soil tex 1. Compa landfill cap 2. Soils w unstructur 3. Most s unstructur applicable 4. Coarse structured

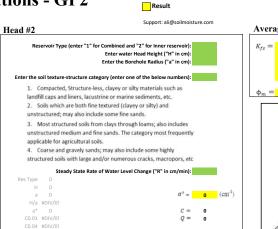
Res Typ

eth	od			
ir Ty	/pe (enter	"1" for Combined and "2" for Inner reservoir):		
		Enter the first water Head Height ("H1" in cm): er the second water Head Height ("H2" in cm):		
		Enter the Borehole Radius ("a" in cm):		
xtu	re-structu	re category (enter one of the below numbers):		
act	ed, Struct	ure-less, clayey or silty materials such as		
		lacustrine or marine sediments, etc.		
		h fine textured (clayey or silty) and		
		o include some fine sands.		
		bils from clays through loams; also includes		
		and fine sands. The category most frequent		
	ragricultu		iy	
		/ sands; may also include some highly		
u sc	ans with id	rge and/or numerous cracks, macropors, et		
		$\alpha^* =$	0	(cm ⁻¹)
Ste	ady State	Rate of Water Level Change ("R1" in cm/min):		
Ste	ady State	Rate of Water Level Change ("R2" in cm/min):		
		$Q_1 =$	0	
		$Q_2 =$	0	
		$C_{1} =$	0	
pe:	2.16	C ₂ =	0	
	#DIV/0!	-		
/a:	#DIV/0!	$G_1 =$	#DIV/0!	
01:	#DIV/0!			
01:	#DIV/0!	$G_2 =$	#DIV/0!	
	#DIV/0!			
04:	#DIV/0!	$G_3 =$	#DIV/0!	
	#DIV/0! #DIV/0!	<i>c</i> –	#DIV/0!	
12: 36:	#DIV/0! #DIV/0!	64 =	#010/01	
	#DIV/0!	<i>v.</i> =	#DIV/0!	cm/sec
		$n_{fz} =$	#DIV/0!	cm/min

DIV/0! cm/mir #DIV/0! m/sec #DIV/0! inch/mi #DIV/0! inch/sec $\phi_m = \#DIV/0! (cm^2/min)$

SOLHOISTURE Guelph Permeameter Calculations - GP2





C0.12 #DIV/0!

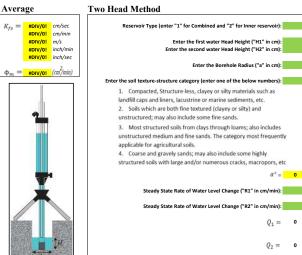
C0.36 #DIV/0!

R 0.000

pi 3.1415

0 0

Input



Res Type: 2.16

C1-0.01: #DIV/0! C2-0.01: #DIV/0!

C1-0.04: #DIV/01

C2-0.04: #DIV/01

C1-0.12: #DIV/01 C2-0.12: #DIV/0!

C1-0.36: #DIV/0! C2-0.36: #DIV/0!

H1/a: #DIV/0! H2/a: #DIV/0!

Enter the first water Head Height ("H1" in cm):

Enter the Borehole Radius ("a" in cm):

 $\alpha^* = 0$ (cm⁻¹)

 $Q_1 = 0$

 $Q_2 = 0$

C₁ = 0

C₂ = 0

 $G_1 = #DIV/0!$

 $G_2 = \#DIV/0!$

 $G_3 = \#DIV/0!$

 $G_4 = \# D I V / 0!$

K_{fs} = **#DIV/0!** cm/sec #DIV/0! cm/min #DIV/01 m/sec #DIV/0! inch/mir #DIV/0! inch/sec $\phi_m = \#DIV/0! (cm^2/min)$

Enter the second water Head Height ("H2" in cm):

the water second where it dependences is a site of Alexandre backweet and the first fit is a second material matterial janijali inastais natus pahimine kontenanya ingkan ingkanananini kanatananini kanatananini ni menal betamenatus Beara ang materiyasiya yani na teraini antuka kara an inainatan da materini kanatan intuka (jing ala, 1914).

Soil Texture-Structure Category	a*(cm-1)	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$\begin{split} C_1 &= \left(\frac{H_1/_a}{2.102 + 0.118(H_1/_a)}\right)^{0.655} \\ C_2 &= \left(\frac{H_2/_a}{2.102 + 0.118(H_2/_a)}\right)^{0.655} \end{split}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$\begin{split} C_1 &= \left(\frac{H_1/_a}{1.992 + 0.091(H_1/_a)}\right)^{0.683} \\ C_2 &= \left(\frac{H_2/_a}{1.992 + 0.091(H_2/_a)}\right)^{0.663} \end{split}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_{1} = \left(\frac{H_{1/a}}{2.074 + 0.093(H_{1/a})}\right)^{0.754}$ $C_{2} = \left(\frac{H_{2/a}}{2.074 + 0.093(H_{2/a})}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$\begin{split} C_1 &= \left(\frac{H_1/a}{2.074 + 0.093 (^{H_1}/a)}\right)^{0.754} \\ C_2 &= \left(\frac{H_2/a}{2.074 + 0.093 (^{H_2}/a)}\right)^{0.754} \end{split}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fg} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matrix flux potential (cm²/s), a^* is Macroscopic capillary length parameter (from Table 2), α is Borchele radius (cm), H_2 is the first head of water established in borchele (cm), H_2 is the second head of water established in borchele (cm) and Cis Shape factor (from Table 2).

K_{fs} = **#DIV/0!** cm/sec

 $\phi_m = \frac{\#\text{DIV}/0!}{(cm^2/min)}$

#DIV/0! cm/min

#DIV/0! inch/min

#DIV/0! inch/sec

#DIV/0! m/ses

One Head, Combined Reservoir	$Q_1 = \tilde{R}_1 \times 35.22$	$\kappa_{fx} = \frac{C_1 \times Q_1}{2\pi H_2^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a^2}\right)}$
One Head, Inner Reservoir	$Q_1 = \tilde{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
Two Head. Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$\begin{split} G_1 &= \frac{H_2C_1}{\pi(2H_1H_2(H_2-H_1)+a^2(H_1C_2-H_2C_1))}\\ G_2 &= \frac{H_1C_2}{\pi(2H_1H_2(H_2-H_2)+a^2(H_1C_2-H_2C_1))}\\ K_{f_4} &= G_2Q_2 - G_2Q_1\\ G_3 &= \frac{(2H_2^2+a^2C_2)C_1}{2\pi(2H_1H_2(H_2-H_1)+a^2(H_1C_2-H_2C_1))} \end{split}$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$\begin{split} G_{k} &= \frac{(2H_{k}^{2} + a^{2}C_{k})C_{2}}{2\pi \big(2H_{1}H_{2}(H_{2} - H_{1}) + a^{2}(H_{1}C_{2} - H_{2}C_{1})\big)} \\ \Phi_{m} &= G_{3}Q_{1} - G_{4}Q_{2} \end{split}$





ALS Canada Ltd.



	CERTIFIC	CATE OF ANALYSIS		
Work Order	: WT2326075	Page	: 1 of 4	
Client	: Palmer Environmental Consulting Group Inc.	Laboratory	: ALS Environmental - Waterloo	
Contact	: Teddy Ou	Account Manager	: Andrew Martin	
Address	: 74 Berkeley Street	Address	: 60 Northland Road, Unit 1	
	Toronto ON Canada M5V 1E3		Waterloo ON Canada N2V 2B8	
Telephone	:	Telephone	: +1 519 886 6910	
Project	: 2304202	Date Samples Received	: 21-Aug-2023 15:30	
PO		Date Analysis Commenced	: 22-Aug-2023	
C-O-C number	: 20-1080778	Issue Date	: 01-Sep-2023 16:20	
Sampler	: CLIENT			
Site	:			
Quote number	: (Q88296) PALMER 2023 STANDING OFFER			
No. of samples received	: 10			
No. of samples analysed	: 10			

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Nik Perkio Niral Patel	Inorganics Analyst	Inorganics, Waterloo, Ontario Centralized Prep, Waterloo, Ontario



General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference. Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances LOR: Limit of Reporting (detection limit).

Unit	Description
%	percent
μS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.



Analytical Results

Sub-Matrix: Soil			Cli	ent sample ID	BH- NT-21/ SS5	BH- NT-19/ SS4	BH- NT-17/ SS4	BH- NT-12/ SS2	BH- NT-11/ SS3
(Matrix: Soil/Solid)									
			Client samp	ling date / time	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2326075-001	WT2326075-002	WT2326075-003	WT2326075-004	WT2326075-005
					Result	Result	Result	Result	Result
Physical Tests									
Conductivity (1:2 leachate)		E100-L/WT	5.00	μS/cm	206	150	212	197	140
Moisture		E144/WT	0.25	%	31.1	18.5	17.0	18.0	17.0
Oxidation-reduction potential [ORP]		E125/WT	0.10	mV	258	275	271	283	293
pH (1:2 soil:CaCl2-aq)		E108A/WT	0.10	pH units	7.77	7.72	7.78	7.73	7.68
Resistivity		EC100R/WT	100	ohm cm	4850	6670	4720	5080	7140
Inorganics									
Sulfides, acid volatile		E396-L/WT	0.20	mg/kg	<0.29	<0.24	<0.24	<0.24	<0.24
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6		5.0	mg/kg	6.2	22.7	75.5	64.9	20.6
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	22	<20	<20	<20	<20

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Analytical Results

Sub-Matrix: Soil			Cl	ient sample ID	BH- NT-9/ SS3	BH- NT-6/ SS2	BH- NT-3/ SS4	BH- NT-4A/ SS3	BH- NT-1/ SS3
(Matrix: Soil/Solid)									
			Client samp	ling date / time	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00	18-Aug-2023 00:00
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2326075-006	WT2326075-007	WT2326075-008	WT2326075-009	WT2326075-010
					Result	Result	Result	Result	Result
Physical Tests									
Conductivity (1:2 leachate)		E100-L/WT	5.00	µS/cm	105	162	317	204	413
Moisture		E144/WT	0.25	%	16.1	14.8	29.0	10.4	26.0
Oxidation-reduction potential [ORP]		E125/WT	0.10	mV	292	304	300	279	296
pH (1:2 soil:CaCl2-aq)		E108A/WT	0.10	pH units	7.71	7.61	7.73	8.09	7.73
Resistivity		EC100R/WT	100	ohm cm	9520	6170	3150	4900	2420
Inorganics									
Sulfides, acid volatile		E396-L/WT	0.20	mg/kg	<0.23	<0.23	<0.28	<0.22	<0.26
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.CI/WT	5.0	mg/kg	14.9	14.6	91.7	31.4	132
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	<20	<20	30	51	24

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



QUALITY CONTROL INTERPRETIVE REPORT

Work Order	WT2326075	Page	: 1 of 14
Client	Palmer Environmental Consulting Group Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Teddy Ou	Account Manager	: Andrew Martin
Address	:74 Berkeley Street	Address	: 60 Northland Road, Unit 1
	Toronto ON Canada M5V 1E3		Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: 2304202	Date Samples Received	: 21-Aug-2023 15:30
PO	:	Issue Date	: 01-Sep-2023 16:20
C-O-C number	: 20-1080778		
Sampler	: CLIENT		
Site	:		
Quote number	: (Q88296) PALMER 2023 STANDING OFFER		
No. of samples received	:10		
No. of samples analysed	:10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- <u>No</u> Method Blank value outliers occur.
- <u>No</u> Duplicate outliers occur.
- <u>No</u> Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

• <u>No</u> Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

• No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples • No Quality Control Sample Frequency Outliers occur.



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: Soil/Solid					E	/aluation: × =	Holding time exce	edance ; •	= Within	Holding Tim
Analyte Group	Method	Sampling Date	Ext	raction / Pr	reparation			Analys	sis	
Container / Client Sample ID(s)			Preparation	Holdin	g Times	Eval	Analysis Date	Holding	g Times	Eval
			Date	Rec	Actual			Rec	Actual	
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-11/ SS3	E396-L	18-Aug-2023	24-Aug-2023	14	7 days	1	24-Aug-2023	7 days	0 days	✓
				days						
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-12/ SS2	E396-L	18-Aug-2023	24-Aug-2023	14	7 days	1	24-Aug-2023	7 days	0 days	✓
				days						
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-17/ SS4	E396-L	18-Aug-2023	24-Aug-2023	14	7 days	1	24-Aug-2023	7 days	0 days	✓
				days						
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-19/ SS4	E396-L	18-Aug-2023	24-Aug-2023	14	7 days	1	24-Aug-2023	7 days	0 days	1
				days						
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-21/ SS5	E396-L	18-Aug-2023	24-Aug-2023	14	7 days	1	24-Aug-2023	7 days	0 days	1
				days						
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-1/ SS3	E396-L	18-Aug-2023	25-Aug-2023	14	8 days	1	25-Aug-2023	7 days	0 days	1
				days						
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-3/ SS4	E396-L	18-Aug-2023	25-Aug-2023	14	8 days	1	25-Aug-2023	7 days	0 days	1
				days						



atrix: Soil/Solid		Commilian Data	-				Holding time exceedance ; ✓ = With Analysis			
Inalyte Group	Method	Sampling Date		traction / Pr						
Container / Client Sample ID(s)			Preparation	-	g Times	Eval	Analysis Date		g Times	Eval
			Date	Rec	Actual			Rec	Actual	
norganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)				1	1 1					
Glass soil jar/Teflon lined cap [ON MECP]						,				
BH- NT-4A/ SS3	E396-L	18-Aug-2023	25-Aug-2023	14	8 days	1	25-Aug-2023	7 days	0 days	1
				days						
norganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-6/ SS2	E396-L	18-Aug-2023	25-Aug-2023	14	8 days	1	25-Aug-2023	7 days	0 days	✓
				days						
norganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-9/ SS3	E396-L	18-Aug-2023	25-Aug-2023	14	8 days	1	25-Aug-2023	7 days	0 days	✓
				days						
eachable Anions & Nutrients : Water Extractable Chloride by IC				-					1 1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-1/ SS3	E236.CI	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 davs	1
		· · · · · · · · · · · · · · · · · · ·	217.009 2020	days	. aaje		217 ag 2020	20 00,0	o aajo	
				uuys						
eachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E236.CI	18-Aug-2023	24-Aug-2023		7 days	1	24-Aug-2023	28 days	0 days	1
DH- N1-11/ 353	E230.CI	16-Aug-2025	24-Aug-2023	30	/ uays	•	24-Aug-2023	20 uays	0 uays	•
				days						
eachable Anions & Nutrients : Water Extractable Chloride by IC								1		
Glass soil jar/Teflon lined cap [ON MECP]	5000.01	40.4				,				
BH- NT-12/ SS2	E236.CI	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 days	~
				days						
eachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-17/ SS4	E236.CI	18-Aug-2023	24-Aug-2023	30	7 days	✓	24-Aug-2023	28 days	0 days	~
				days						
eachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-19/ SS4	E236.Cl	18-Aug-2023	24-Aug-2023	30	7 days	✓	24-Aug-2023	28 days	0 days	✓
				days						
				-				1	1 1	
eachable Anions & Nutrients : Water Extractable Chloride by IC										
eachable Anions & Nutrients : Water Extractable Chloride by IC Glass soil iar/Teflon lined cap ION MECP1										
eachable Anions & Nutrients : Water Extractable Chloride by IC Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E236.CI	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 days	1



Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis		is	
Container / Client Sample ID(s)			Preparation Date	Holding Rec	g Times Actual	Eval	Analysis Date	Holding	g Times Actual	Eval
eachable Anions & Nutrients : Water Extractable Chloride by IC			Dale	1100	Hotaal			1100	riotadi	
Glass soil jar/Teflon lined cap [ON MECP]							1			
BH- NT-3/ SS4	E236.CI	18-Aug-2023	24-Aug-2023	30 days	7 days	1	24-Aug-2023	28 days	0 days	~
eachable Anions & Nutrients : Water Extractable Chloride by IC								1	I I	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-4A/ SS3	E236.CI	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	~
eachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E236.CI	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	1
eachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E236.CI	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	~
eachable Anions & Nutrients : Water Extractable Sulfate by IC								1		
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	1
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	~
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	~
eachable Anions & Nutrients : Water Extractable Sulfate by IC								I	II	
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	1	24-Aug-2023	28 days	0 days	~
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E236.SO4	18-Aug-2023	24-Aug-2023	30 days	7 days	4	24-Aug-2023	28 days	0 days	~



	A de the end	Compling Data		traction (D	reneration		Holding time exceedance ; ✓ = Within <i>Analysis</i>			
nalyte Group	Method	Sampling Date		traction / Pr	· ·					
Container / Client Sample ID(s)			Preparation	-	g Times	Eval	Analysis Date		g Times	Eval
			Date	Rec	Actual			Rec	Actual	
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP]	5000.004	40.4 0000				,				,
BH- NT-21/ SS5	E236.SO4	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 days	1
				days						
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-3/ SS4	E236.SO4	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 days	✓
				days						
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-4A/ SS3	E236.SO4	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 days	✓
				days						
eachable Anions & Nutrients : Water Extractable Sulfate by IC				-					1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-6/ SS2	E236.SO4	18-Aug-2023	24-Aug-2023	30	7 days	1	24-Aug-2023	28 days	0 davs	1
			217.009 2020	days				20 00,0	° aujo	
				uays						
eachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP]	E236.SO4	19 Aug 2022	24 Aug 2022		7 dava	1	24 Aug 2022	28 days	0 days	1
BH- NT-9/ SS3	E230.304	18-Aug-2023	24-Aug-2023	30	7 days	•	24-Aug-2023	zo uays	0 days	•
				days						
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-1/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30	7 days	✓	25-Aug-2023	30 days	8 days	1
				days						
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-11/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30	7 days	✓	25-Aug-2023	30 days	8 days	✓
				days						
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)									· · · · · ·	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-12/ SS2	E100-L	18-Aug-2023	24-Aug-2023	30	7 days	1	25-Aug-2023	30 days	8 days	1
		-	-	days	-		-			
				,			I	1		
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Blass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E100-L	18-Aug-2023	24-Aug-2023	30	7 days	1	25-Aug-2023	30 days	8 days	1



Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis		sis	
Container / Client Sample ID(s)			Preparation Date	Holding Rec	g Times Actual	Eval	Analysis Date	Holding	g Times Actual	Eval
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)			2010						<u> </u>	
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	1	25-Aug-2023	30 days	8 days	1
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)									1	
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	√	25-Aug-2023	30 days	8 days	~
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	1	25-Aug-2023	30 days	8 days	1
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	1	25-Aug-2023	30 days	8 days	~
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)									<u> </u>	
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	✓
hysical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E100-L	18-Aug-2023	24-Aug-2023	30 days	7 days	✓	25-Aug-2023	30 days	8 days	1
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E144	18-Aug-2023					22-Aug-2023		5 days	
Physical Tests : Moisture Content by Gravimetry							1	I	1	
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-11/ SS3	E144	18-Aug-2023					22-Aug-2023		5 days	
Physical Tests : Moisture Content by Gravimetry									1	
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E144	18-Aug-2023					22-Aug-2023		5 days	



Analyte Group	Method	Sampling Date	Exi	traction / P	reparation			Analy	sis	
Container / Client Sample ID(s)		Camping 2 ato	Preparation		g Times	Eval	Analysis Date	Holdin	g Times	Eval
			Date	Rec	Actual	Lvar	Analysis Date	Rec	Actual	Lvar
hysical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-17/ SS4	E144	18-Aug-2023					22-Aug-2023		5 days	
hysical Tests : Moisture Content by Gravimetry					1				1 1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-19/ SS4	E144	18-Aug-2023					22-Aug-2023		5 days	
hysical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-21/ SS5	E144	18-Aug-2023					22-Aug-2023		5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-3/ SS4	E144	18-Aug-2023					22-Aug-2023		5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-4A/ SS3	E144	18-Aug-2023					22-Aug-2023		5 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-6/ SS2	E144	18-Aug-2023					22-Aug-2023		5 days	
hysical Tests : Moisture Content by Gravimetry				_						
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-9/ SS3	E144	18-Aug-2023					22-Aug-2023		5 days	
Physical Tests : ORP by Electrode							1	1	1 1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-1/ SS3	E125	18-Aug-2023	23-Aug-2023	180 days	6 days	4	24-Aug-2023	180 days	7 days	1
hysical Tests : ORP by Electrode						I			- 1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-11/ SS3	E125	18-Aug-2023	23-Aug-2023	180	6 days	1	24-Aug-2023	180	7 days	✓
				days				days		



nalyte Group	Method	Sampling Date	Extraction / Preparation					Analys	Analysis	
Container / Client Sample ID(s)			Preparation	Holdin	g Times	Eval	Analysis Date	Holding	g Times	Eval
			Date	Rec	Actual	Lva	Analysis Date	Rec	Actual	LVU
hysical Tests : ORP by Electrode			Dute							
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-12/ SS2	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	1
				days				days		
hysical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-17/ SS4	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	✓
				days				days		
hysical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-19/ SS4	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	~
				days				days		
hysical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-21/ SS5	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	√
				days				days		
hysical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-3/ SS4	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	√
				days				days		
hysical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-4A/ SS3	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	1
				days				days		
hysical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-6/ SS2	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	✓
				days				days		
hysical Tests : ORP by Electrode					<u> </u>				ı 1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-9/ SS3	E125	18-Aug-2023	23-Aug-2023	180	6 days	✓	24-Aug-2023	180	7 days	1
				days				days		
hysical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received								-	1 1	
Glass soil jar/Teflon lined cap [ON MECP]										
BH- NT-11/ SS3	E108A	18-Aug-2023	23-Aug-2023	30	5 days	✓	24-Aug-2023	30 days	7 days	1
	1	Ŭ	5	days			l v	1		



Aatrix: Soil/Solid Analyte Group	Method	Sampling Date	Evi	traction / Pr			Holding time exce	Analys		
Container / Client Sample ID(s)	Method	Sampling Date	Preparation Date		g Times Actual	Eval	Analysis Date	1 <u> </u>	Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-12/ SS2	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	¥	24-Aug-2023	30 days	7 days	4
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-17/ SS4	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	✓	24-Aug-2023	30 days	7 days	4
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-19/ SS4	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	~	24-Aug-2023	30 days	7 days	4
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-21/ SS5	E108A	18-Aug-2023	23-Aug-2023	30 days	5 days	1	24-Aug-2023	30 days	7 days	1
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-1/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	V	25-Aug-2023	30 days	8 days	1
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-3/ SS4	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	V	25-Aug-2023	30 days	8 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-4A/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	√	25-Aug-2023	30 days	8 days	1
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-6/ SS2	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	~	25-Aug-2023	30 days	8 days	1
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH- NT-9/ SS3	E108A	18-Aug-2023	23-Aug-2023	30 days	6 days	√	25-Aug-2023	30 days	8 days	✓

Legend & Qualifier Definitions

 Page
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 Work Order
 :
 WT2326075

 Client
 :
 Palmer Environmental Consulting Group Inc.

 Project
 :
 2304202



Rec. HT: ALS recommended hold time (see units).



Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: Soil/Solid		Evaluatio	n: × = QC freque	ency outside spe	ecification; ✓ = 0	QC frequency wit	hin specificatio
Quality Control Sample Type			Co	ount		Frequency (%)	
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1103763	2	18	11.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1097635	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	1098416	2	33	6.0	5.0	✓
ORP by Electrode	E125	1099994	1	18	5.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1099425	2	40	5.0	5.0	~
Water Extractable Chloride by IC	E236.Cl	1102290	1	15	6.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1102289	1	15	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1103763	2	18	11.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1097635	2	19	10.5	10.0	~
Moisture Content by Gravimetry	E144	1098416	2	33	6.0	5.0	✓
ORP by Electrode	E125	1099994	1	18	5.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1099425	2	40	5.0	5.0	✓
Water Extractable Chloride by IC	E236.CI	1102290	2	15	13.3	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1102289	2	15	13.3	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1103763	2	18	11.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1097635	1	19	5.2	5.0	~
Moisture Content by Gravimetry	E144	1098416	2	33	6.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1102290	1	15	6.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1102289	1	15	6.6	5.0	~



Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction)	E100-L	Soil/Solid	CSSS Ch. 15	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is
(Low Level)			(mod)/APHA 2510	measured by immersion of a conductivity cell with platinum electrodes into a soil sample
	ALS Environmental -		(mod)	that has been added in a defined ratio of soil to deionized water, then shaken well and
	Waterloo			allowed to settle. Conductance is measured in the fluid that is observed in the upper
				layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108A	Soil/Solid	MECP E3137A	pH is determined by potentiometric measurement with a pH electrode, and is conducted
- As Received				at ambient laboratory temperature (normally 20 \pm 5°C) and is carried out in accordance
	ALS Environmental -			with procedures described in the Analytical Protocol (prescriptive method). A minimum
	Waterloo			10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium
				chloride solution by shaking for at least 30 minutes. The aqueous layer is separated
				from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter
				and electrode.
ORP by Electrode	E125	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the
				platinum metal-reference electrode employed in the analysis, measured in mV.
	ALS Environmental -			
Moisture Content by Gravimetry	Waterloo	Soil/Solid		
Molsture Content by Gravinetry	E144	3011/30110	CCME PHC in Soil - Tier	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is
	ALS Environmental -		1	calculated as the weight loss (due to water) divided by the wet weight of the sample,
	Waterloo			expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and /or UV
- , - , - , - , - , - , - , - , - , - ,	LLUU.OI			detection using a soil sample that has been added in a defined ratio of soil to deionized
	ALS Environmental -			water, then shaken well and allowed to settle. Anions are measured in the fluid that is
	Waterloo			observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and /or UV
				detection using a soil sample that has been added in a defined ratio of soil to deionized
	ALS Environmental -			water, then shaken well and allowed to settle. Anions are measured in the fluid that is
	Waterloo			observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry	E396-L	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500
(0.2 mg/kg)				S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
	ALS Environmental -			
	Waterloo			
Resistivity Calculation for Soil Using E100-L	EC100R	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1
				water:soil leachate (dry weight). This method is intended as a rapid approximation for
	ALS Environmental -			Soil Resistivity. Where high accuracy results are required, direct measurement of Soil
	Waterloo			Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Page	:	14 of 14
Work Order	:	WT2326075
Client	:	Palmer Environmental Consulting Group Inc.
Project	:	2304202



Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108	Soil/Solid	BC WLAP METHOD:	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample
			PH, ELECTROMETRIC,	with deionized/distilled water at a 1:2 ratio of sediment to water.
	ALS Environmental -		SOIL	
	Waterloo			
Leach 1:2 Soil : 0.01CaCl2 - As Received for	EP108A	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M
pH				calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is
	ALS Environmental -			separated from the soil by centrifuging, settling or decanting and then analyzed using a
	Waterloo			pH meter and electrode.
Preparation of ORP by Electrode	EP125	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP
				meter.
	ALS Environmental -			
	Waterloo			
Anions Leach 1:10 Soil:Water (Dry)	EP236	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30
				minutes. The extract is filtered and analyzed by ion chromatography.
	ALS Environmental -			
	Waterloo			
Distillation for Acid Volatile Sulfide in Soil	EP396-L	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample
				that has been treated with hydrochloric acid within a purge and trap system, where the
	ALS Environmental -			evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.
	Waterloo			

ALS Canada Ltd.



QUALITY CONTROL REPORT Work Order Page : 1 of 6 WT2326075 Client : Palmer Environmental Consulting Group Inc. Laboratory : ALS Environmental - Waterloo Account Manager : Andrew Martin Contact : Teddy Ou Address Address :74 Berkeley Street :60 Northland Road, Unit 1 Toronto ON Canada M5V 1E3 Waterloo, Ontario Canada N2V 2B8 Telephone Telephone :+1 519 886 6910 Project Date Samples Received :21-Aug-2023 15:30 :2304202 PO Date Analysis Commenced :22-Aug-2023 :----C-O-C number Issue Date :20-1080778 :01-Sep-2023 16:27 Sampler : CLIENT Site · ____ Quote number : (Q88296) PALMER 2023 STANDING OFFER No. of samples received :10 No. of samples analysed :10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Nik Perkio	Inorganics Analyst	Waterloo Inorganics, Waterloo, Ontario
Niral Patel		Waterloo Centralized Prep, Waterloo, Ontario



General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percent Difference

= Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.



Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: Soil/Solid							Labora	Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier			
Physical Tests (QC	Lot: 1097635)													
WT2326061-002	Anonymous	Conductivity (1:2 leachate)		E100-L	5.00	μS/cm	0.278 mS/cm	273	1.81%	20%				
Physical Tests (QC	Lot: 1098386)													
EO2307467-001	Anonymous	pH (1:2 soil:CaCl2-aq)		E108A	0.10	pH units	7.70	7.80	1.29%	5%				
Physical Tests (QC	Lot: 1098388)													
HA2300549-003	Anonymous	Moisture		E144	0.25	%	25.6	27.1	5.75%	20%				
Physical Tests (QC	Lot: 1098416)													
WT2325790-006	Anonymous	Moisture		E144	0.25	%	8.41	8.32	1.15%	20%				
Physical Tests (QC	Lot: 1099425)													
WT2326032-003	Anonymous	pH (1:2 soil:CaCl2-aq)		E108A	0.10	pH units	7.08	7.23	2.10%	5%				
Physical Tests (QC	Lot: 1099994)													
WT2325868-001	Anonymous	Oxidation-reduction potential [ORP]		E125	0.10	mV	276	295	6.65%	25%				
Inorganics (QC Lot	: 1102211)													
WT2325833-004	Anonymous	Sulfides, acid volatile		E396-L	0.23	mg/kg	<0.23	<0.23	0.0002	Diff <2x LOR				
Inorganics (QC Lot	: 1103763)													
WT2326054-001	Anonymous	Sulfides, acid volatile		E396-L	0.22	mg/kg	1.14	0.98	14.2%	45%				
Leachable Anions &	Nutrients (QC Lot: 110	2289)							1					
WT2326054-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	189	196	3.21%	30%				
Leachable Anions &	Nutrients (QC Lot: 110	2290)												
WT2326054-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	779	804	3.15%	30%				



Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Analyte	CAS Number Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1097635)					
Conductivity (1:2 leachate)	E100-L	5	μS/cm	<5.00	
Physical Tests (QCLot: 1098388)					
Moisture	E144	0.25	%	<0.25	
Physical Tests (QCLot: 1098416)					
Moisture	E144	0.25	%	<0.25	
norganics (QCLot: 1102211)					
Sulfides, acid volatile	E396-L	0.2	mg/kg	<0.20	
norganics (QCLot: 1103763)					
Sulfides, acid volatile	E396-L	0.2	mg/kg	<0.20	
eachable Anions & Nutrients (QCLot	: 1102289)				
Sulfate, soluble ion content	14808-79-8 E236.SO4	20	mg/kg	<20	
eachable Anions & Nutrients (QCLot	: 1102290)				
Chloride, soluble ion content	16887-00-6 E236.Cl	5	mg/kg	<5.0	



Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Soil/Solid					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery	Limits (%)	
Analyte	CAS Number Met	hod	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1097635)									
Conductivity (1:2 leachate)	E10	0-L	5	μS/cm	1409 µS/cm	99.3	90.0	110	
Physical Tests (QCLot: 1098386)									
pH (1:2 soil:CaCl2-aq)	E108	8A		pH units	7 pH units	100	98.0	102	
Physical Tests (QCLot: 1098388)									
Moisture	E144	4	0.25	%	50 %	99.2	90.0	110	
Physical Tests (QCLot: 1098416)									
Moisture	E144	4	0.25	%	50 %	100	90.0	110	
Physical Tests (QCLot: 1099425)									
pH (1:2 soil:CaCl2-aq)	E108	8A		pH units	7 pH units	100	98.0	102	
Inorganics (QCLot: 1102211)									
Sulfides, acid volatile	E39	6-L	0.2	mg/kg	2.196 mg/kg	90.2	70.0	130	
Inorganics (QCLot: 1103763)									
Sulfides, acid volatile	E39	6-L	0.2	mg/kg	2.196 mg/kg	87.4	70.0	130	
Leachable Anions & Nutrients (QCLot: 1102289)									1
Sulfate, soluble ion content	14808-79-8 E23	6.SO4	20	mg/kg	5000 mg/kg	98.2	80.0	120	
Leachable Anions & Nutrients (QCLot: 1102290)									
Chloride, soluble ion content	16887-00-6 E23	6.Cl	5	mg/kg	5000 mg/kg	97.9	80.0	120	



Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:						Refere	nce Material (RM) Re	eport	
					RM Target	Recovery (%)	Recovery	Limits (%)	
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests	(QCLot: 1097635)								
	RM	Conductivity (1:2 leachate)		E100-L	1725.6 µS/cm	105	70.0	130	
Physical Tests	(QCLot: 1099994)								
	RM	Oxidation-reduction potential [ORP]		E125	475 mV	98.5	90.0	110	
Leachable Ani	ons & Nutrients (QCLot:	1102289)							
	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	1070 mg/kg	99.1	70.0	130	
Leachable Anio	ons & Nutrients (QCLot:	1102290)							
	RM	Chloride, soluble ion content	16887-00-6	E236.CI	432 mg/kg	97.6	70.0	130	

SDL-170

Chain of Custody (COC) / Analytical Request Form

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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Fallure to complete ali portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.